Answers for

Year 11 Mathematics Course Book NCEA 1 Level 6

NuLake Ltd
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ANSWERS – MEASUREMENT

Page 4

1. 1.5 cm

2. 0.786 km

3. 0.0156 t

4. 2700 m^2

5. 15.7 m

6. 45 kg

7. 0.129 L

8. 1000 x 1000 = 1 000 000 g

9. 4500 cm

10. 48.9 cm = 489 mm

11. 2.33 m = 233 cm

12. 5.28 km = 5280 m

13. 1.221 L = 1221 mL

14. 2700 mg = 2.7 g

15. 600 g

16. 350 kg

17. 17 450 mL

18. 1 500 cm^3

19. 1.4 ha

20. 22 000 m^2

21. 2.03 ha = 20 300 m^2

22. 23 cm^2 = 2300 mm^2

23. 17.5 L = 17 500 cm^3

24. 0.562 m^3 = 562 000 cm^3

25. grams

26. metres^2

27. 1200 to 3000 grams or 1.2 to 3 kilograms.

28. 5 to 10 litres

29. 17 ¢

30. $2.23

31. $4475

32. 184 lots

33. 35 bags

34. 100 teaspoons

35. 400 shovels

36. 23 256 matches

37. 0.111 mm

Page 4 cont...

38. 97 200 s = 27 hours

39. 133.33 h (133 h 20 min)

40. 200 000

Page 6

41. 15.5 mm ≤ x < 16.5 mm

42 97.35 kg ≤ x < 97.45 kg

43. 65.775 m ≤ x < 65.785 m

44. 14.95 m ≤ x < 15.05 m

45. 2.5 h ≤ x < 3.5 h

46. 1534.5 km ≤ x < 1535.5 km

47. 18.335 cm ≤ x < 18.345 cm

48. 0.445 L ≤ x < 0.455 L

49. 4.5 L ≤ x < 5.5 L

50. 83.5 ≤ x < 84.5 light years

51. 115 km ≤ x < 125 km

52. 16 450 km ≤ x < 16 550 km

53. 8.5 days ≤ x < 9.5 days

54. 4.995 m ≤ x < 5.005 m

55. 4.5 m ≤ x < 5.5 m

56. Error = ± 0.5 cm

57. Error = ± 0.5 kg

58. Error = ± 0.5 m

59. Error = ± 0.05 m

60. Error = ± 0.5 days

61. Error = ± 0.5 km

62. Error = ± 0.005 L

63. Error = ± 0.05 T

64. Error = ± 0.005 m

65. 15 m ≤ x < 17 m

66. 18.2 m ≤ x < 18.4 m

67. 9.875 kg ≤ x < 9.985 kg

68. 542 km ≤ x < 544 km

69. 71 min ≤ x < 73 min

70. 9.50 L ≤ x < 9.52 L

71. 11.625 m^2 ≤ x < 16.625 m^2

72. 4.8825 km^2 ≤ x < 5.3625 km^2

73. 55.875 m^2 ≤ x < 64.175 m^2

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74. 2 sf

75. 3 sf

76. 1 sf

77. 4 sf

78. 2 sf

79. 3 sf

80. 3 sf

81. 4 sf

82. 5 sf

Page 9

83. 60.0 cm (1 dp)

84. 419.3 m (1 dp)

85. 105.5 m (1 dp)

86. 60 mm (0 dp)

87. 96 mm (0 dp)

88. 94 mm (0 dp)

89. 42.8 cm (1 dp)

90. 39.0 cm (1 dp)

91. 141 mm (0 dp)

92. Note steps in the explanation.

$$\text{Length} = 21x + 2x2\pi x$$

$$\text{Steel} = \frac{350}{4.35}\ \text{m}$$

$$= 80.46\ \text{m}$$

$$80.46\ \text{m} = 21x + 4\pi x$$

$$x = 2.40\ \text{m (2 dp)}$$

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93. Rectangle 1

$$\text{2 strgts} = 200\ \text{m}$$

$$\text{curves} = 200\ \text{m}$$

$$\pi d_1 = 200$$

$$d_1 = 63.66\ \text{m}$$

$$\text{Rect}_1 = 100 \times 63.66$$

$$= 6370\ \text{m}^2\ \text{(3 sf)}$$

Rectangle 2

$$\text{2 strgts} = 240\ \text{m}$$

$$\text{curves} = 160\ \text{m}$$

$$\pi d_2 = 160$$

$$d_2 = 50.93\ \text{m}$$

$$\text{Rect}_2 = 120 \times 50.93$$

$$= 6110\ \text{m}^2\ \text{(3 sf)}$$

Page 10 Q93 cont...

Smallest rectangle has 120 m straights and diameter of semicircle of 50.9 m (1 dp).

Page 12

94. 192.5 = 190 cm^2 (2 sf)

95. 103.8 = 104 cm^2 (3 sf)

96. 245.5 = 246 m^2 (3 sf)

97. 24 340 = 24 000 mm^2 (2 sf)

98. 110.67 = 110 cm^2 (2 sf)

99. 118.6 = 120 cm^2 (2 sf)

100. 9434.6 = 9430 mm^2 (3 sf)

101. 4698 = 4700 mm^2 (2 sf)

102. Area land = 239.08

= 239 m^2 (3 sf)

9 x 1 kg bags and 1 x 500 g bags

Cost = \$86.50

Page 13

103. Area court. = 408.37 m^2

No. of moulds = 10 890

Total cost = \$9000 (2 sf)

Or cost = \$9100 rounding up

Page 15

104. Volume = 624 m^3

Required air = 3120 m^3/hour

Required air = 52 m^3/minutes

105. Volume = 37 212.8 cm^3

Volume = 37 200 cm^3 (3 sf)

Capacity = 37.2 litres

106. Volume = 2386.2 cm^3

Working in cm only.mice = 7 (or 8)

Page 16

107. Volume = 5481.6 mm^3

Volume = 5.48 cm^3 (3 sf)

Density = 0.58 g/cm^3 (2 sf)

108. Assume the truck is filled to approx. flat so cuboid.

Vol. truck= 5.939 m^3

No. trips = 20.4

Round up trips to 21.

Time = 21 x (11.75 + 42 + 6.5)

Time = 21 hours

Page 16 cont...

109. Length = π x 16

= 5.026 cm

Vol. of gold = $5.026 \times 0.5\pi\, 0.4^2$

Vol. of gold = 1.263...

= 1.3 cm^3 (2 sf)

Must be in centimetres throughout.

Cost = \$1500 (2 sf)

110. The best model is a cone as the pile will be approximately circular in base and have approximately straight lines from the base to the vertex.

The model may under estimate the volume if deviations from the cone are ignored.

$$\text{Vol. cone} = \frac{1}{3}\pi(2h)^2h$$

$$2.4 = \frac{4}{3}\pi h^3$$

$$h = 0.83 \text{ m}$$

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111. As the trench is half as deep as it is wide and has curved sides the best model is likely to be half a cylinder.

$$\text{Vol. trench} = \frac{1}{2}\pi(1.6)^2 \times 245$$

$$= 985.2 \text{ m}^3$$

112. a) Prism as the two ends are joined by straight sides.

Vol = 4.752 m^3

Vol = 4.8 m^3 (2 sf)

b) Pyramid as all lines from the base go to one point.

Vol = 4.7917 m^3

Vol = 4.8 m^3 (2 sf)

c) Cuboid.

Vol = 4.76 m^3

Vol = 4.8 m^3 (2 sf)

d) Half a cylinder.

Vol = 4.75 m^3

Vol = 4.8 m^3 (2 sf)

e) All the same to 2 significant figures.

f) If you are shorter than 1.7 m then tent c) otherwise tent b) as you can stand up in the centre.

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113. 6.2557 = 6.3 m^2 (2 sf)

114. 1060.98 = 1060 cm^2 (3 sf)

115. 1420.32 = 1420 cm^2 (3 sf)

116. 1380.05 = 1380 cm^2 (3 sf)

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117. 3 drops per roll of wallpaper

Length (18 drops) = 6 rolls

width (9 drops) = 3 rolls

Total rolls = 18

Cost = \$629.10

118. Area to paint = 942.8 m^2

Litres (2 coats) = 104.8 L

Tins of paint = 105

Cost = \$1443.75

Discount = \$216.56

Total Cost = \$1227.19

119. Area of sphere = 53 093 cm^2

Volume of gold = 185.8 cm^3

Mass of gold = 3587 g

Cost of gold = \$214 144

= \$214 000 (3 sf)

120. a) Best model is a trapezium minus 3 triangles.

Area of W= 202 500 cm^2

b) Volume of metal = 81 000 cm^3

Mass of metal = 684 kg (3 sf)

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121. a) 18.87 = 19 L (2 sf)

b) 18.869 = 19 L (2 sf)

122. 12.2145 = 12 L (2 sf)

123. 2389 ÷ 10 = 239 mL/ cup

= 240 mL (2 sf)

124. Vol. = 3 x 3 x 8.1 $inches^3$

Vol. = 7.62 x 7.62 x 20.57 cm^3

Vol. = 1190 cm^3

Capacity = 1.2 litres (2 sf)

Page 22 cont...

125. Vol. of pool = 488.4 m^3

(Note: 554.4 means you have completely filled the pool)

No. of litres = 488 400 L

Time (mins) = 20 350 mins.

Time (hours) = 339 h (0 dp)

Total = 14 days 3 hours

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126. Volume = $\pi r^2 h$

diameter = 2r

height = 4r

Volume = $\pi r^2 4r$

$4\pi r^3$ = 340 cm^3

r = 3 cm

diameter = 6 cm

Height = 12 cm

127. a) Volume of tank = 11.08 m^3

Capacity (2 sf) = 11 000 L

b) Consum 5 d = 2709 L

Consum/per./d = 135 L

c) Consumn x 7 = 945 L/d

Water remaining = 8374 L

Days left = 8.86

= 9 days (1 sf)

d) Every 1000 L means mark stick with 11 divisions

Each division = 0.162 m

Round to 2 sf = 16 cm

128. a) Cap. 0.5 cylind. = 242 L

Capacity cuboid = 129 L

Total capacity = 371 L

b) Displaced = 74 L

c) Drop in level = 75 mm

New depth = 365 mm

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129. Load = 12.2 kg (1 dp)

130. Load total = 170 kg

Wine casks = 56.7 (1 dp)

Limit = 56 wine casks

131. Vol. petrol = 8.65 m^3

Mass petrol = 8.65 T

Total mass = 11.1 T (1 dp)

132. 90% capacity = 52.4 L

Bottles = 1539

Page 24 cont...

133. Mass water = 2552 kg

Total = 2840 kg (3 sf)

134. $6d^3$ = 380 cm^3

Depth = 40 mm

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135. Circle area = 2.01 m^2

a) Volume = 1.6 m^3

b) Volume = 74.6 m^3

c) Capacity = 74 600 litres

136. a) Area = 14 850 m^2

Concrete = 223 m^3 (3 sf)

Sand = 371 m^3 (3 sf)

b) Water = 1260 m^3 (3 sf)

Pump = 158 000 L/h

c) d x 14 850 = 250 m^3

Rain (d) = 17 mm/h

ANSWERS – Geometry

Page 30

(other reasons are possible)

1. A = 50°
Angle sum Δ = 180°.
B = 62°
Angle sum Δ = 180°.

2. C = 58°
Angle sum Δ = 180°.
D = 122°
Adj. angles str. line 180°.
E = 58°
Vert. opp. angles equal.

3. F = 80°
Adj. angles str. line 180°.
G = 70°
Adj. angles str. line 180°.

4. 15x = 180°
Angle sum Δ = 180°.
x = 12°
y = 324°
Angle sum of a point = 360°.

5. H = 72°
Angle sum of a point = 360°.
I = 72°
Exterior angles poly = 360°.
J = 54°
Base angle isos Δ equal.

6. M = 60°
Equilateral Δ.
N = 120°
Adj. angles str. line 180°.
P = 30°
Base angle isos Δ equal.

7. Q = 297°
Angle sum hexagon = 720°.
R = 63°
Angle sum of a point = 360°.

8. S = 108°
Angle sum pentagon = 540°.
T = 36°
Base angles isos. Δ equal.
U = 72°
T + U = 108°.
Int. angle regular pentagon.

Page 30 cont...

9. V = 28°
Adj. angles str. line 180°
and Angle sum Δ = 180°.
W = 288°
Angle sum of a point = 360°
and symmetrical angles.

10. Y = 87°
Adj. angles str. line 180°
Z = 46.5°
Base angle isos Δ equal.

11. A = 32°
Base angle isos Δ equal.
B = 64°
Angle sum Δ = 180° and
Adj. angles str. line 180°.
C = 52°
Base angle isos Δ equal and
Angle sum Δ = 180°

12. 5y+ 90 = 180°
Adj. angles str. line 180°.
y = 18°

13. R = 117°
Adj. angles str. line 180°.
S = 27°
Adj. angles str. line 180°.
Q = 63°
Vert. opp. angles equal.

14. T = 40°
Exterior angles poly = 360°.
U = 120°
Angle sum of a point 360°.
V = 140°
Interior angles 9 sided poly.
W = 220°
Exterior angle + 180°.

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15. 12x + 96 = 180°
Angle sum Δ = 180°.
x = 7°

16. Y = 42°
Angle sum Δ = 180°.
Z = 318°
Angle sum of a point 360°.

Page 31 cont...

17. A = 135°
Interior angle of a octagon.
B = 120°
Interior angle of a hexagon.
C = 105°
Angle sum of a point 360°.

18. D = 211°
Angle of a quad. sum 360°.
E = 149°
Angle sum of a point 360°.

Page 32

(other reasons are possible)

19. A = 41°
Alt. angles // lines =.
B = 139°
Co-int. angles // = 180°.

20. P = 46°
Co-int. angles // = 180°.
Q = 134°
Corr. angles // lines =.

21. B = 34°
Corr. angles // lines =.
A = 34°
Vert. opp. angles equal.

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22. C = 23°
Alt. angles // lines =.
D = 71°
Alt. angles // lines =.
E = 86°
Angle sum Δ = 180°.
F = 94°
Adj. angles str. line 180°.

23. G = 44°
Alt. angles // lines =.
H = 99°
Angle sum Δ = 180°.

24. J = 5°
Angle sum Δ = 180°.
K = 124°
Alt. angles // lines =.

25. L = 38°
Alt. angles // lines =.
M = 105°
Adj. angles str. line 180°.
N = 37°
Alt. angles // lines =.

Page 33 cont...

26. D = 32°
Corr. angles // lines =.
XED = 32°
Base angle isos Δ equal.
DXE = 116°
Angle sum Δ = 180°.

27. R = 112°
Vert. opp. angles equal.
S = 68°
Co-int. angles // = 180°.
T = 65°
Angle sum Δ = 180°.

28. U = 109°
Corr. angles // lines =.
V = 71°
Adj. angles str. line 180°.
W = 61°
Angle sum Δ = 180°.

29. 15x = 180°
Co-int. angles // = 180°.
x = 12°
7y = 112°
Co-int. angles // = 180°.
y = 16°

30. Z = 141 + 152
Co-int. angles // = 180°.
Z = 293°

31. A = 5°
Co-int. angles // = 180°.
B = 18°
Alt. angles // lines =.
C = 157°
Angle sum Δ = 180°.

32. D = 127°
Alt. angles // lines =.
E = 74°
Base angle isos Δ equal. and
Angle sum Δ = 180°.
F = 53°
Vert. opp. angles equal.

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33. G = 101°
Corr. angles // lines =.
and Adj. angles str. line 180°.

Page 34 cont...

34. H = 123°
Alt. angles // lines =. and
Adj. angles str. line 180°. and
Ext. angle of a Δ = 2 opp. int. ∠'s.

Page 36

(other reasons are possible)

35. X = 98°
Angle sum of a point 360°.
Y = 82°
Tangent at 90° to radius.
and Angle of a quad. sum 360°.

36. A = 42°
Angle centre 2xAngle circum.
B = 21°
Angles same arc =.

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(other reasons are possible)

37. C = 107°
Angle centre 2xAngle circum.
D = 73°
Angle centre 2xAngle circum.
and angle sum of a point is 360°

38. E = 90°
Angle in semi circle 90°.
F = 23°
Angle centre 2xAngle circum.

39. G = 31°
Base angles isos Δ are =.
H = 59°
Angle in semi circle 90°.
I = 59°
Base angles isos Δ are =.

40. J = 18°
Angles same arc =.
K = 18°
Alt. angles // lines =.
M = 144°
Angle sum of a Δ = 180°.

41. N = 226°
Angle centre 2xAngle circum.
P = 134°
Angle sum of a point is 360°

Page 37 cont...

42. Q = 41°
Angles same arc =.
R = 131°
Angle in semi circle 90°.
and Adj. angles str. line 180°.
S = 24.5°
Base angles isos Δ are =.

43. T = 67°
Tangent at Rt. angle to radius.
U = 33.5°
Angle centre 2xAngle circum.

44. Q = 22°
Angle between a tangent
and a radius is a Rt. angle.
R = 136°
Base angles isos Δ are = and
Angle sum of a Δ = 180°.
S = 68°
Angle centre 2xAngle circum.
T = 44°
Angle sum of a quad. = 360°.

45. U = 90°
Angle in semi circle 90°.
V = 33°
Tangent at 90° to radius.
W = 33°
Angle sum of a Δ = 180°.

46. x = 32°
Angles same arc =.
y = 35°
Angle sum of a Δ = 180°.

47. x = 41°
Alt. angles // lines =.
y = 98°
Angles same arc = and
Angle sum of a Δ = 180°.

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(other reasons are possible)

48. y = 12°
Angles same arc =.
x = 8°
Angle centre 2xAngle circum.

49. y = 63°
Alt. angles // lines =.
x = 63°
Angles same arc =.

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(other reasons are possible)

50. A = 99°
Opp. angles of a cyclic quad add to 180°.
B = 62°
The ext. angle cyclic quad. = Opp. int. angle.

51. C = 90°
Tangent at Rt. angle to radius.
D = 63°
Opp. angles of a cyclic quad add to 180°

52. E = 67°
Base angles isos Δ are =.
F = 67°
Base angles isos Δ are =.
G = 23°
Angle centre 2xAngle circum.
H = 113°
Opp. angles of a cyclic quad add to 180°.

53. J = 57°
Opp. angles of a cyclic quad add to 180°.
K = 114°
Angle centre 2xAngle circum.
M = 21°
Angle between a tangent and a radius is a Rt. angle.

54. P = 22°
Angle between a tangent and a radius is a Rt. angle.
Q = 90°
Angle in semi circle 90° and Adj. angles str. line 180°.
R = 68°
Angle sum of a Δ = 180°.
S = 22°
Angle sum of a Δ = 180.

55. T = 107°
The ext. angle of a cyclic quad. = the opp. angle.
U = 73°
Adj. angles str. line 180°.

Page 39 cont...

(other reasons are possible)

56. V = 138°
Opp. angles of a cyclic quad add to 180°.
W = 42°
Opp. angles of a cyclic quad add to 180°.

57. X = 110°
Opp. angles of a cyclic quad add to 180°.
Y = 111°
The ext. angle of a cyclic quad. = the Opp. angle.

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(other reasons are possible)

58. A = 39°
Base angles isos Δ are =.
B = 102°
Angle sum of a Δ = 180°.
C = 78°
Opp. angles of a cyclic quad add to 180°.
D = 60°
Angle sum of a Δ = 180°.

59. e = 61°
Opp. angles of a cyclic quad add to 180°.
BED = 119°
The ext. angle of a cyclic quad. = the opp. angle.
c = 119°
The ext. angle of a cyclic quad. = the opp. angle.
b = 96°
The ext. angle of a cyclic quad. = the opp. angle.
f = 96°
The ext. angle of a cyclic quad. = the opp. angle.

60. m = 68°
Adj. angles str. line 180°.
j = 68°
Opp. angles of a cyclic quad add to 180°
k = 90°
Angle in semi circle 90°.
g = 22°
Angle sum of a Δ = 180.

Page 40 cont...

61. u = 71°
Opp. angles of a cyclic quad add to 180°
t = 68°
Opp. angles of a cyclic quad add to 180°
v = 62°
Opp. angles of a cyclic quad add to 180°
q = 59°
Opp. angles of a cyclic quad add to 180°

Page 41

62. x = 30.6 cm (1 dp)

63. y = 78.0 mm (1 dp)

64. z = 26.0 mm (1 dp)

65. w = 24.8 m (1 dp)

66. q = 42.4 m (1 dp)

67. m = 90.2 cm (1 dp)

68. 19.2 km (1 dp)

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69. 63 m (0 dp)

70. 77 m (0 dp)

71. 5.6 km (1 dp)

72. z = 38 mm (0 dp)

73. $2x^2 = 20.5$
x = 3.2 m (1 dp)

74. 11 300 m (3 sf)

75. Total = 4 of 29.16
= 117 m (0 dp)

76. h = 9.9 m (1 dp)

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77. a) 2.2 m (1 dp)
b) 4.2 m (1 dp)
c) Beth and Colin 4.2 metres apart whereas other pairs all 4.1 metres apart.

78. 58.7 km (1 dp)

79. rad. (x) = 19 cm (0 dp)

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80. y = 13.8 mm (3 sf)

81. z = 26.6 m (3 sf)

82. w = 7.10 m (3 sf)

83. v = 11.5 km (3 sf)

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84. w = 4.84 m (3 sf)

85. v = 1.59 m (3 sf)
z = 1.86 m (3 sf)

86. Ht. = 10.6 m (3 sf)

87. Ht. = 0.59 km (2 sf)

88. Ht. = 51 + 2
= 53 m (2 sf)

89. Dist. = 2.4 m (2 sf)

90. Height = 40 cm
Width = 55 cm (2 sf)

91. x = 29 m (2 sf)

92. 3.35 m (3 sf)

93. 8.9 m (2 sf)

Page 47

94. a) 689 m
b) 2403 m
c) 23 seconds
d) 1057 m

95. 2.0 m (2 sf)

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96. w = 2.75 m (3 sf)

97. z = 41.8 m (3 sf)

98. q = 19.4 m (3 sf)

99. m = 33.0 m (3 sf)

100. a = 11 m (2 sf)

101. b = 29.4 cm (3 sf)

102. w = 15.6 m (3 sf)

103. Dist. = 120 m (2 sf)

104. Rope = 1.1 m (2 sf)

105. Lgth. = 6.9 m (2 sf)

106. d = 25 m (2 sf)

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107. 1340 m (3 sf)

108. slant l. = 8.31 m (2 dp)
width = 7.54 m (2 dp)

109. a) 158 m (0 dp)
b) 195 m (0 dp)
c) 95 m (0 dp)

110. 13.2 m (1 dp)

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111. A = 43.5° (1 dp)

112. B = 58.1° (1 dp)

113. C = 28.4° (1 dp)

114. D = 31.7° (1 dp)

115. E = 54.4° (1 dp)
F = 35.6° (1 dp)

116. G = 22.8° (1 dp)

117. H = 65.4° (1 dp)

118. I = 46.7° (1 dp)

119. J = 60.2° (1 dp)
K = 29.8° (1 dp)

120. L = 47.9°(1 dp)
M = 42.1° (1 dp)

121. A = 73.9° (1 dp)
OK for safety

122. E = 25.1° (1 dp)

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123. Ht. = 9.78 m (3 sf)
H = 22.2° (1 dp)

124. Ht. = 0.0406 (3 sf)
J = 26.6° (1 dp)

125. K = 56.8° (1 dp)
M = 32.2° (1 dp)

126. N = 90° + 10.4°
= 100.4° (1 dp)
P = 29.3° (1 dp)

127. Angle = 0.7° (1 dp)

128. Angle = 22.4° (1 dp)

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129. a) a = 78.2 mm (3 sf)
b) X = 23.7° (1 dp)
c) b = 89.5 mm (3 sf)
d) Y = 29.1° (1 dp)

130. a) c = 4.60 m (3 sf)
b) d = 2.76 m (3 sf)
c) X = 50.7° (1 dp)
d) e = 4.76 m (3 sf)

Page 53 cont...

131. r = 1.30 m (3 sf)
A = 15.6° (1 dp)
steel = 11.5 m (3 sf)

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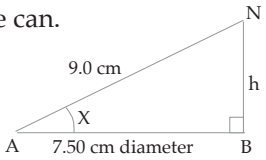
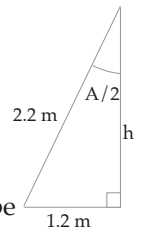
132. SQ = 5.94 m (3 sf)
WQ = 7.87 m (3 sf)
VQ = 6.87 m (3 sf)
SQP = 49.6° (1 dp)
WQT = 35.0° (1 dp)
VQU = 41.2° (1 dp)

133. Approach. The triangle is formed by the nail, diameter and height it reaches up the side. Angle X is the angle the nail makes with the bottom of the can.



a) Angle X = 33.6° (1 dp)
b) h = 5.0 cm (1 dp)

134. Approach is to form a triangle with the centre of the teepee. Half the angle at the apex and the height can be calculated.



a) Ht. = 1.84 m (3 sf)
No, would touch the top.
b) A = 66.1° (1 dp)

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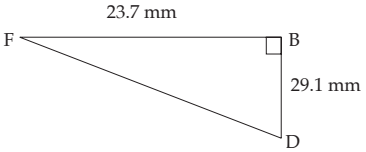
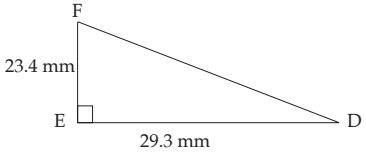
135. a) First calculate BD using Pythagoras. Then work with triangle FBD.



FDB = 39.2° (1 dp)

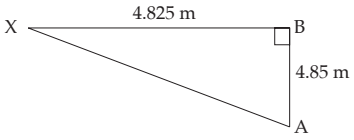
b) First calculate ED. Then work with triangle FDE.



FDE = 38.6° (1 dp)

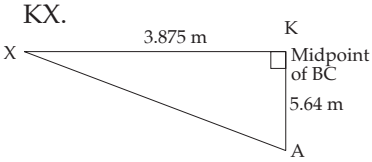
Page 57 cont...

136. a) Calculate BX as half of BG. Then work with triangle ABX.



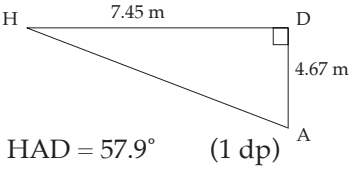
AXB = 45.1° (1 dp)

b) Let K be the midpoint of BC. Then we calculate AK and KX.



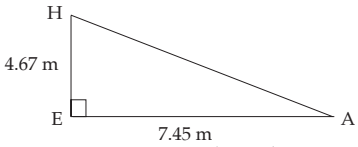
XAK = 34.5° (1 dp)

137. a) The projection of plane ABGH on plane ABCD has H in front of D. So we work with triangle ADH.



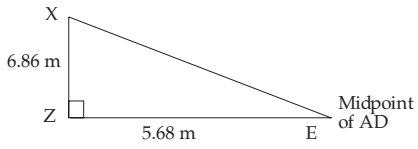
HAD = 57.9° (1 dp)

b) The projection of plane ABGH on plane ABFE has H in front of E. So we work with triangle AEH.



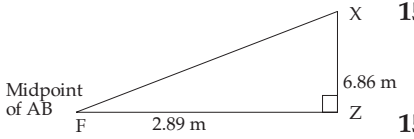
HAE = 32.1° (1 dp)

138. a) The rays at right angles to the line of intersection pass through Z and X from the midpoint of AD labelled E.



XEZ = 50.4° (1 dp)

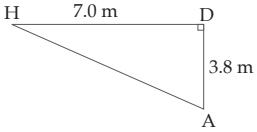
b) The rays at right angles to the line of intersection pass through Z and X from the midpoint of AB labelled F.



XFZ = 67.2° (1 dp)

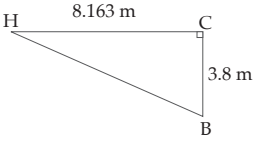
Page 57 cont...

139. a)



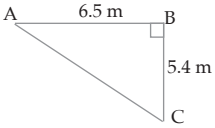
DAH = 61.5° (1 dp)

b)



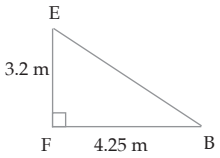
HBC = 65.0° (1 dp)

140. a)



AC = 8.5 m (2 sf)

b)



Ropes = 5.3 m (2 sf)

c) Same triangle.

Angle = 37.1° (1 dp)

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141. x = 12.0 cm (1 dp)

142. x = 6.0 cm (1 dp)

143. x = 3.5 cm (1 dp)
y = 3.6 cm (1 dp)

144. x = 8.0 cm (2 sf)
y = 17 cm (2 sf)

145. x = 12.0 cm (1 dp)
y = 10.9 cm (1 dp)

146. x = 10.2 cm (1 dp)
y = 28.8 cm (1 dp)

147. x = 7.5 m (1 dp)
y = 13.0 m (1 dp)

148. x = 9.0 m (1 dp)
y = 15.0 m (1 dp)

149. x = 28.0 cm (1 dp)
y = 24.2 cm (1 dp)
z = 6.9 cm (1 dp)

150. x = 2.8 m (1 dp)
y = 17.2 m (1 dp)

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151. x = 26.8 mm (1 dp)
y = 10.7 mm (1 dp)
z = 14.4 mm (1 dp)

152. x = 3.6 m (1 dp)
y = 8.0 m (1 dp)

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153. AB = 10.0 m
BC = 23.0 m (1 dp)

154. AB = 12.0 cm
BC = 20.8 cm (1 dp)
BD = 10.4 cm (1 dp)

155. AB = 7.5 m (1 dp)
BC = 14.1 m (1 dp)
BD = 6.6 m (1 dp)

156. 16 m

157. 8 m

158. 122.4 cm

159. 84.5 cm

160. 30 m

161. 5.32 m

162. 36.6 m (1 dp)

163. 530.4 cm

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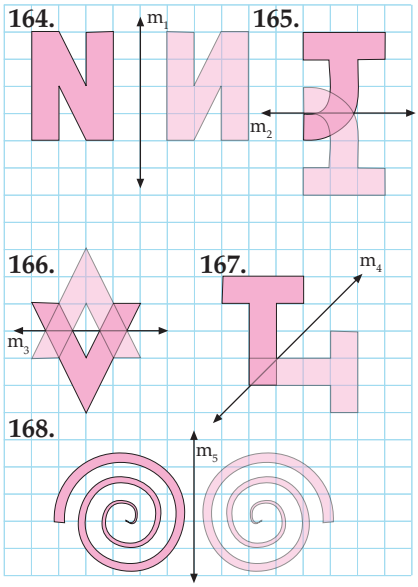
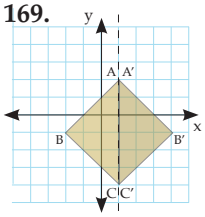
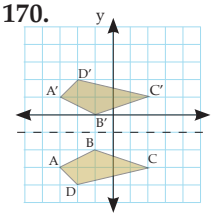


169.



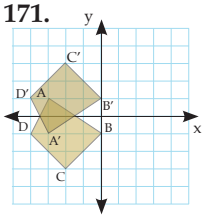
A and C

170.



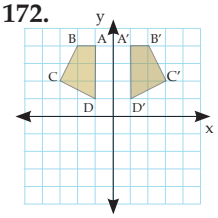
None

171.



Those that the mirror line goes through.

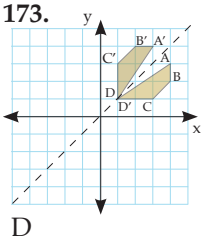
172.



None

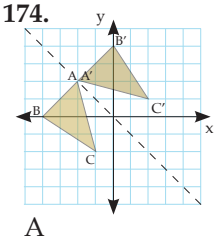
Page 62 cont...

173.



D

174.



A

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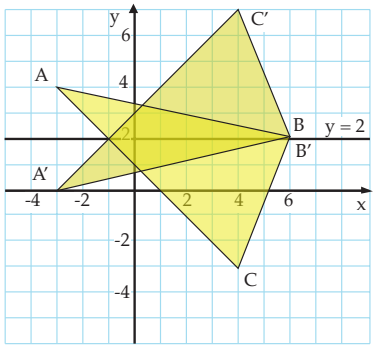
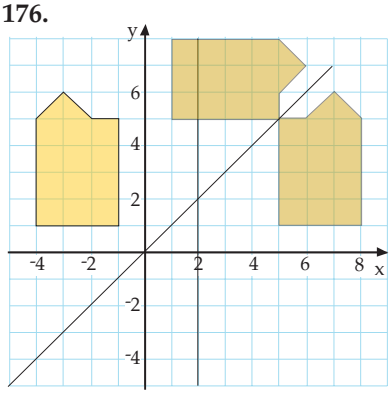
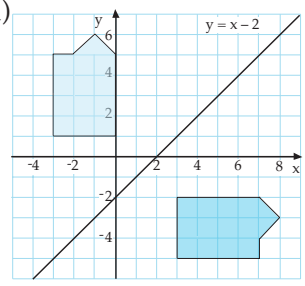
175.



176.



177. a)



b) The natural orientation of the image has changed compared to the object. Reflection is the only transformation that causes a change in orientation or sense.

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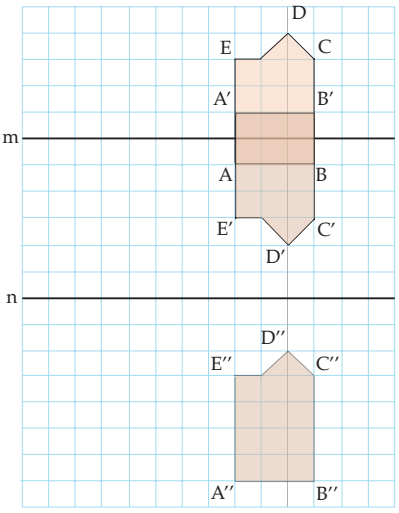
178. a) and b)



c) Translation 12 units down.

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179. Reflection in the y axis or x = 0

180. Reflection in the x axis or y = 0

181. Reflection in the line y = 1

182. Reflection in x = ⁻1

183. Reflection in y = 2.5

184. Reflection in y = x

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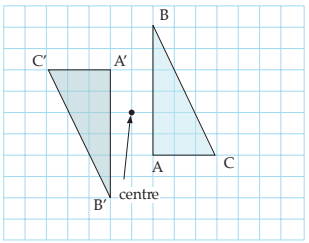
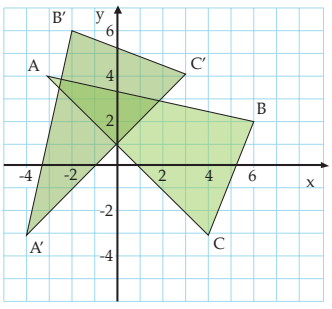
185.

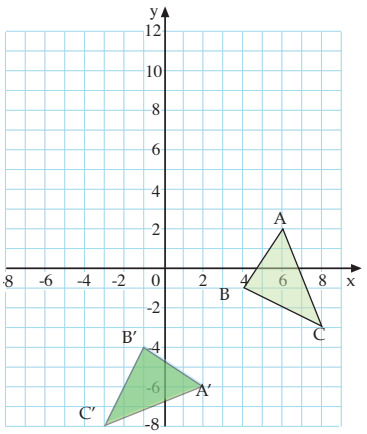


186.

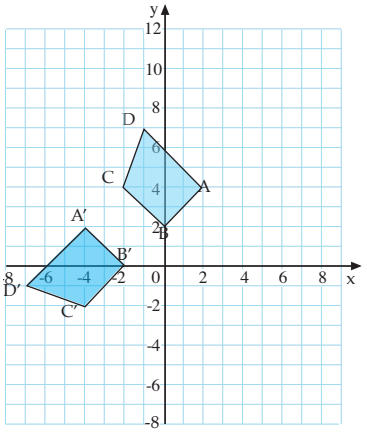


Page 66 cont...

187.



188.



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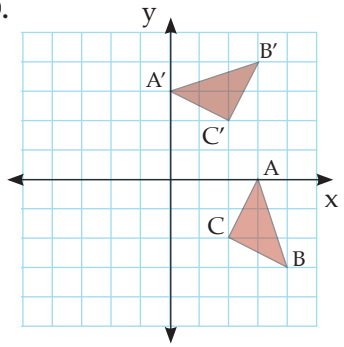
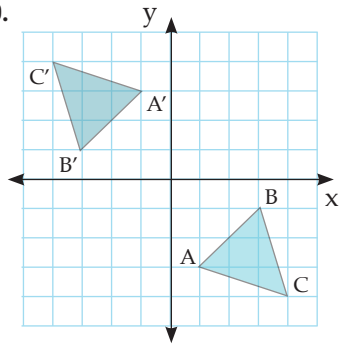
189.



190.



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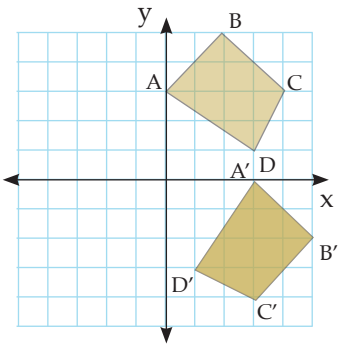
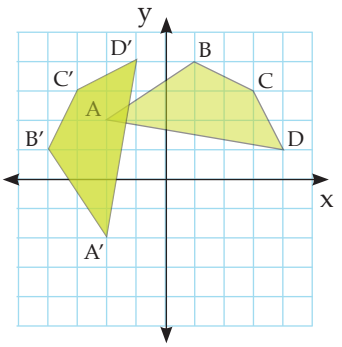
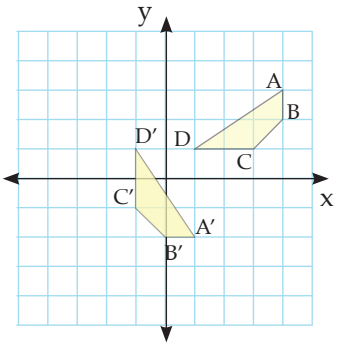
191.



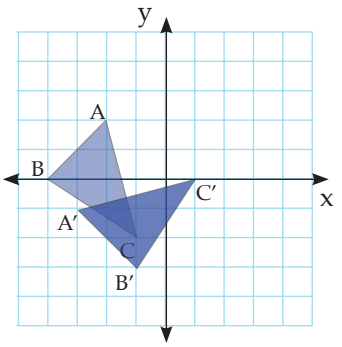
192.



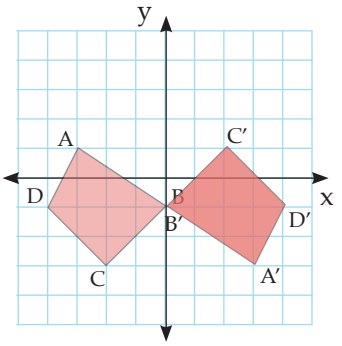
193.



194.

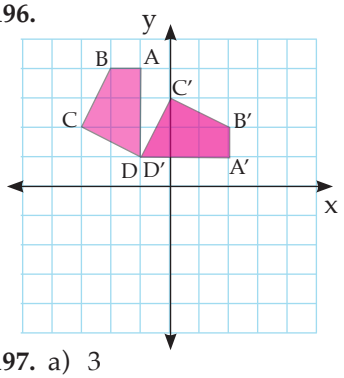


195.



Page 67 cont...

196.



197. a) 3

b) 4

c) 8

d) 2

Page 68 Q197 cont...

e) 10

f) 2

g) 5

h) 12

198. Rotation 90° about (-1, 1)

199. Rotation 180° about (0, 0)

200. Rotation 270° about (1, -2)

201. Rotation 90° about (-1, 1)

202. Rotation 180° about (-1, 0)

203. Rotation 270° about (1, -3)

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204. Rotation of 90° clockwise about (-1, 1)

205. Rotation of 90° anticlockwise about (2, -2)

206. Rotation of 180° about (1, 1)

207. Rotation of 90° anticlockwise about (-1, -2)

208. Rotation of 90° clockwise about (-1, 2)

209. Rotation of 180° about (0, 1)

Page 72

210. $\begin{pmatrix}4\\1\end{pmatrix}$

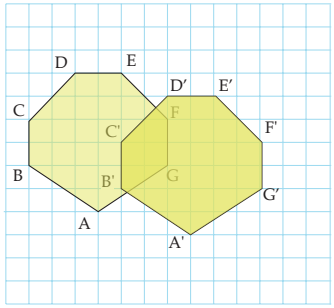
211. $\begin{pmatrix}-3\\-4\end{pmatrix}$

212. $\begin{pmatrix}2\\-1\end{pmatrix}$

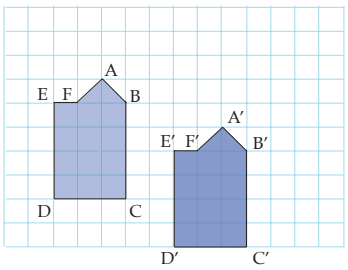
213. $\begin{pmatrix}0\\-2\end{pmatrix}$

214. $\begin{pmatrix}5\\0\end{pmatrix}$ Then the image $\begin{pmatrix}5\\0\end{pmatrix}$

215.



216.



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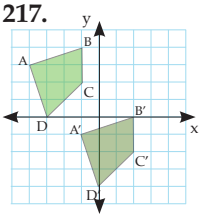
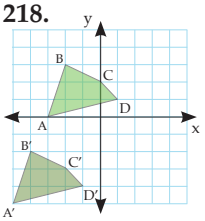
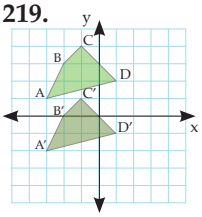
217.



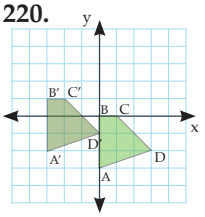
218.



219.

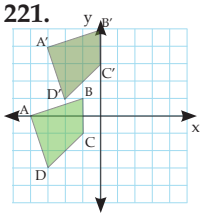


220.

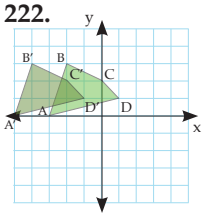


Page 73 cont...

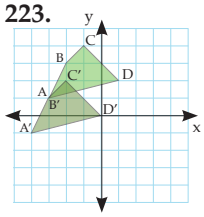
221.



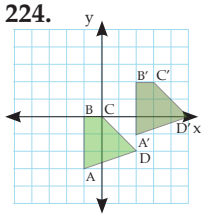
222.



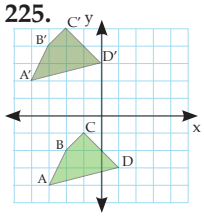
223.



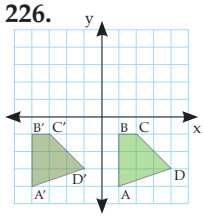
224.



225.



226.



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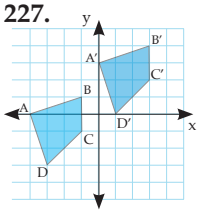
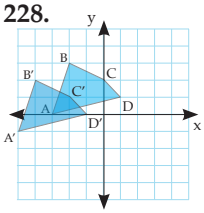
227.



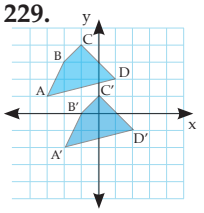
Translation by the vector $\begin{pmatrix} 4 \\ 3 \end{pmatrix}$

228.



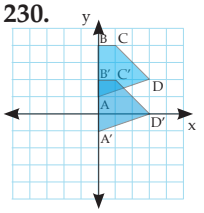
Translation by the vector $\begin{pmatrix} -2 \\ -1 \end{pmatrix}$

229.



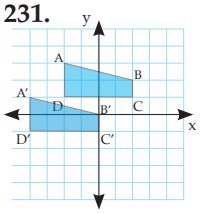
Translation by the vector $\begin{pmatrix} 1 \\ -3 \end{pmatrix}$

230.



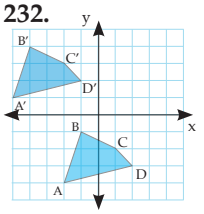
Translation by the vector $\begin{pmatrix} 0 \\ -2 \end{pmatrix}$

231.



Translation by the vector $\begin{pmatrix} -2 \\ -2 \end{pmatrix}$

232.



Translation by the vector $\begin{pmatrix} -3 \\ 5 \end{pmatrix}$

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233. Axes = 6, rotational = 6, total = 12

234. Axes = 4, rotational = 4, total = 8

235. Axes = 0, rotational = 4, total = 4

236. Axes = 6, rotational = 6, total = 12

237. Axes = 0, rotational = 6, total = 6

238. Axes = 0, rotational = 2, total = 2

239. Axes = 4, rotational = 4, total = 8

240. Axes = 0, rotational = 2, total = 2

Page 77

241. Axes = 1, rotational = 1, total = 2

242. Axes = 4, rotational = 4, total = 8

243. Axes = 1, rotational = 1, total = 2

244. Axes = 2, rotational = 2, total = 4

245. Axes = 4, rotational = 4, total = 8

246. Axes = 2, rotational = 2, total = 4

247. Axes = 0, rotational = 1, total = 1

248. Axes = 0, rotational = 2, total = 2

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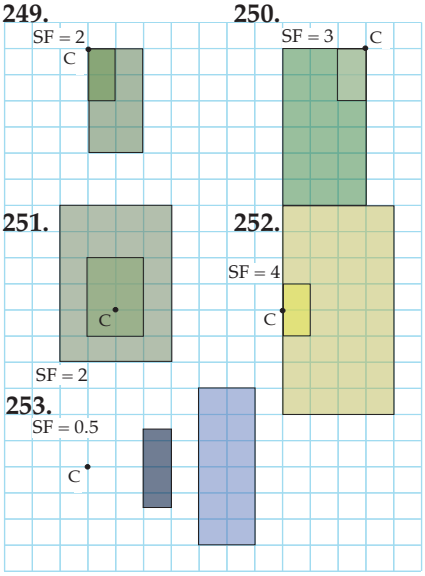
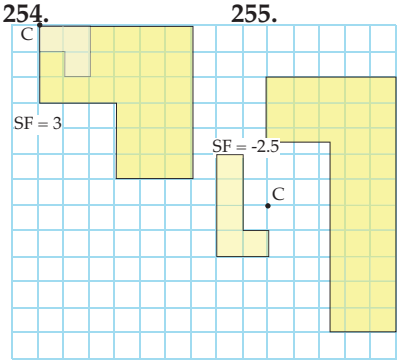
249.



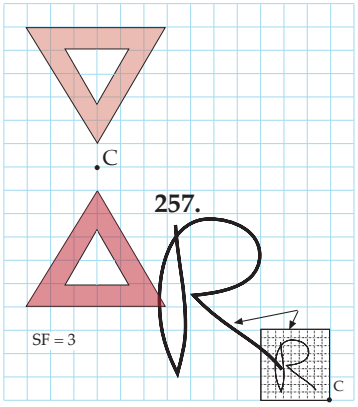
Page 80 cont...

254.



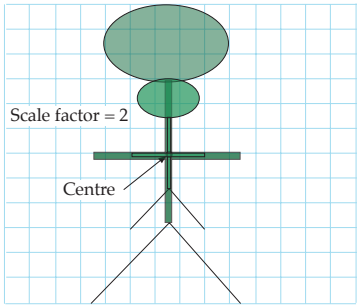
255.

256.

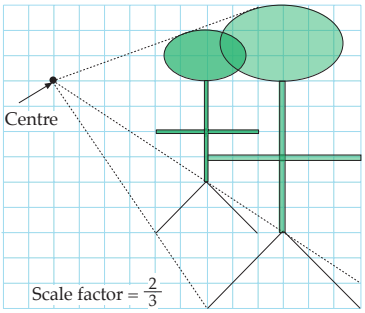


257.

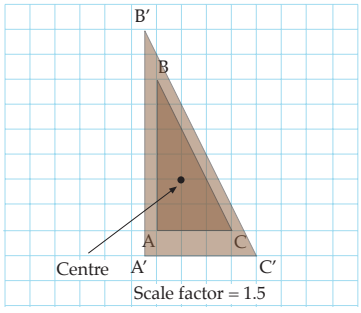
258.



259.

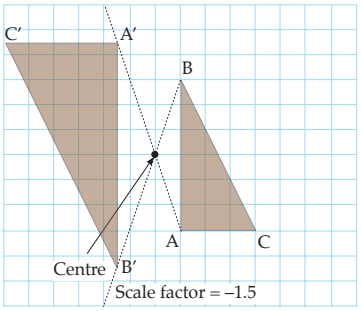


260.



Page 80 cont...

261.



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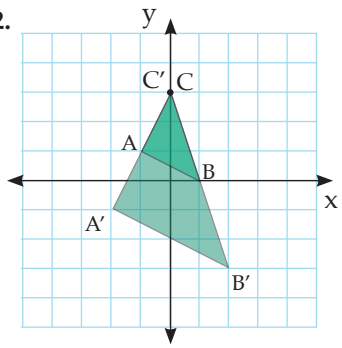
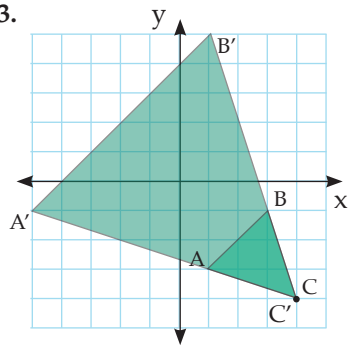
262.



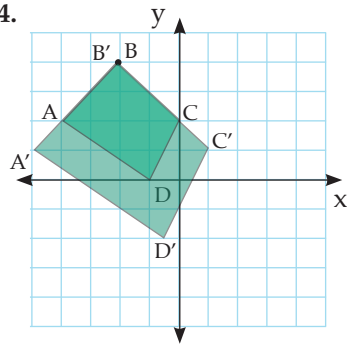
Invariant point C.

263.



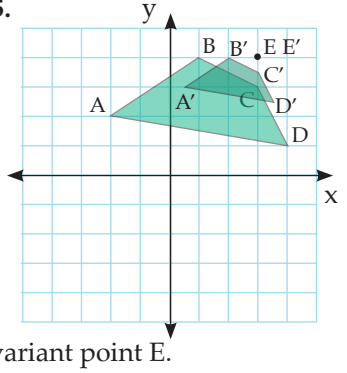
Invariant point C.

264.



Invariant point B.

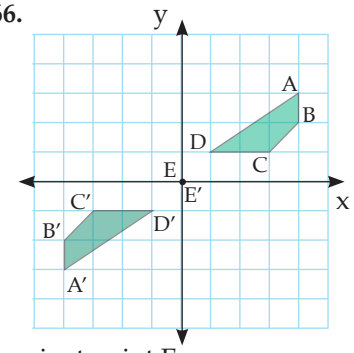
265.



Invariant point E.

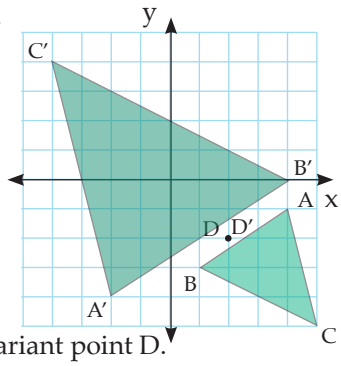
Page 81 cont...

266.



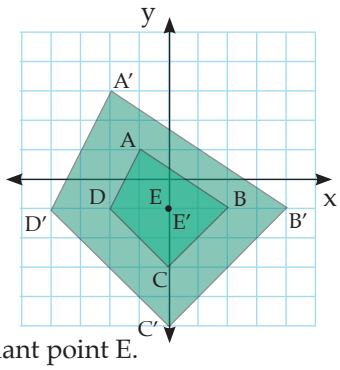
Invariant point E.

267.



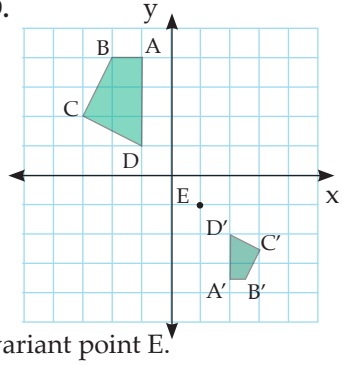
Invariant point D.

268.



Invariant point E.

269.



Invariant point E.

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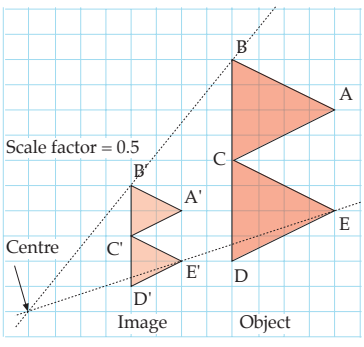
270.



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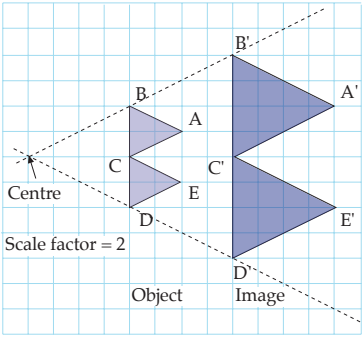
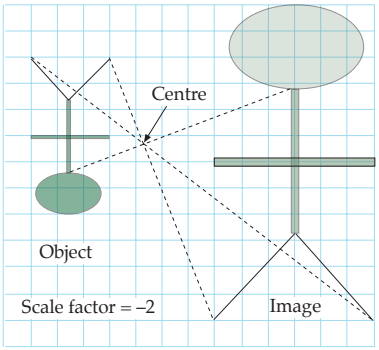
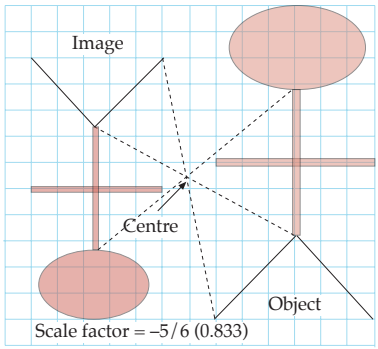
271.



272.



273.



274. Enlargement scale factor 2 centre (⁻3, ⁻5).

275. Enlargement scale factor 2.5 centre (⁻1.5, 1.5).

276. Enlargement scale factor ⁻1 centre (0, 0).

277. Enlargement scale factor ⁻1.5 centre (2, 1).

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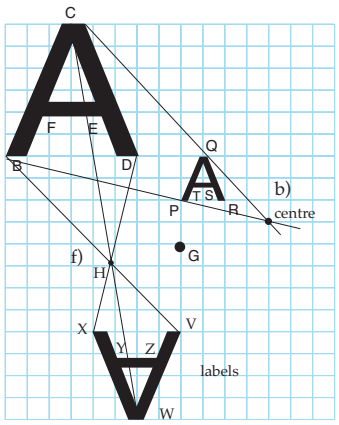
278. Enlargement scale factor 1/3 centre (5, ⁻5).

279. Enlargement scale factor ⁻0.5 centre (0, 0).

Page 83 cont...

280. a) SF = 3

b), c) and f) see diagram below.

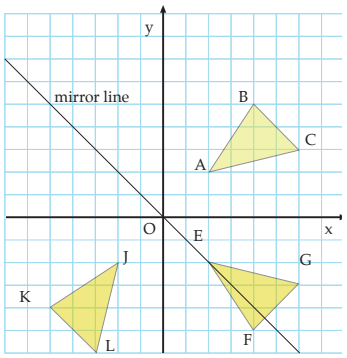


d) Enlargement through a point between the As with negative SF changes the size and rotates 180°.

e) SF = ⁻1.5

281.

a), b) and c)



d) Rotation 180° about O.

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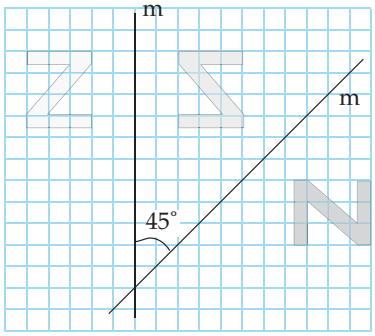
282.

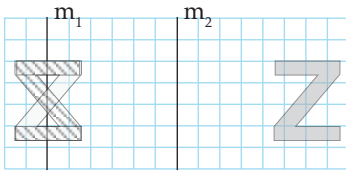
a)



Rotation clockwise through 90° about the intersection of the mirror lines.

Page 84 cont... Q282

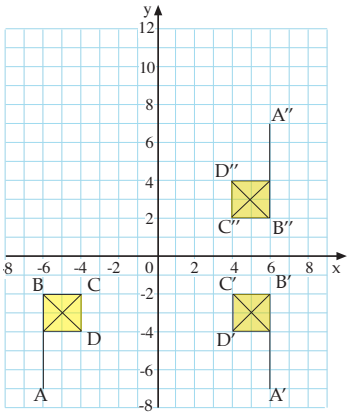
b)



Translation right 12 units and up 0 units.

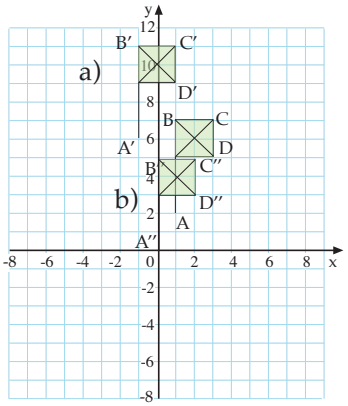
283.

a) and b)



c) Rotation of 180° about the point (0, 0).

284.



c) Translation by the vector $\begin{pmatrix}-1\\-2\end{pmatrix}$.

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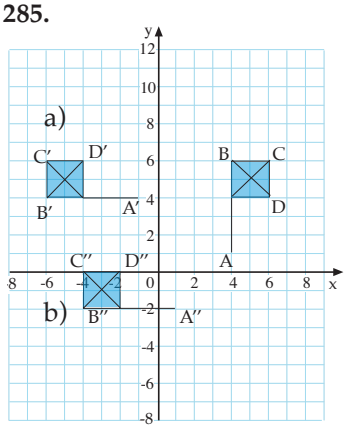
285.



c) Rotation 90° about the point (4, ⁻2).

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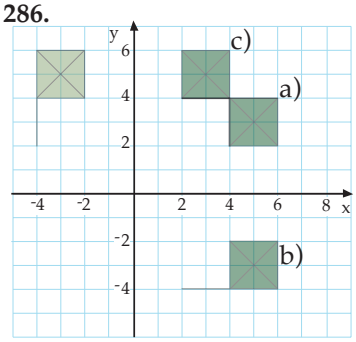
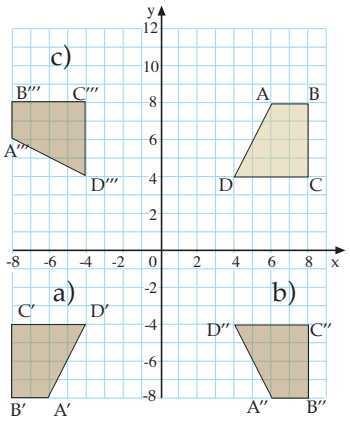
286.



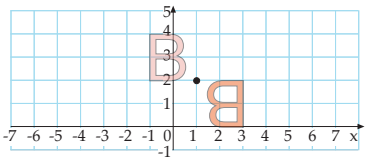
d) Reflection in the y axis.

287.



d) Rotation of 90° about (0, 0)

288. a) and b)



c) No, if the mirror line was on an angle (e.g. 45°) it would make the vertical back of the B horizontal.

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289. a) 070°

b) 300°

c) 230°

d) 165°

e) 290°

f) 215°

g) 245°

h) 280°

i) 075°

j) 190°

k) 350°

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290. a) N80°E
b) S60°E
c) S20°W
d) S60°W
e) N40°W
f) S65°W
g) S45°E
h) N75°W

291. A 062° and N62°E
B 108° and S72°E
C 115° and S65°E
D 202° and S22°W
F 236° and S56°W
G 341° and N19°W

292. A 063° and N63°E
B 128° and S52°E
C 167° and S13°E
D 215° and S35°W
F 303° and N57°W
G 341° and N19°W

293. The bearing of B from A is 053°.

The bearing of A from B is 233°.

294. The bearing of B from A is 124°.

The bearing of A from B is 304°.

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295. The bearing of B from A is 219°.

The bearing of A from B is 039°.

296. The bearing of B from A is 277°.

The bearing of A from B is 097°.

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297. 02400120

298. 08400810

299. Whanganui

300. New Plymouth

301. Whanganui

302. Invercargill

303. 066°

304. 246°

305. 302° and 240 km

306. 030° and 672 km

307. 06601620

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308. 03500540

309. Just below the 'r' of Greymouth on the map.

310. Directly about the 'h' of New Plymouth.

311. 138° and 280 km

312. 030° and 816 km

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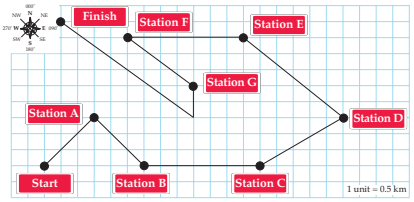
313. a) 3908
b) 1826
c) 3122
d) Toowoomba
e) 170 km ± 10 km
f) 690 km ± 10 km
g) Northeast
h) 345° ± 2°
i) Port Pirie or Port Augusta
j) Port Pirie

314. a) NE
b) 135°
c) 3.5 km
d) 2.9 km
e) 310°
f), g), h)



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315. a) 284°
b) 144°
c) 201°
d) Edgewater
e) 1.06 km

316. a) 034°
b) 323°
c) Reference (4, 2.5)

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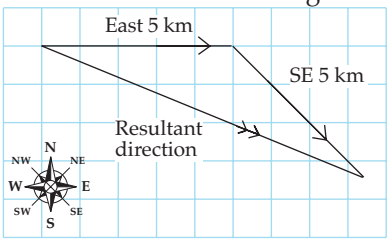
317. Distance = 9.2 km bearing 113°



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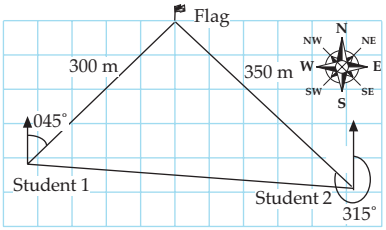
318.



Using 1 unit = 50 metres

Distance = 461 m (2 sf)

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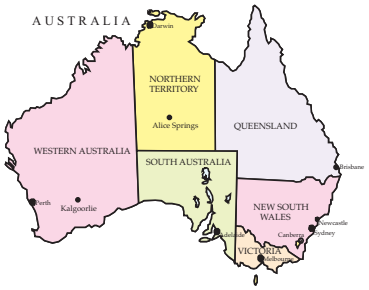
319. a) 020°
b) 120°
c) 2100 km
d) 2600 km
e) Newcastle
f) and g)



ANSWERS – NUMBER

Page 99

1. 25

2. 21

3. 4

4. 64

5. 17

6. 60

7. 168

8. 168

9. 98

10. 540

11. 288

12. 24

13. 35

14. 177

15. $1\frac{1}{24}$

16. $\frac{1}{2}$

17. $\frac{17}{25}$

18. $\frac{27}{70}$

19. 2

20. $\frac{73}{120}$

21. 44

22. $^{-}27$

23. $\frac{2}{5}$ (0.4)

24. $2\frac{5}{14}$ (2.357 (3 dp))

25. $\frac{3}{20}$ (0.15)

26. $\frac{7}{9}$ (0.778 (3 dp))

27. $\frac{2}{3}$ (0.667 (3dp))

28. $\frac{^{-}1}{32}$ ($^{-}$0.03125)

29. $71 - 6 \times 8 + 7 \times (4 - 4) - 3$
$71 - 48 + 7 \times 0 - 3$
$71 - 48 + 0 - 3$
$= 20$

30. $9 + 3 - 16 + 5 \times 4 - 2$
$9 + 3 - 16 + 20 - 2$
$12 - 16 + 20 - 2$
$^{-}4 + 20 - 2$
$16 - 2$
$= 14$

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31. 789.88

32. 0.0024

33. 50.0

34. 67 500

35. 0.0098

36. 2000

37. 655.0

38. 0.0480

39. 27 000

40. 44

41. 0.9

42. 5.23

43. 480

44. 8.4

45. 60

46. 7220

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47. 6.0 (1 dp)

48. 9 (1 sf)

49. 3.22 (2 dp)

50. 39 (2 sf)

51. 2.62 (3 sf)

52. 12 (2 sf)

53. 110 (2 sf)

54. 0.13 (2 sf)

55. 22.8 m (1 dp)

56. 47 cm^3 (2 sf)

57. 5.4 m (1 dp)

58. 5.6 L (2 sf)
as only the 45 litres is measured (the 8 parts are counted).

59. 43 cm^2 (2 sf)

60. $353.50 (2 sf)

61. a) 21 m^2

b) 4

c) 55 cm^3 (2 sf)

d) $170.95

e) $3897

f) No should be rounded to 3 sf i.e 52.8 m^3.

g) 18 hours.

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62. 120 (accept 102)

63. 70 (accept 77)

64. 500

65. 9

66. 200

67. 60

68. 100

69. 250

70. $150

71. $10 000

72. $100

73. $3

74. $12 000

75. 1500 cm^3

76. $300

77. 1250 km

78. 8000 minutes

79. $180

80. $2400

81. Car $20 000.
Deposit $4000.
Balance $16 000
+ interest = $18 000.
Cost per month = $1000.
Other costs per month = $50.
Fuel per month = $160.
Sevices per month = $40.
Total $1250 per month.

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82. 4.15×10^4

83. 5.91×10^2

84. 1.275×10^1

85. 4.5×10^{-2}

86. 5.92×10^{-1}

87. 7×10^0

88. 1.27×10^7

89. 9.56×10^{-6}

90. 9.32×10^3

91. 1.58×10^3

92. 4.53×10^{-5}

93. 1.2×10^3

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94. 4.44×10^{1}

95. 7.13×10^{-1}

96. 5.0×10^{2}

97. 1.774×10^{0}

98. 5.025×10^{6}

99. 3.819×10^{7}

100. 5.0×10^{-3}

101. 3.65×10^{-2}

102. 0.000 485

103. 78 900 000

104. 0.325

105. 1.98

106. 987.6

107. 0.1423

108. 18.04

109. 0.0132

110. 499 seconds (3 sf)

111. 3.1×10^{10} years (2 sf)

112. 9.47×10^{12} km (3 sf)

113. 14.0×10^{20} kg (1 dp)
$= 1.40 \times 10^{21}$ kg (2 dp)

114. 1.9×10^{17} joules (2 sf)

115. 5.3×10^{4} years
= 53 000 years

116. 12.096 mm
= 12 mm (2 sf)

117. \$5263.15
\$5300 per person (2 sf)

118. a) 73 800 000 000 000
b) 7.38×10^{13}
c) 4.54×10^{23}
d) 8.88×10^{-10}
e) 5.35×10^{14}
f) 3.942×10^{7}
g) 3.35×10^{9}
h) 2.24×10^{8}

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119. $\frac{19}{50}$

120. $1\frac{11}{20}$

121. $\frac{7}{40}$

122. $\frac{3}{4}$

123. $\frac{3}{50}$

124. $\frac{1}{200}$

125. $\frac{17}{250}$

126. $\frac{1}{8}$

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127. 72%

128. 43.5%

129. 80%

130. 125%

131. 180%

132. 2.5%

133. 37.5%

134. 5%

135. \$18

136. 135 kg

137. \$323.75

138. 7.65 L

139. \$22.50

140. 55

141. 4.74

142. 276

143. \$26.40

144. 12.9 kg

145. 756 girls

146. \$105

147. 70.4% (1 dp)

148. 5%

149. \$37.50

150. \$17

151. 75.7% (1 dp)

152. 600 boys

153. a) \$914.16
b) \$68.56
c) \$86.85
d) \$83

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154. \$258.30

155. 126.1

156. \$41.56

157. \$47.25

158. \$110.98

159. \$3499.13

160. 506 pupils

161. \$649 900

162. 1544 or 1545

163. \$19 125

164. 31.4 % (1 dp)

165. 23.1 % (1 dp)

166. 10.7% (1 dp)

167. 20.8% (1 dp)

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168. 38.0 % (1 dp)

169. 46.6% (1 dp)

170. \$182.61

171. \$430.43

172. \$45

173. \$2086.96

174. \$168.18

175. \$133.90

176. \$476.86

177. 12.0% (1 dp)

178. a) \$544.50
b) \$441.05
c) 10.2% (1 dp)
d) Receives \$456.00 now so better off by \$14.95
e) 62.8% (1 dp)

Page 110 cont...

179. a)

Commission – Company A	$210 000
Flat fee of $400	$400
4.5% of $100 000	$4500
2.5% of $110 000	$2750
Total (excluding GST)	$7650
Total (including GST of 15%)	$8797.50

b)

Commission – Company B	$210 000
Flat fee	$250
4% of $80 000	$3200
3.5% of $130 000	$4550
Total (excluding GST)	$8000
Total (including GST of 15%)	$9200

c) $402.50

d) 4.4% (1 dp)

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180. $7024.64

181. $23 534.07

182. 14.4% more (1 dp)

183. a) $30.52

b) $15.52

c) 103.5%

184. a) Option 1 = $7693.12
Option 2 = $8525
Option 2 better
by $831.88

b) 10.8%

c) 11.3%

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185. 1 : 2

186. 1 : 16

187. 1 : 3

188. 2 : 3

189. 16 : 1

190. 2 : 5

191. 3 : 4 : 10

192. 4 : 9 : 3

193. 3 : 5

194. 1 : 50

195. 1 : 6

196. 2 : 3 : 5

197. 10 : 6 : 2 : 1

198. 1 : 30

199. 1 : 100 000

200. 3 : 10

Page 113 cont...

201. w = 35

202. x = 144

203. y = 2.33 (2 dp)

204. z = 12

205. $12, $20

206. 30 L, 10 L

207. $49.78, $78.22

208. 4.75 L , 0.25 L

209. 1.2 m, 2.4 m, 1.6 m

210. $8.95, $5.37, $14.32, $7.16

211. $6.60, $11.00

212. $66, $55, $22

213. Alysia = $144
Barbara = $96

214. Clare = $26.67
Dennis = $20
Elliot = $33.33

215. $3400 and $5100

216. $480 and $200

217. $15

218. 1.56 litres

219. 12 cows

220. 56 kg

221. a) 1333 g (1.333 kg)

b) 67 500 L

c) $247.50

d) $224.24

e) 162.5 ml

f) 7.5 km

g) 3 gold medals.

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222. 24 + 48 + 60 = 132

223. 10 men

224. 161.5 units of copper and
28.5 units of iron

225. 85 grams

226. 30 scientific and 10 algebraic calculators.

227. 24 males

228. Construction cost = $262 500
Total cost = $375 000

229. x = 6

230. x = 5

Page 114 cont...

231. Printing = $36 000
Paper = $18 000
Covers = $9000
Total cost = $63 000

232. x = 20

233. By 2400 books.

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234. a) 7.5 seams/min.

b) 337 or 338 seams (337.5)

c) 133.3 mins. (1 dp)

235. a) $14.75 per hour

b) $3156.50

c) 340 hours

236. a) 427.5 km

b) 26.39 m/s

c) 3.8 seconds (1 dp)

237. a) 18.7 mins.

b) 38.9 hours

c) 900 L/h

238. a) 25 kg/h

b) 23.3 kg/h

239. a) 0.354 cm/h

b) 23 days 13 hours

240. a) 12 days

b) 1.2 days

c) $\frac{12}{x}$ days

241. a) 7.5 hours

b) 4 hours

c) $\frac{60}{x}$ hours

242. a) 12.5 days

b) 22.1 days

243. a) 2 days

b) 3.6 days

c) 15 people

244. a) 50 days

b) 65 days

c) 45 people

245. a) 0.75 m track/worker/day

b) 26.7 days

c) 100 workers

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246. a) 200 seconds
b) 54 km/h
c) 63 km/h

247. 4.8 hours

248. 4.5 hours

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249. $\frac{1}{8}$

250. $\frac{1}{25}$

251. $\frac{4}{9}$

252. $\frac{8}{125}$

253. $\frac{64}{343}$

254. 625

255. 2187

256. 256

257. 1

258. $\frac{1}{5}$

259. $\frac{1}{16}$

260. $\frac{1}{27}$

261. $\frac{1}{6561}$

262. 4

263. $\frac{3}{2}$

264. $\frac{64}{27}$

265. 20

266. 28

267. 85

268. 96

269. $\frac{1}{2}$

270. $\frac{1}{4}$

271. $\frac{2}{3}$

272. $\frac{5}{7}$

273. $\frac{7}{10}$

274. $1\frac{1}{2}$

Page 118 cont...

275. $1\frac{2}{3}$

276. $1\frac{3}{5}$

277. Between 3 and 4

278. Between 5 and 6

279. Between 6 and 7

280. Between 10 and 11

281. Between 12 and 13

282. Between 17 and 18

283. Between 30 and 31

284. Between 31 and 32

285. 6.083 (4 sf)

286. 14.07 (4 sf)

287. 19.49 (4 sf)

288. 24.90 (4 sf)

289. 12.25 (4 sf)

290. 17.32 (4 sf)

291. 30.82 (4 sf)

292. 31.62 (4 sf)

293. 39.75 (4 sf)

294. 50.12 (4 sf)

295. 98.89 (4 sf)

296. 113.5 (4 sf)

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297. $\frac{1}{64}$

298. 3

299. $\frac{1}{100}$

300. 216

301. $\frac{1}{125}$

302. 81

303. $\frac{1}{4}$

304. 3

305. 4

306. $\frac{4}{3}$

307. $\frac{3}{2}$

308. 4

309. 2

310. $\frac{1}{2}$

311. 2

Page 120 cont...

312. $\frac{1}{4}$

313. 64

314. $\frac{1}{10}$

315. 8

316. $\frac{1}{16}$

317. $\frac{1}{25}$

318. $\frac{1}{6}$

319. 64

320. 9

321. $\frac{64}{27}$

322. 3

323. 16

324. $\frac{27}{8}$

325. $\frac{16}{9}$

326. $\frac{8}{5}$

327. 15.625

328. 0.000 32

329. 10

330. 0.04

331. 16

332. 3.375

333. -5

334. 100

335. 0.16

336. -2

337. 0.027

338. 0.000 01

339. $\sqrt[3]{x}$ **340.** $\sqrt[3]{y^2}$

341. $\sqrt[4]{z^3}$ **342.** $\frac{1}{\sqrt{x}}$

343. $\frac{1}{\sqrt{y^3}}$ **344.** $\frac{1}{\sqrt[3]{z^2}}$

345. $4\sqrt[3]{x}$ **346.** $3\sqrt{y}$

347. $5\sqrt[3]{z^4}$ **348.** $\frac{2}{\sqrt{x}}$

349. $\frac{8}{\sqrt[4]{y^3}}$ **350.** $\frac{10}{\sqrt[3]{z^2}}$

ANSWERS – ALGEBRA

Page 123

1. $2x + 12$
2. $9x + 2$
3. $4x - 18$
4. $10y - 9$
5. $5x$
6. 6
7. $8x - 3$
8. 0
9. $4x + 12y - 2$
10. $4x - 1$
11. $9x^2 - 18$
12. $^-3ab - 7$
13. $5z + 7x$
14. $y + 3$
15. $4t - 15$
16. $5x^2 - 6x + 1$
17. $^-5k^2 - 9k$
18. $^-3x - 8y - 3$
19. $8ab - 2a$
    (3ba is the same as 3ab)
20. $^-3a^2 + 5a$
21. $^-6x + 8x^3 - 13x + 4x^3$
22. $3q^2 + 7m - q^2 - 9m$
23. $m^3 - 3m^2 - 3m^3 + 7m^2$
24. $8ac - 12ab - ac + ab$
25. $x^2 - 4x + 7x - 3x^2$
26. $15pq - pq - 18 + 3$
27. $9k^2 - 4k^2 - 8k - 3k + 2$
28. $^-4mn - 6mn + pq - 2pq$
29. $9x + 19y$
30. $^-8x + 2y$
31. $10x$
32. $2(15 - 2x) + 2(8 - 2x) + 8x$
    $= 46$ cm, for $0 \le x < 4$
33. $8x - 2y - 2z$
34. $14x - 2y$
35. $8p - 5$ or equivalent.
36. $8D - 20$ or equivalent.
37. $wx + qx$ or equivalent.
38. $3x + 3$

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39. $x^a(p + r) + x^b(s - q)$
40. $6x^a - 2y^b$
41. $x^e(a + b) - y^f$

Page 124 cont...

42. $^-2m^n + 6p^q$
43. $x^b(a - d) + 3c$
44. $^-4p^q + 1$

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45. $3y^5$
46. $8a^2b^3$
47. $2p^5$
48. $60x^6$
49. $24a^4b^5$
50. $12m^3n^3$
51. $27x^6$
52. $16a^{16}b^8$
53. $25m^4n^8$
54. $36a^7b^4$
55. $72m^{13}n^9$
56. $200p^9q^6$
57. $32p^3q^{10}$
58. $100q^6r^8$
59. $512a^6b^{10}$
60. $k = 7$
61. $k = 3$
62. $k = 2$
63. $V = 3\pi x^3$
64. $V = 2\pi x^5$

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65. $\frac{3c}{2b}$
66. $\frac{4m}{3n}$
67. $\frac{5x}{4y^3}$
68. $\frac{9}{4a^2b^2}$
69. $\frac{1}{9m^5}$
70. $\frac{2}{3t}$
71. $\frac{m^2}{3n^2}$
72. $\frac{2}{a}$
73. $\frac{5f^3}{2eg}$
74. x^{25}
75. $8y^3$
76. $5x^4y^8$

Page 127 cont...

77. $\frac{x^4}{k}$
78. m^2
79. $\frac{1}{2a^2b}$
80. $\frac{16p^4}{q^5}$
81. $\frac{1}{b}$
82. $\frac{2p}{q}$
83. $a^{2n}x^{3n}$
84. $\frac{x^8}{b^2}$
85. $\frac{x^{15}}{3}$
86. $\frac{5k^8}{m^{18}}$
87. $12x^{26}$
88. $k = 30$
89. $k = 4$
90. $y = \frac{z}{\sqrt{x}}$

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91. $\frac{a^0}{a^n} = a^{0-n}$
    $= a^{-n}$ but as $a^0 = 1$
    $\frac{1}{a^n} = a^{-n}$

92. $\frac{a^n}{a^n} = a^{n-n}$
    $= a^0$
    but $\frac{a^n}{a^n} = \frac{\cancel{a} \times \cancel{a} \times \cancel{a} \times \cancel{a} \times \cancel{a} \ldots}{\cancel{a} \times \cancel{a} \times \cancel{a} \times \cancel{a} \times \cancel{a} \ldots}$
    $= 1$
    $a^0 = 1$

93. $a^{1/2} \times a^{1/2} = a^1$
    $= a$

94. a) $\sqrt{a} \times \sqrt{a} = (\sqrt{a})^2$
    $= a$

    b) $a^{1/2} = \sqrt{a}$

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95. $\frac{2x+3y}{6}$

96. $\frac{7a}{20}$

97. $\frac{15y+2x}{12xy}$

98. $\frac{5x}{12}$

99. $\frac{21a-10b}{35}$

100. $\frac{6y-7x}{2xy}$

101. $\frac{3}{k}$

102. $\frac{13x^2}{15}$

103. $\frac{11}{2x^2}$

104. $\frac{7x-1}{10}$

105. $\frac{5x-5}{4}$

106. $\frac{6x+1}{5}$

107. $\frac{4a^2}{3d^2}$

108. $\frac{4bdy}{x}$

109. $\frac{3x^2y-5}{4y}$

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110. $\frac{4m^2}{9}$

111. y^4

112. $\frac{9q^2}{7p^2}$

113. $\frac{27r}{35p^2t^2}$

114. $\frac{25n^5}{48m^3}$

115. $\frac{96ab}{5}$

116. xy

117. $\frac{\sqrt{37}x}{4}$

118. $\frac{2(x+1)}{x+4}$

Page 130 cont...

119. $x = ^-1$

120. $b = 7$

121. $y = ^-7$

122. $x = \frac{^-2}{7}$

123. $m = ^-2$

124. $x = \frac{^-8}{5}\,(^-1.6)$

125. $d = 2.25$

126. $c = 8$

127. $a = ^-16$

128. $d = 1$

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129. $F = 608\ ^\circ F$

130. $C = ^-15\ ^\circ C$

131. $a = 9$

132. $b = ^-4$

133. $c = ^-2$

134. $x = 25$

135. $c = \frac{^-7}{4}\,(^-1.75)$

136. $d = ^-4.5$

137. $d = ^-4$

138. $e = 16$

139. $m = 216$

140. $K = 3$

141. V = IR where V = voltage, I is current and R is resistance.
R = 160 ohms.

142. $C = \frac{F}{D}$ where
C is consumption, F is fuel and D is distance.
D = 6.03 (00) km

143. $A = \frac{(a+b)d}{2}$ where a and b are the lengths of // sides, A is the area and d is the distance between.
d = 3.5 m.

144. W = n(0.5 + J) + 2.25 where W is weight, J is weight jar and n is number of jars.
J = 0.05 kg (50 g)

145. C = 31T + 0.55D where C is cost, T is days and D is distance.
D = 172 km

Page 131 cont...

146. C = 1.6d + 0.32u
d is days, u is units and C is the cost.
u = 740 units

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147. 1.5 + 18 ÷ J + 0.5 > 81 ÷ 18 + 0.5
J is the speed that Kauri jogs.
J < 6 km/h

148. 30W ≥ 3500 + 1100
W is the weekly wage.
W ≥ $153.33

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149. $x = 1$

150. $z = ^-0.5\ \left(\frac{^-1}{2}\right)$

151. $x = ^-7$

152. $y = ^-4$

153. $y = ^-5$

154. $x = 7$

155. $x = 8$

156. $w = 13$

157. $a = ^-13$

158. $b = ^-2$

159. $m = 1$

160. $q = 12$

161. $x = 2$

162. $x = \frac{2}{7}$

163. $x = ^-7\frac{1}{2}$

164. $x = 1\frac{5}{8}$

165. $x = 1\frac{8}{9}$

166. $x = 6\frac{12}{13}$

167. $x = \frac{^-1}{10}$

168. $x = 2\frac{5}{12}$

169. $c = \frac{^-3}{5}$

170. n + (n + 1) + (n + 2) = 108
n = 35
Numbers are 35, 36 and 37

171. 7n = 10n – 36
n = 12,
Number is 12

Page 134 cont...

172. $2n - (n + 2) = 46$
$n = 48$,
Number are 48 and 50

173. $2A - 1 + 2A - 4 + A = 35$
$A = 8$
Ages are Asif 8, Hamil 12 and Jamil 15.

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174. $\frac{(86+92+80+2x)}{5} = 84$
$258 + 2x = 420$
$x = 81$
Average on next two test is 81%

175. $\frac{x}{4} + \frac{x}{6} = 1$
$x = 2.4$ hours

176. $10x + 5(130 - x) = 890$
$5x + 650 = 890$
$x = 48$, \$10 notes and 82, \$5 notes.

177. $\frac{x}{6} + \frac{(10-x)}{12} = 1$
walk 2 km and run 8 km.

178. $30 - 0.5x = 45 - 2x$
$x = 10$ hours (5 am)

179. $J + 15 = H - 15$ so $H = J + 30$
$H + 10 = 2(J - 10)$
$H + 10 = 2J - 20$
$(J + 30) + 10 = 2J - 20$
Jian = \$60, Harris \$90

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180. $3x + 15 = 27$
$x = 4$

181. $0.5x + 15 = 22$
$x = 14$

182. $\frac{x}{4} + 16 = 20$
$x = 16$

183. $200 - 5x = 30$
$x = 34$

184. $6x - 11 = 61$
$x = 12$

185. $4(x + 5) = 60$
$x = 10$

Page 137 cont...

186. $20 - 2 = 3f$
friends = 6

187. $2(20w) = 13$
$w = 0.325$ kg

188. $2x + 7 = 3x$
$x = 7$

189. $15 + \frac{P}{5} = 41$
P = \$130 (note \$)

190. $0.5(x - 15) = 34$
x = \$83

191. $(1 - \frac{1}{2} - \frac{1}{3})$Area = 3
Area = 18 m^2

192. $3x = 5x - 12$
$x = 6$

193. $(x + 2) \div 3 = 21$
$x = 61$

194. $12 + 24T = 42$
T = 1.25 hours (1 h 15 min)

195. $6(W + 8) = 10W$
W = 12 metres

196. $N + (N + 1) = 71$
$N = 35$
Numbers 35 and 36

197. $N + (N + 1) + (N + 2) = 60$
$N = 19$
Numbers 19, 20 and 21

198. $N + (N + 5) = 29$
N = 12 years

199. $d + (d + 3) + (d + 6) + (d + 9) = 90$
distance = 18 km

200. $J + J + 8.5 = 32.7$
Distance = 12.1 km

201. $H + (2H + 3) = 27$
Heidi has = 8 books

202. $5m + 6 + 2(4.5) + 6.75 + 2 = 66.25$
Ticket cost = \$8.50

203. $C + (C + 3) + (C + 7) = 28$
Craig = \$6.00

204. $2(W + 3W) = 656$
Wide = 82 metres

205. $(G + 12) + G + (G - 5) = 130$
Guo = \$41

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206. $y = 12 - 3x$

207. $m = ^-6 - 2r$

208. $t = \frac{7+y}{4}$

209. $y = \frac{4x+9}{3}$

210. $t = \frac{3x+q}{^-7} = \frac{^-3x-q}{7}$

211. $k = \frac{7+y}{2x}$

212. $I = \frac{V}{R}$

213. $t = \pm\sqrt{12+q}$

214. $a = \frac{v-u}{t}$

215. $y = \frac{pq}{m}$

216. $R = \frac{100\,I}{PT}$

217. $h = \frac{V}{\pi r^2}$

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218. $C = 2\pi r$
$r = \frac{C}{2\pi}$

219. $A = \pi r^2$
$r = \sqrt{\frac{A}{\pi}}$

220. $C = 6 \times \frac{d}{2}$
$C = 3d$
$d = \frac{C}{3}$

221. A = 6 (area side)
$A = 6x^2$
$x = \sqrt{\frac{A}{6}}$

222. $h^2 = a^2 + a^2$
$2a^2 = h^2$
$a = \sqrt{\frac{h^2}{2}}$ or $\frac{h}{\sqrt{2}}$

Page 139 cont...

223. $A = x^2$

$h^2 = 2x^2$

$h^2 = 2A$

$A = \frac{1}{2}h^2$

224. A = large sq. – small sq.

$= x^2 - r^2$

$x = \sqrt{A + r^2}$

225. $A = \pi x^2 - \pi r^2$

$x = \sqrt{\frac{A}{\pi} + r^2}$ OR

$x = \sqrt{\frac{A + \pi r^2}{\pi}}$

226. $V = \frac{1}{3}\pi x^2(2x)$

$V = \frac{2}{3}\pi x^3$

$x = \sqrt[3]{\frac{3V}{2\pi}}$

227. $A = (2x)^2 + \frac{1}{2}\pi x^2$

$A = 4x^2 + \frac{1}{2}\pi x^2$

$x = \sqrt{\frac{2A}{8 + \pi}}$

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228.

x	y	First order differences
-2	-5	3
-1	-2	3
0	1	3
1	4	3
2	7	

Linear – First order differences constant.

229.

x	y	First order differences
-2	4	-3
-1	1	-1
0	0	1
1	1	3
2	4	

Not linear – First order differences not constant.

230.

x	y	First order differences
-2	7	-4
-1	3	-4
0	-1	-4
1	-5	-4
2	-9	

Linear – First order differences constant.

Page 142 cont...

231.

x	y	First order differences
0	1	1
1	2	7
2	9	19
3	28	37
4	65	

Not linear – First order differences not constant.

232.

x	y	First order differences
-2	-2	1
-1	-1	1
0	0	1
1	1	1
2	2	

Linear – First order differences constant.

233.

x	y	First order differences
0	3	0
1	3	0
2	3	0
3	3	0
4	3	

Linear – First order differences constant.

234.

x	y	First order differences
-2	2	-3
-1	-1	-1
0	-2	1
1	-1	3
2	2	

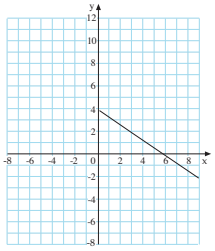
Not linear – First order differences not constant.

235.

x	y	First order differences
5	30	-10
4	20	-8
3	12	-6
2	6	-4
1	2	

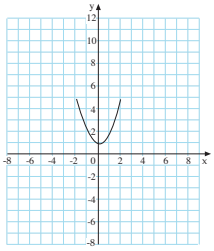
Not linear – First order differences not constant.

236.



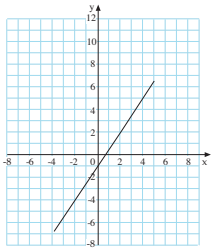
Linear

237.



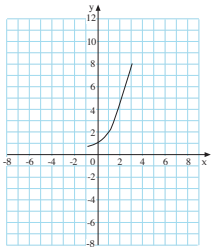
Not linear

238.



Linear

239.



Not linear

240. Linear **241.** Not linear

242. Not linear **243.** Linear

244. Not linear **245.** Linear

246. Not linear **247.** Linear

248. Linear **249.** Linear

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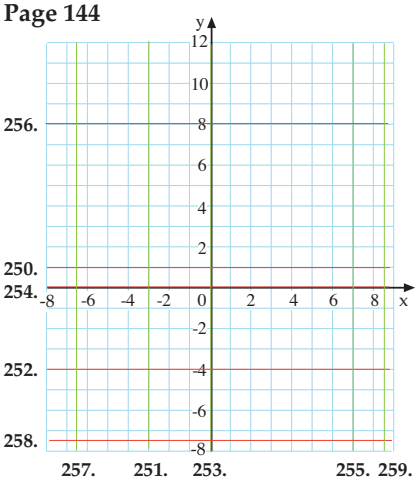

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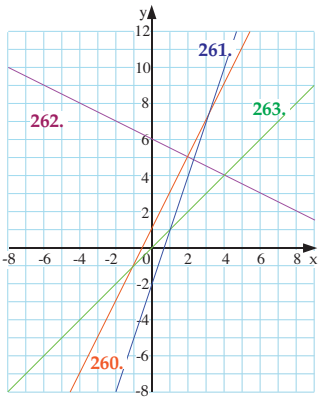
260. grad. = 2, y int. = 1

261. grad. = 3, y int. = -2

262. grad. = -0.5, y int. = 6

263. grad. = 1, y int. = 0



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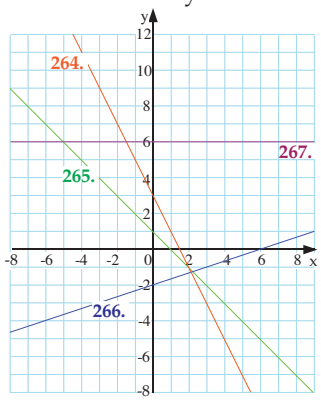
264.
grad. = $^{-}2$
y int. = 3

265.
grad. = $^{-}1$
y int. = 1

266.
grad. = 0.333
y int. = $^{-}2$

267.
grad. = 0
y int. = 6



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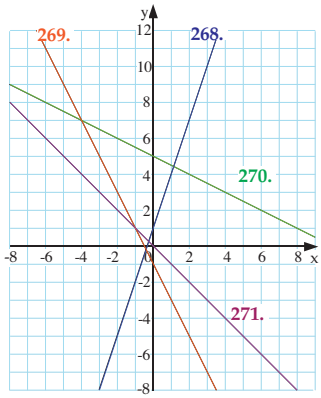
268.
grad. = 3
y int. = 1

269.
grad. = $^{-}2$
y int. = $^{-}1$

270.
grad. = $^{-}0.5$
y int. = 5

271.
grad. = $^{-}1$
y int. = 0

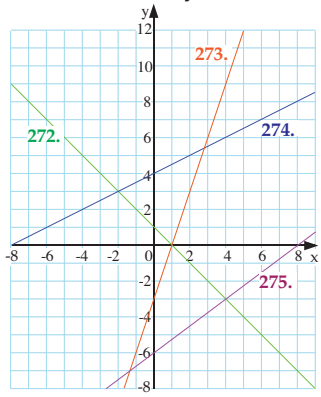


272.
grad. = $^{-}1$
y int. = 1

273.
grad. = 3
y int. = $^{-}3$

274.
grad. = 0.5
y int. = 4

275.
grad. = 0.75
y int. = $^{-}6$



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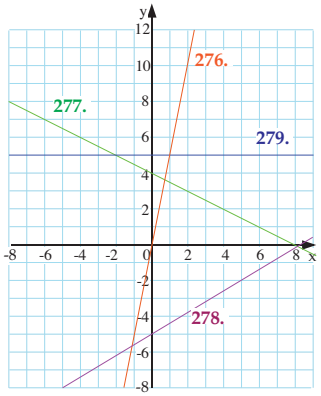
276.
grad. = 5
y int. = 0

277.
grad. = $^{-}0.5$
y int. = 4

278.
grad. = 0.6
y int. = $^{-}5$

279.
grad. = 0
y int. = 5



280. (A)
grad. = $^{-}1$
y int. = 5
y = $^{-}$x + 5

281. (B)
grad. = 0.5
y int. = $^{-}1$
y = 0.5x – 1

282. (C)
grad. = 3
y int. = 0
y = 3x

283. (D)
grad. = 0
y int. = 7
y = 7

284. (E)
grad. = $^{-}1$
y int. = 0
y = $^{-}$x

285. (F)
grad. = 4
y int. = 2
y = 4x + 2

286. (G)
grad. = 1
y int. = 6
y = x + 6

287. (H)
grad. = $^{-}0.5$
y int. = 4
y = $^{-}0.5$x + 4

288. (I)
grad. = $^{-}0.4$
y int. = 6
y = $^{-}0.4$x + 6

289. (J)
grad. = undef.
y int. = n/a
x = 6

290. (K)
grad. = 1
y int. = 0
y = x

291. (L)
grad. = $^{-}2$
y int. = 2
y = $^{-}2$x + 2

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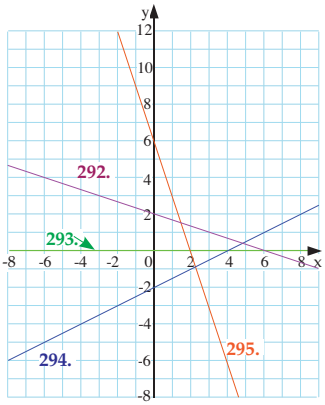
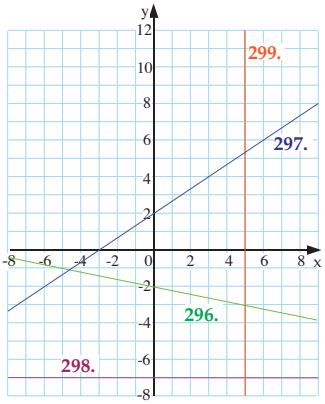
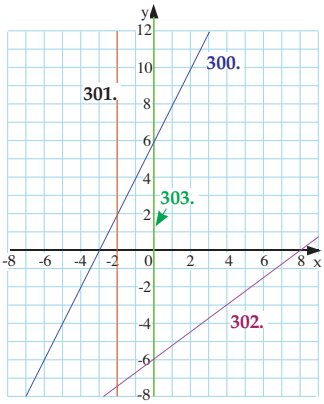
292. 293. 294. and 295.



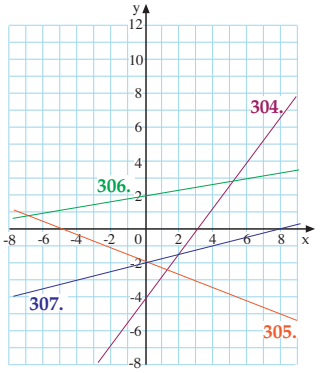
296. 297. 298. and 299.



300. 301. 302. and 303.



304. 305. 306. and 307.



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308. $y = \frac{2}{3}x + \frac{7}{3}$ or $2x - 3y + 7 = 0$

309. $y = \frac{-4}{5}x - \frac{6}{5}$ or $4x + 5y + 6 = 0$

310. $y = \frac{1}{7}x + \frac{23}{7}$ or $x - 7y + 23 = 0$

311. $y = x - 6$ or $x - y - 6 = 0$

312. $y = 5$ or $y - 5 = 0$

313. $y = \frac{-1}{2}x + \frac{3}{2}$ or $x + 2y - 3 = 0$

314. $y = 3x - 13$ or $3x - y - 13 = 0$

315. $y = \frac{1}{2}x + 8$ or $x - 2y + 16 = 0$

316. $y = \frac{-2}{5}x - \frac{33}{5}$
or $2x + 5y + 33 = 0$

317. $y = \frac{3}{2}x - \frac{11}{2}$ or $3x - 2y - 11 = 0$

318. $y = \frac{-8}{3}x - \frac{7}{3}$ or $8x + 3y + 7 = 0$

319. $y = -1.5x + 6.65$
or $3x + 2y - 13.3 = 0$

320. $y = 2x - 5$ or $2x - y - 5 = 0$

321. $y = -2x + 1$ or $2x + y - 1 = 0$

322. $y = 3x + 10$ or $3x - y + 10 = 0$

323. $y = \frac{1}{2}x - 7$ or $x - 2y - 14 = 0$

324. $y = \frac{1}{6}x + \frac{8}{3}a$ or $x - 6y + 16a = 0$

325. $y = -q$ or $y + q = 0$

326. $y = \frac{-5}{2}x + 10.4$
or $5x + 2y - 20.8 = 0$

327. $y = 3x - 2$ or $3x - y - 2 = 0$

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328. $m = \frac{-7}{2}$ (-3.5)

y intercept $= \frac{9}{2}$ (4.5)

329. $m = \frac{-4}{7}$ (-0.57)

y intercept $= \frac{13}{7}$ (1.86)

Page 152 cont...

330. $m = \frac{-1}{3}$ (-0.33)

y intercept $= \frac{3}{4}$ (0.75)

331. $m = \frac{-4}{5}$ (-0.8)

y intercept $= \frac{6}{5}$ (1.2)

332. $6x + 5y = 0$

333. Equation $y = 2x + 13$
or $2x - y + 13 = 0$
Points A, B and C can be substituted into this equation.

334. AB, $y = \frac{3}{5}x + \frac{34}{5}$
or $3x - 5y + 34 = 0$
BC, $y = 12x - 16$
or $12x - y - 16 = 0$

335. The points B, D and E.

336. $y = \frac{1}{2}x + 2$ or $x - 2y + 4 = 0$

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337. Only c) with gradients -2, and d) with gradients 0 are parallel.

338. Only a) with gradients 3, e) with gradients 0 and f) with gradients -2 are parallel.

339. $y = \frac{-5}{2}x - 4$
$5x + 2y + 8 = 0$

340. $y = \frac{3x}{4} - \frac{1}{2}$
$3x - 4y - 2 = 0$

341. $y = \frac{-9}{4}x + \frac{5}{4}$
$9x + 4y - 5 = 0$

342. $y = -3x - 1$
$3x + y + 1 = 0$

343. $q = -4\frac{2}{3}$, $y = \frac{2}{3}x - 4$
$2x - 3y - 12 = 0$

344. $y = 2x - 7$
$2x - y - 7 = 0$

Page 153 cont...

345. $y = -3x - 4$
$3x + y + 4 = 0$

346. $y = \frac{2}{3}x - \frac{19}{3}$
$2x - 3y - 19 = 0$

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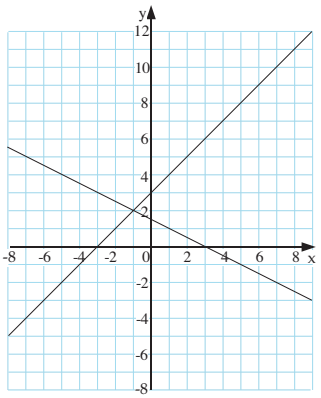
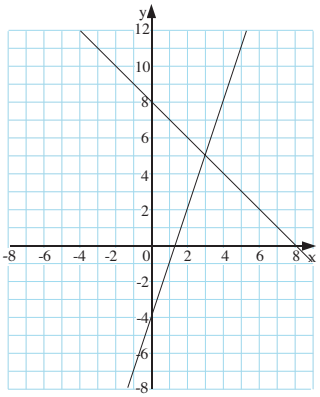
347.



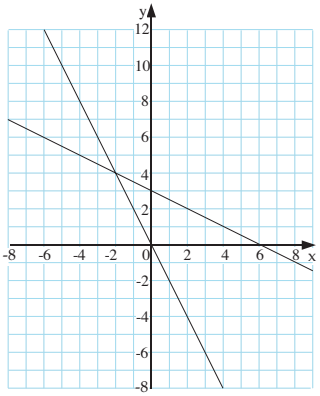
Point of intersection $(-1, 2)$

348.



Point of intersection $(3, 5)$

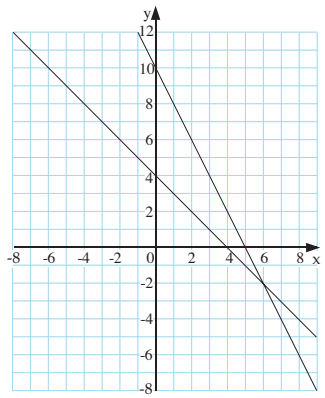
349.



Point of intersection $(-2, 4)$

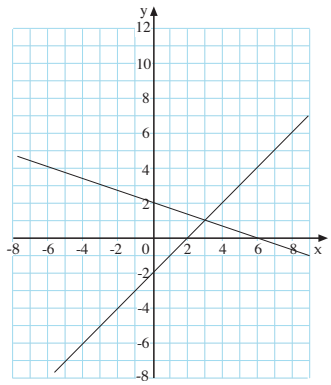
Page 155 cont...

350.



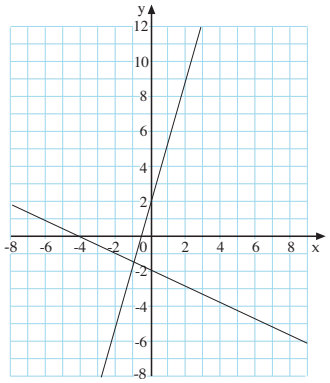
Point of intersection (6, ⁻2)

351.



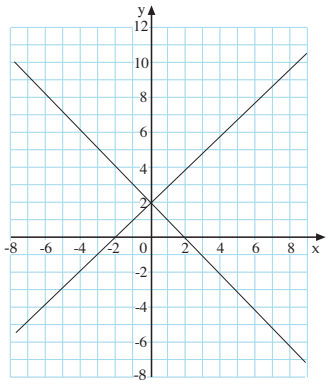
Point of intersection (3, 1)

352.



Point of intersection $(^{-}1, {}^{-}1\frac{1}{2})$

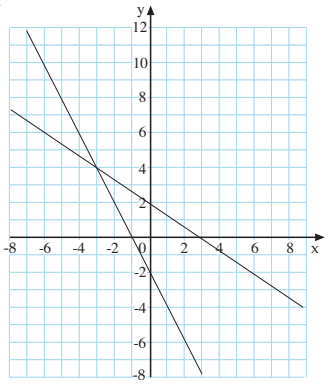
353.



Point of intersection (0, 2)

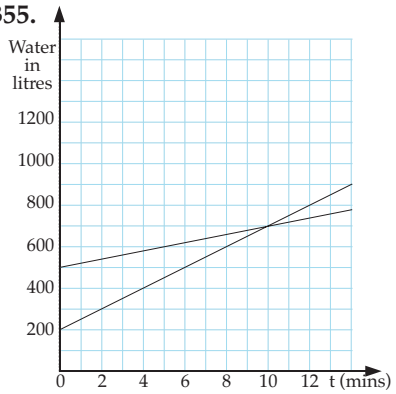
Page 155 cont...

354.



Point of intersection (⁻3, 4)

355.



After 10 minutes they will have the same amount (700 L).

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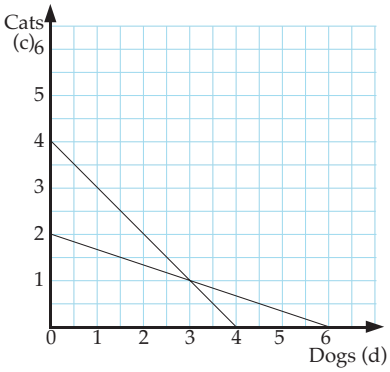
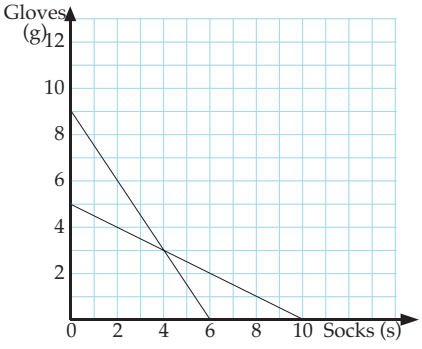
356. 2d + 6c = 12
4d + 4c = 16



Dogs 3 cans and the cats 1 can.

357. 3s + 6g = 30
6s + 4g = 36



4 pairs of socks and 3 pairs of gloves.

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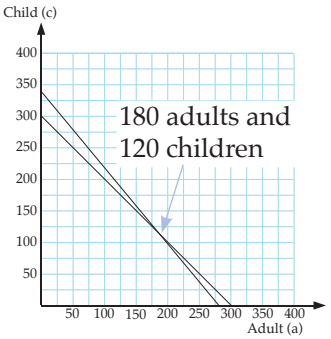
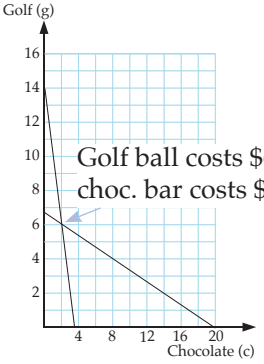
358. a + c = 300
6a + 5c = 1680



359. 3g + c = 20
g + 4c = 14



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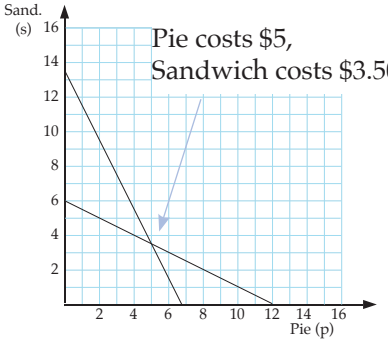
360. p + 2s = 12
2p + s = 13.50



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361. 4x – y = 8

2x + 3y = 12

$x = 2\frac{4}{7}$ (2.571 (4 sf)) and

$y = 2\frac{2}{7}$ (2.286 (4 sf))

362. 8x – 5y = 40

4x + 3y = 12

$x = 4\frac{1}{11}$ (4.091 (4 sf)) and

$y = {}^{-}1\frac{5}{11}$ (⁻1.455 (4 sf))

Page 158 cont...

363. Point A (5.5, 2)
Point B (6.182, 4.727) (4 sf)
Point B $(6\frac{2}{11}, 4\frac{8}{11})$

364. Point C (7.667, $^-$4.333) (4 sf)
Point C $(7\frac{2}{3}, ^-4\frac{1}{3})$
Point D (4.571, 1.857) (4 sf)
Point D $(4\frac{4}{7}, 1\frac{6}{7})$

365. Point E (3.810, 3.381) (4 sf)
Point F ($^-$3.130, $^-$0.957) (4 sf)
Point G (7.8, $^-$4.6)

366. Point H ($^-$1.25, 3.5)
Point I (1.8, $^-$2.6)
Point J (3.83, 3.5)

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367 Point K (32, 32)
Point L (54, 43)
Point M (37.5, 37.5)

368. Point N (6.667, 36.67) (4 sf)
Point P (14.29, 55.71) (4 sf)
Point Q (9.091, 60.91) (4 sf)

369. Line 1: $y = 4x$
Line 2: $y = x + 50$
Line 3: $y = 0.25x + 100$
Line 1 when $x < 16.67$ (4 sf)
Line 2 for $16.67 < x < 66.67$
Line 3 for $x > 66.67$ (4 sf)

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370. $x = 1, y = 3$
371. $x = 3, y = ^-2$
372. $x = 2, y = 6$
373. $x = ^-3, y = 1$
374. $x = ^-5, y = ^-1$
375. $x = 2, y = ^-3$
376. $x = ^-7, y = 1$
377. $x = 1, y = 7$
378. $x = 4, y = 2.5$
379. $x = ^-1.5, y = 7$
380. $x = ^-1, y = 1$

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381. $x = 2, y = ^-1$
382. $x = 1, y = 2$
383. $x = 3.5, y = 2$
384. $x = 3, y = ^-3$
385. $x = 1, y = 3$
386. $x = 2, y = 3$
387. $x = 6, y = 7$
388. $x = 4, y = 5$
389. $x = 0, y = 4$

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390. $x = ^-3, y = 1$
391. $x = ^-13, y = ^-10$
392. $x = ^-3, y = 1$
393. $x = ^-2, y = 2$
394. $x = ^-5, y = ^-1$
395. $x = ^-4, y = ^-4$
396. $x = 5, y = 2$
397. $x = 1, y = 4$
398. $x = 3, y = 0$
399. $x = 2, y = 5$
400. $x = ^-2, y = ^-4$
401. $x = 0, y = 3$
402. $x = 3, y = ^-1$
403. $x = 5, y = 3$
404. $x = 0, y = ^-4$
405. $x = ^-4, y = 1$
406. $x = 3, y = 4, x + y = 7$
407. $x = 1, y = ^-8, x - y = 9$

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408. Flour \$2 kg
Eggs \$6 dozen

409. Larger number is 36
Smaller number is 15

410. Grandstand \$40
Terraces \$15

411. Width 28 cm, Length 112 cm

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412. Calculus \$20, Year 11 \$25
413. Adults 300, Students 200
414. \$3 ice-creams 35
\$5 ice-creams 15
415. 15 two-mark questions.
20 three-mark questions.

Page 166 cont...

416. a) $2b + d = 15, b + 2d = 12$
b) Burger = \$6, dessert = \$3.

417. a) $25x + 3y = 20$,
$10x + 5y = 27$
b) 1(00) texts and
15 min. = \$8

418. a) $9x + 3y = 300$
b) $6x + 8y = 440$
c) 20 kg poultry,
40 kg compost.

419. a) $2000A + 8000B = 34000$
$4000A + 2000B = 26000$
b) A = \$5, B = \$3

420. a) Speed blue = 80 km/h
b) Red closer after 1.5 hours

421. After a distance of 240 km and a cost of \$240 Magic Carpet car is cheaper to rent.

422. a) $P_1 = 11000 - 500t$ m/min
$P_2 = 250t$ m/min
b) t = 14 min 40 s (14.67 min)
Height = 3666.7 metres

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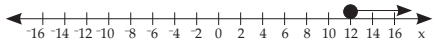
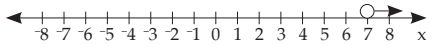
423. $x \geq 12$

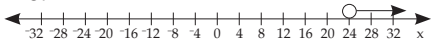


424. $x \leq 3$

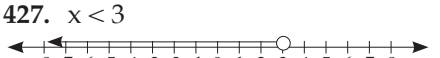
425. $x > 7$



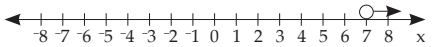
426. $x > 24$



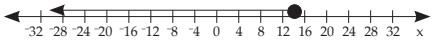
427. $x < 3$



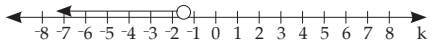
428. $x > 7$



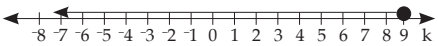
429. $x \leq 14$



430. $k < \frac{^-3}{2}(^-1.5)$



431. $k \leq 9$



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432. $x > 4$

433. $a \geq 20$

434. $y > \frac{14}{9}$ $\left(1\frac{5}{9}\right)$

435. $q < -20$

436. $w < -12$

437. $m > \frac{-11}{9}$

438. $w < 6$

439. a) $\frac{5x-2}{2}$

b) $x \geq \frac{-2}{7}$

440. $x > \frac{-8}{3}$

441. $x \geq \frac{-10}{13}$

442. $x > -5\frac{5}{11}$

443. $0.75k + 2.50 \geq 16$
$k \geq 18$ km

444. $n + (n + 1) + (n + 2) \geq 144$
$3n + 3 \geq 144$
$n > 47$
Numbers are 47, 48 and 49

445. $4.5x + 10 > 45$
$x > 7.777$, so 8 visits

446. $\frac{n}{8} + \frac{(n-12)}{6} \leq 54$
$6n + 8(n - 12) \leq 2592$
$n \leq 192$
Tia 192 oysters and
Hector 180 oysters.

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447. $t = 5n + 1$

Sequence	First order differences
6	5
11	5
16	5
21	5
26	5
31	5
36	

448. $t = -3n + 30$

Sequence	First order differences
27	-3
24	-3
21	-3
18	-3
15	-3
12	-3
9	

449. Not Linear

Sequence	First order differences
2	3
5	5
10	7
17	9
26	11
37	13
50	

450. $t = -7n + 54$

Sequence	First order differences
47	-7
40	-7
33	-7
26	-7
19	-7
12	-7
5	

Page 171 cont...

451. $t = -6n + 17$

Sequence	First order differences
11	-6
5	-6
-1	-6
-7	-6
-13	-6
-19	-6
-25	

452. Not Linear

Sequence	First order differences
1	6
7	10
17	14
31	18
49	22
71	26
97	

453. $t = -3n + 13$

Sequence	First order differences
10	-3
7	-3
4	-3
1	-3
-2	-3
-5	-3
-8	

454. $t = 4.5n + 6$

Sequence	First order differences
10.5	4.5
15	4.5
19.5	4.5
24	4.5
28.5	4.5
33	4.5
37.5	

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455. a) Constant difference is 12 hence must be linear.

b) $A = 12t + 8$

c) $A = 188$ m²

d) 96 trees

e) 12 m²/tree

456. a)

Head height (h)	Total matches (m)	First order differences
1	11	3
2	14	3
3	17	3
4	20	3
5	23	3
6	26	

b) Constant difference is 3 hence must be linear.

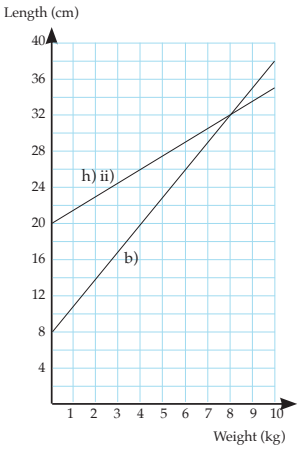
c) $m = 3h + 8$

d) 68 matches

e) 36 matches

457. a) Constant difference is 3 hence must be linear.

b)



Page 173 Q457 cont...

c) 3 cm/kg

d) $L = 3W + 8$

e) 8 cm

f) 44 cm

g) $W = 25$ kg

h) i) $L = 1.5W + 20$

ii) see graph.

iii) 8 kg

i) $W_1 \leq 30.7$ kg
$W_2 \leq 53.3$ kg

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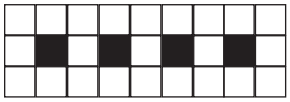
458. a)

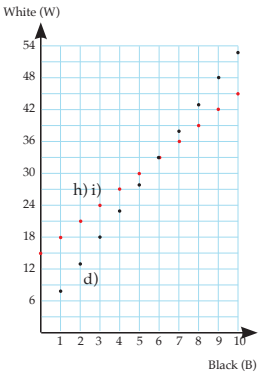


b)

Black tiles (B)	White tiles (W)	Differences
1	8	5
2	13	5
3	18	5
4	23	5
5	28	5
6	33	

c) Constant difference is 5 hence must be linear.

d)



e) $W = 5B + 3$

f) 63 white tiles

g) 15 black tiles

h) i) see graph above

ii) 6 black tiles

i) 12 black and 69 white 

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459. a) Acme Net, $30

b) 90 cents

c) 75 calls, $67.50

d) Most expensive would be Tel Net because the gradient is steeper.

e) $C = 0.5n + 30$

f) C = $95

g) 310 calls

h) $n = 50$ calls and
$n = 100$ calls

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460. a) Sarah = 9 parcels/hour
Chang = 10 parcels/hour

b) Chang starts work 30 minutes after Sarah.

Chang delivers 10 parcels per hour whereas Sarah only delivers an average of 9 parcels per hour.

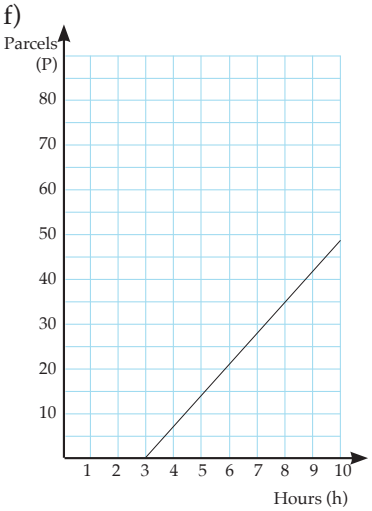
At 5 hours both Sarah and Chang have delivered 45 parcels.

c) P = 10H – 5

d) 30 parcels

e) 6.8 hours

f)



g) 49 parcels

h) 4 pm

i) 3 hours

j) P = 9h – 27

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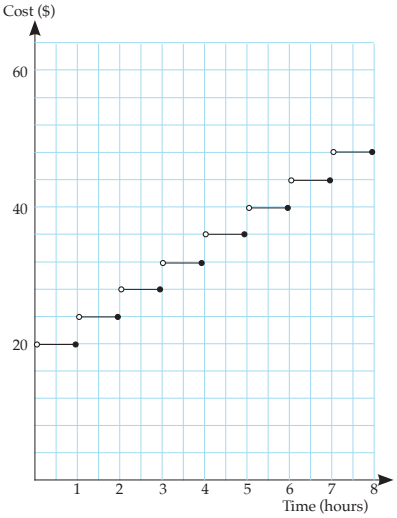
461. a)



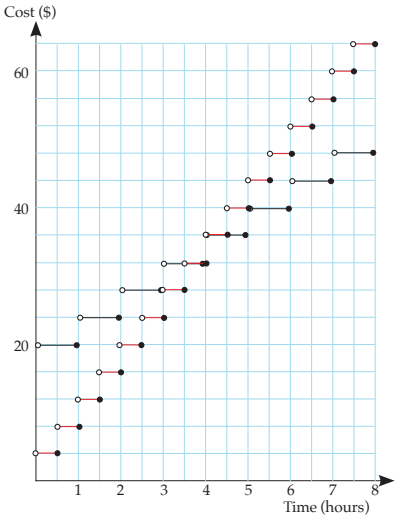
Page 175 Q461 cont...

b) You pay $20 for the first one hour (or part thereof) and then $4 for every extra hour up to a maximum of 8 hours.

c) $40

d) At a time of 3 hours there is a solid circle at $28 and an open circle at $32.

e) i)



ii) The second company is cheaper up to 3.5 hours, the same from 3.5 to 4.5 hours and more expensive from 4.5 hours onwards.

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462. $4x + 8$

463. $3a – 6b + 9c$

464. $^{-}15k^2 + 20k$

465. $^{-}12y^2 + 28xy$

466. $x^2 – 5x – 14$

467. $^{-}y^2 + 8y – 15$

468. $16k^2 – 8k + 1$

469. $6x^3 – 18x^2 + 8$

470. $2x^2 – 5x – 12$

471. $^{-}x^2 + 4x – 4$

472. $2x^2 + 6x – 20$

473. $10x – 5$

474. $10x + 4$

475. $3x^2$

476. $^{-}7x^2 + 12x – 5$

477. $30x^2 + 25x – 20$

Page 177 cont...

478. $acx^2 – adx + bcx – bd$

479. $a^2x^2 + 2abx + b^2$

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480. $2x^2 + 26x + 44$

481. $4x^2 + 16x + 15$

482. $2x^2 + x – 28$

483. $x^2 – 8x + 12$

484. $(x – y)^2 + 2xy$
$= x^2 + y^2$

485. $(2x + 4)(x – 3) – 0.5 \times 2x \times x$
$= x^2 + 10x + 12$

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486.

x	y	First order differences	Second order differences
-3	22		
		-9	
-2	13		2
		-7	
-1	6		2
		-5	
0	1		2
		-3	
1	-2		2
		-1	
2	-3		2
		1	
3	-2		

Quadratic – Second differences constant

487.

x	y	First order differences	Second order differences
0	0		
		-1	
1	-1		2
		1	
2	0		2
		3	
3	3		2
		5	
4	8		2
		7	
5	15		2
		9	
6	24		

Quadratic – Second differences constant

488.

x	y	First order differences	Second order differences
-1	4		
		-1	
0	3		4
		3	
1	6		4
		7	
2	13		4
		11	
3	24		4
		15	
4	39		4
		19	
5	58		

Quadratic – Second differences constant

489.

x	y	First order differences	2nd Diff.
-3	-34		
		19	
-2	-15		-8
		11	
-1	-4		-8
		3	
0	-1		-8
		-5	
1	-6		-8
		-13	
2	-19		-8
		-21	
3	-40		

Quadratic – Second differences constant

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490.

x	y	First order differences	Second order differences
−1	14		
		−5	
0	9		0
		−5	
1	4		0
		−5	
2	−1		0
		−5	
3	−6		0
		−5	
4	−11		0
		−5	
5	−16		

Not Quadratic – linear since first differences constant

491.

x	y	First order differences	Second order differences
−3	24		
		−14	
−2	10		6
		−8	
−1	2		6
		−2	
0	0		6
		4	
1	4		6
		10	
2	14		6
		16	
3	30		

Quadratic – Second differences constant

492.

x	y	First order differences	Second order differences
0	−2		
		8	
1	6		2
		10	
2	16		2
		12	
3	28		2
		14	
4	42		2
		16	
5	58		2
		18	
6	76		

Quadratic – Second differences constant

493.

x	y	First order differences	Second order differences
−3	−63		
		37	
−2	−26		−18
		19	
−1	−7		−12
		7	
0	0		−6
		1	
1	1		0
		1	
2	2		6
		7	
3	9		

Not quadratic – Second differences not constant

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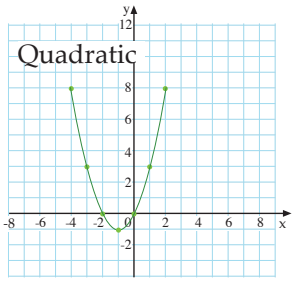
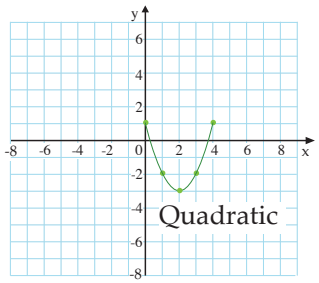
494.

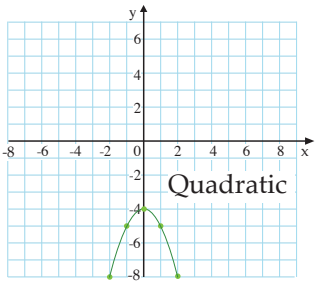


495.

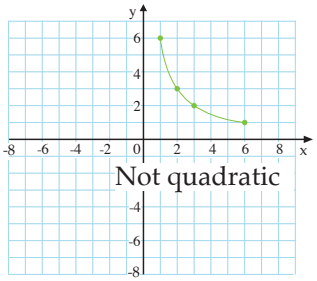


Page 181 cont...

496.



497.



498. Quadratic

499. Quadratic

500. Not quadratic

501. Quadratic

502. Not quadratic

503. Quadratic

504. Not quadratic

505. Quadratic

506. Quadratic

507. Quadratic

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508. $3(3x - 2y)$

509. $7q(p - 2q)$

510. $abc(c - b - a)$

511. $x^3y(3x + 4y)$

512. $(x + a)(5 + 2y)$

513. $(2m - n)(-3x - 5)$

514. $(4x + 5)(x + c)$

515. $(4 - 2p)(m + n)$
$= 2(2 - p)(m + n)$

516. $(3x + y)(x - k)$

517. $\frac{a}{y}(a + \frac{c}{y})$

518. $x(y + \frac{x}{4})$

519. $x(xy + 5y + 5)$

520. $x^2(y^2 - 2)$

521. $(x + 2)(x + 3)$

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522. $(x - 9)(x + 2)$

523. $(x - 2)(x - 3)$

524. $(x - 2)(x + 3)$

525. $(x + 1)(x - 6)$

526. $(x + 13)(x - 2)$

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527. $(x - 3)(x - 6)$

528. $(x + 2)(x + 6)$

529. $(x - 10)(x + 2)$

530. $(x + 7)(x - 3)$

531. $(x - 1)(x - 3)$

532. $(x + 1)^2$

533. $(x - 9)(x + 6)$

534. $(x + 13)(x - 11)$

535. $(x - 12)(x + 10)$

536. $(x - 3)(x + 1)$

537. $(m + 4)(m + 7)$

538. $(t + 5)(t - 1)$

539. $x(x - 9)$

540. $x(15 + x)$

541. $(p + 3)(p + 13)$

542. $5w^2 + 13w + 6$
$= (w + 2)(5w + 3)$

543. $(x - 19)$

544. $(x - 10)(x - 2)$

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545. $(x + 4)(x - 4)$

546. $(x + 8)(x - 8)$

547. $(x + 6)(x - 6)$

548. $(2x + 1)(2x - 1)$

549. $(6q + 5)(6q - 5)$

550. $(3m - 4)(3m + 4)$

551. $(x + 4)(x + 4) = (x + 4)^2$

552. $(x - 5)(x - 5) = (x - 5)^2$

553. $(x + 7)(x + 7) = (x + 7)^2$

554. $(x - 3)(x - 3) = (x - 3)^2$

555. $(x + 1)(x + 1) = (x + 1)^2$

556. $(x - 10)(x - 10) = (x - 10)^2$

557. $(xa - y)(xa + y)$

Page 185 cont...

558. $(x + 2y)(x + 2y) = (x + 2y)^2$

559. $\left(\frac{a}{2} - ab\right)\left(\frac{a}{2} + ab\right)$

560. $(3x - 3y)(3x - 3y) = (3x - 3y)^2$

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561. $3(x + 4)(x + 3)$

562. $4(x - 1)(x - 4)$

563. $2(p + 11)(p - 5)$

564. $3(x - 1)(x - 7)$

565. $2(k - 5)(k + 1)$

566. $4(p - 9)(p + 1)$

567. $(2x - 1)(2x + 3)$

568. $(x - 1)(5x + 1)$

569. $(3m + 4)(m + 3)$

570. $(2x + 1)(x + 3)$

571. $(x - 2)(3x - 2)$

572. $(2p - 2)(3p + 1)$
$2(p - 1)(3p + 1)$

573. $(2x - 5)(2x - 5) = (2x - 5)^2$

574. $(3x + 5)(5x - 3)$

575. $(3y - 2)(2y + 3)$

576. $(2x + 1)(3x - 4)$

577. $(2x + 3)(2x + 3) = (2x + 3)^2$

578. $(9x - 1)(x + 1)$

579. $3(x - 1)(x + 1)$

580. $(4x - 3)$

581. $(3x - 10)(3x - 2)$

582. $(2x - 9)$

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583. $x = 7$ or $x = -3$

584. $x = 4$ or $x = -2$

585. $x = 0$ or $x = \frac{-1}{3}$

586. $x = 1$

587. $x = 3$ or $x = -5$

588. $x = 0$ or $x = \frac{1}{3}$

589. $x = \frac{5}{2}$ or $x = \frac{-5}{2}$

590. $x = \frac{1}{2}$ or $x = \frac{4}{3}$

591. $x = 5$ or $x = \frac{-3}{2}$

592. $(x - 8)(x - 2) = 0$
$x = 2$ or $x = 8$

Page 187 cont...

593. $(x + 4)(x + 3) = 0$
$x = -4$ or $x = -3$

594. $(x - 8)(x + 4) = 0$
$x = 8$ or $x = -4$

595. $(x + 6)(x + 2) = 0$
$x = -2$ or $x = -6$

596. $(x + 4)(x - 3) = 0$
$x = -4$ or $x = 3$

597. $(x - 4)(x + 3) = 0$
$x = -3$ or $x = 4$

598. $(y - 5)^2 = 0$
$y = 5$

599. $3(x + 2)(x + 1) = 0$
$x = -1$ or $x = -2$

600. $(x - 1)(x - 12) = 0$
$x = 12$ or $x = 1$

601. $(x + 16)(x - 2) = 0$
$x = 2$ or $x = -16$

602. $(x - 1)(x - 2) = 0$
$x = 2$ or $x = 1$

603. $(x + 8)(x - 8) = 0$
$x = 8$ or $x = -8$

604. $(2q + 5)(2q - 5) = 0$
$q = \frac{5}{2}$ or $q = \frac{-5}{2}$

605. $(x + 1)^2 = 0$
$x = -1$

606. $3x(x - 2) = 0$
$x = 0$ or $x = 2$

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607. $q = 16$, solution $x = 4$

608. $3x^2 + 5x - 2 = 0$

609. $x(px + q) = 0$
$x = 0$ or $x = \frac{-q}{p}$

610. $(ax + b)(ax - b) = 0$
$x = \frac{-b}{a}$ or $x = \frac{b}{a}$

611. $2(x - 1)(x - 6) = 0$
$x = 1$ or $x = 6$

612. $(x - 6)(x + 5) = 0$
$x = 6$ or $x = -5$

Page 188 cont...

613. $(x + 5)(x - 2) = 0$
$x = 2$ or $x = -5$

614. $(3x - 1)(2x + 1) = 0$
$x = \frac{1}{3}$ or $x = \frac{-1}{2}$

615. $2(2x - 3)(x + 2) = 0$
$x = 1.5\left(\frac{3}{2}\right)$ or $x = -2$

616. $x(7x + 1) = 0$
$x = 0$ or $x = \frac{-1}{7}$

617. $(3x - 4)(3x + 4) = 0$
$x = \frac{4}{3}$ or $x = \frac{-4}{3}$

618. $(3x - 2)(2x - 3) = 0$
$x = \frac{2}{3}$ or $x = \frac{3}{2}$

619. $(2x - 1)^2 = 0$
$x = \frac{1}{2}$ only

620. $(x + 10)(x - 4) = 0$
$x = 4$ or $x = -10$

621. $3(x + 5)(x - 1) = 0$
$x = 1$ or $x = -5$

622. $(x - 9)(x + 1) = 0$
$x = 9$ or $x = -1$

623. $(5x + 1)(x - 5) = 0$
$x = 5$ or $x = \frac{-1}{5}$

624. $x^2 - 2x - 3 = 0$
$(x - 3)(x + 1) = 0$
$x = 3$ or $x = -1$

625. $x^2 - 1 = 0$
$(x - 1)(x + 1) = 0$
$x = 1$ or $x = -1$

626. $2w^2 + 3w - 35 = 0$
$(2w - 7)(w + 5) = 0$
$w = 3.5$ m, length $= 10$ m

627. $15x^2 - 960 = 0$
$15(x - 8)(x + 8) = 0$
$x = 8$ shortest side, hypotenuse is 32.

628. $n^2 - 6n + 5 = 0$
$(n - 1)(n - 5) = 0$
Possible odd numbers are 1 and 3 or 5 and 7.

Page 188 cont...

629. $n^2 - 3n - 10 = 0$

$(n - 5)(n + 2) = 0$

Consecutive odd numbers are 5, 7 and 9.

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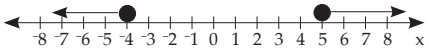
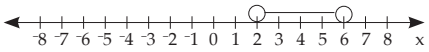
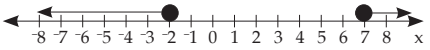
630. $x \le -4$ or $x \ge 5$



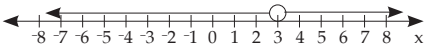
631. $2 < x < 6$



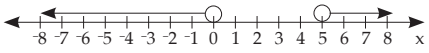
632. $x \le -2$ or $x \ge 7$



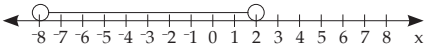
633. $x < 3$ or $x > 3$



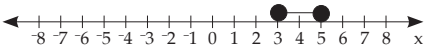
634. $x < 0$ or $x > 5$



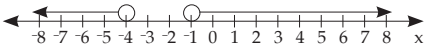
635. $-8 < x < 2$



636. $3 \le x \le 5$



637. $x < -4$ or $x > -1$

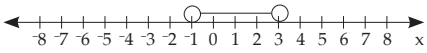


638. $x^2 - 2x < 3$

$x^2 - 2x - 3 < 0$

$(x - 3)(x + 1) < 0$

$-1 < x < 3$



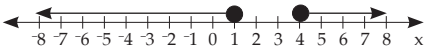
639. $x + \frac{4}{x} \ge 5$

$x^2 + 4 \ge 5x$

$x^2 - 5x + 4 \ge 0$

$(x - 1)(x - 4) \ge 0$

$x \le 1$ or $x \ge 4$



640. $(w + 3)w < 18$

$-6 < w < 3$

No negative or 0 dimensions so answer $0 \text{ m} < w < 3 \text{ m}$

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641. $-s^2 + 9s \ge 18$

$-s^2 + 9s - 18 \ge 0$

$s^2 - 9s + 18 \le 0$

$(s - 3)(s - 6) \le 0$

At or above a height of 18 m for $3 \le s \le 6$ seconds.

642. $(16 - x)x \le 28$

$16x - x^2 \le 28$

$x^2 - 16x + 28 \ge 0$

$(x - 14)(x - 2) \ge 0$

$x \le 2$ or $x \ge 14$

643. $x(x - 12) < 189$

$x^2 - 12x - 189 < 0$

$(x + 9)(x - 21) < 0$

$-9 < x < 21$, but valid solutions are $12 \text{ m} < x < 21 \text{ m}$

644. $x^2 + (x - 19)^2 \le 193$

$2x^2 - 38x + 168 \le 0$

$x^2 - 19x + 84 \le 0$

$(x - 12)(x - 7) \le 0$

$7 \le x \le 12$.

Two numbers are between 7 and 12 inclusive.

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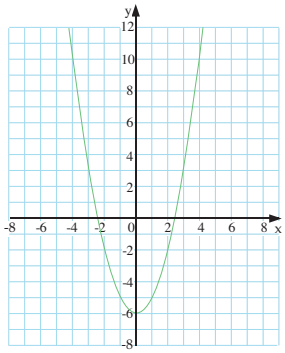
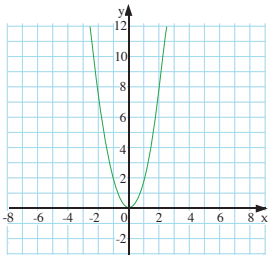
645.



646.



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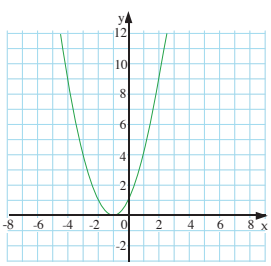

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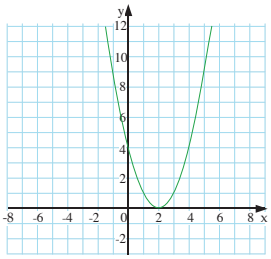
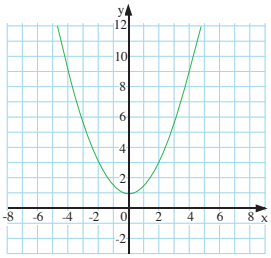
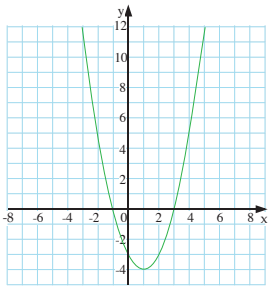
648.



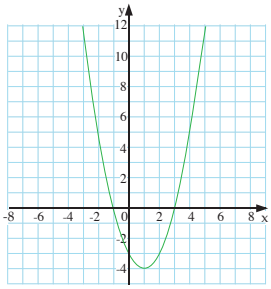
649.



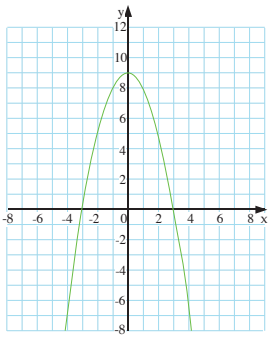
650.



651. The same graph as Q650.



652.



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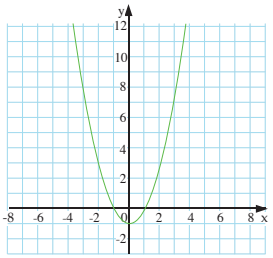
653. x int. (1, 0) and (-1, 0)
y int. (0, -1), base at (0, -1).



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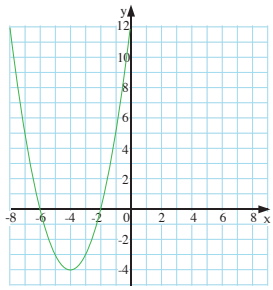
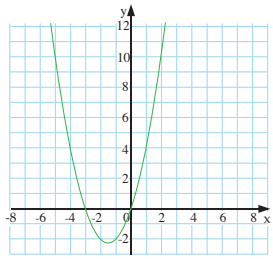
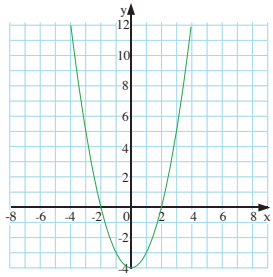
654. x int. (⁻2, 0) and (⁻6, 0)
y int. (0, 12), base at (⁻4, ⁻4).



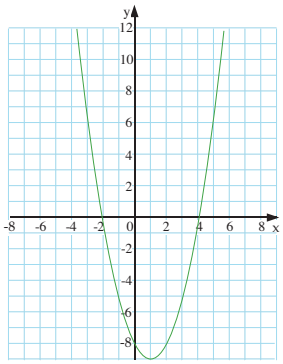
655. x int. (0, 0) and (⁻3, 0)
y int. (0, 0), base at (⁻1.5, ⁻2.25).



656. x int. (⁻2, 0) and (2, 0)
y int. (0, ⁻4), base at (0, ⁻4).



657. x int. (⁻2, 0) and (4, 0)
y int. (0, ⁻8), base at (1, ⁻9).



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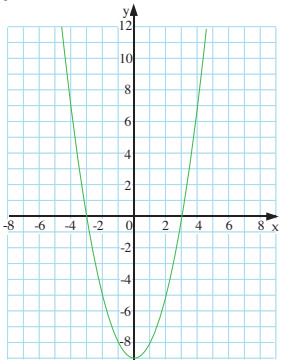
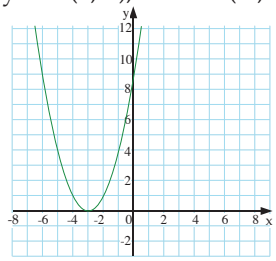
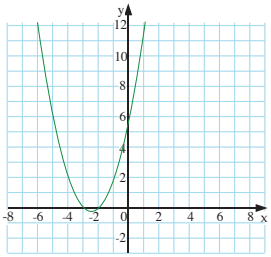
658. x int. (3, 0) and (⁻3, 0)
y int. (0, ⁻9), base at (0, ⁻9).



659. x int. (⁻3, 0) and (⁻3, 0)
y int. (0, 9), base at (⁻3, 0).



660. x int. (⁻2, 0) and (⁻3, 0)
y int. (0, 6), base at (⁻2.5, ⁻0.25).



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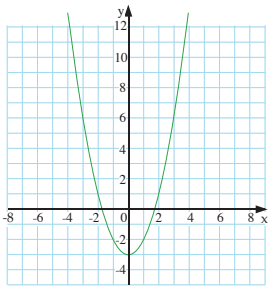
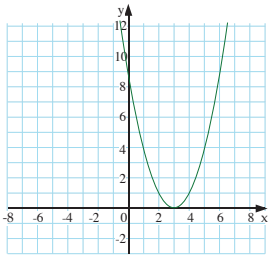
661.



662.



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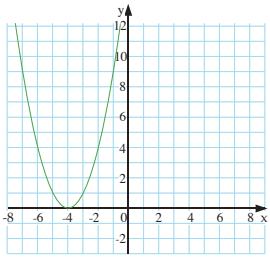
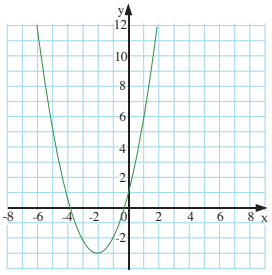
663.



664.



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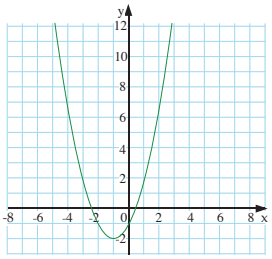
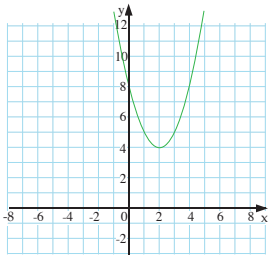


666.



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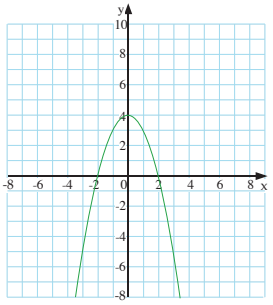
667. x int. (⁻2, 0) and (2, 0)
y int. (0, 4), base (0, 4).



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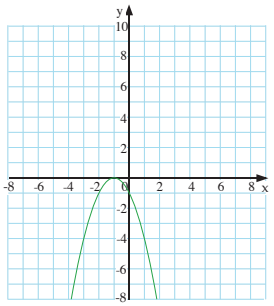
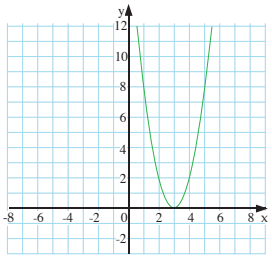
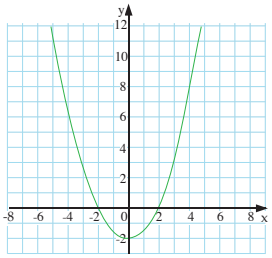
668. x int. $(^{-}1, 0)$ [and $(^{-}1, 0)$]
y int. $(0, ^{-}1)$, base $(^{-}1, 0)$.



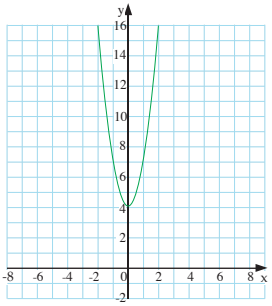
669. x int. (3, 0) [and (3, 0)]
y int. (0, 18), base (3, 0).



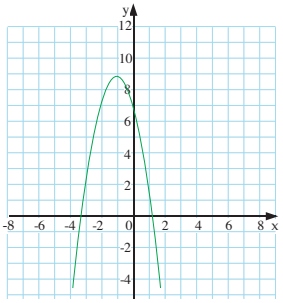
670. x int. (2, 0) and $(^{-}2, 0)$
y int. $(0, ^{-}2)$, base $(0, ^{-}2)$.



671. x int. n/a, y int. (0, 4),
base (0, 4).



672. x int. (1, 0) and $(^{-}3, 0)$,
y int. (0, 6), base $(^{-}1, 8)$



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673. a) $y = (x + 3)^2 - 25$

$0 = (x + 3)^2 - 25$

$x^2 + 6x - 16 = 0$

$(x + 8)(x - 2) = 0$

$x = ^{-}8, 2$

b) Negative for $^{-}8 < x < 2$, because shape of graph is ∪

674. a) $y = ^{-}(x - 1)^2 + 4$

$0 = ^{-}(x - 1)^2 + 4$

$^{-}x^2 + 2x + 3 = 0$

$^{-}(x - 3)(x + 1) = 0$

$x = ^{-}1, 3$

b) Positive for $^{-}1 < x < 3$, because shape of graph is ∩

675. $0 = xq(x - q)$
$x = 0, q$

Positive for $x < 0$ or $x > 3$, because shape of graph is ∪

676. $y = x^2 - 4x + 7$
$y = (x - 2)^2 + 3$

Turning point is at (2, 3) and shape of graph is ∪ so always above x axis so positive.

677. $y = ^{-}x^2 + 6x - 13$
$y = ^{-}(x - 3)^2 - 4$

Turning point is at $(3, ^{-}4)$ and shape of graph is ∩ so always below x axis so negative.

678. $y = x^2 + 2x - 15$
$y = (x + 5)(x - 3)$
$0 = (x + 5)(x - 3)$
$x = ^{-}5, 3$
Negative for $^{-}5 < x < 3$,
because shape of graph is ∪

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679. a) $A = ^{-}20t^2 + 140t$
$^{-}20t^2 + 140t + 600 = 0$
$^{-}20(t^2 - 7t + 30) = 0$
$(t - 10)(t + 3) = 0$
$t = ^{-}3$, 10 so after 10 weeks.

b) Maximum amount in account is $245 between 3rd and 4th week.

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680. a) $y = (x - 6)^2$
b) $y = x^2 - 8$
c) $y = (x - 1)^2$
d) $y = (x + 5)^2$
e) $y = x^2 + 8$

681. a) $y = (x - 6)^2 + 3$
b) $y = (x - 5)^2 - 8$
c) $y = (x - 1)^2 - 2$
d) $y = (x + 5)^2 - 8$
e) $y = (x + 6)^2 + 8$

682. a) $y = (x - 6)^2 - 8$
b) $y = (x - 7)^2 + 3$
c) $y = (x + 4)^2 - 1$
d) $y = ^{-}(x + 7)^2$
e) $y = ^{-}x^2 - 4$

683. a) $y = (x - 4)(x - 9)$
b) $y = (x - 1)(x - 4)$
c) $y = x(x + 6)$
d) $y = (x + 4)(x + 8)$
e) $y = (x + 3)(x + 3) = (x + 3)^2$

684. a) $y = ^{-}(x - 6)(x - 8)$
b) $y = ^{-}(x + 2)(x - 5)$
c) $y = (x - 2)(x + 4)$
d) $y = (x + 5)(x + 7)$
e) $y = ^{-}(x - 1)(x - 5)$

685. a) $y = ^{-}2(x - 6)(x - 8)$
b) $y = ^{-}0.5(x - 2)(x + 2)$
c) $y = 2(x + 4)(x + 8)$
d) $y = 3(x + 5)(x + 7)$
e) $y = (x - 3)(x - 3) = (x - 3)^2$

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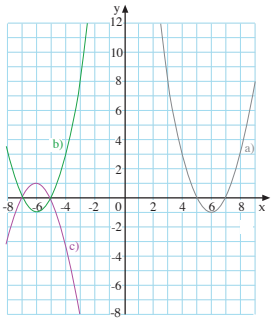
686. a) and c)

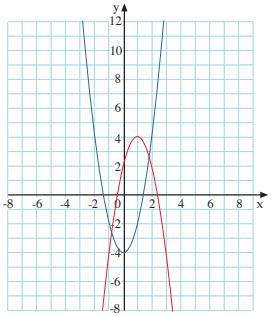


b) $y = (x + 6)^2 - 1$

d) $y = -(x + 6)^2 + 1$

e) $y = -(x - 6)^2 + 1$

687. a)



b) Reflect $y = 2x^2 - 4$ in x-axis

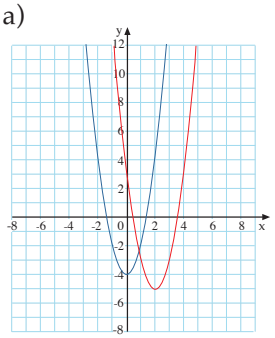
$-y = 2x^2 - 4$

Then translate 1 unit right

$-y = 2(x - 1)^2 - 4$

$y = -2(x - 1)^2 + 4$

688. a)



b) Translate left 2 down 1.

$(y + 1) = 2(x + 2)^2 - 4$

$y = 2(x + 2)^2 - 5$

Then reflect in y-axis

$y = 2(-x + 2)^2 - 5$

$y = 2(2 - x)^2 - 5$

689. Translate left 4 and up 3.

$y - 3 = (x + 4)^2$

$y = (x + 4)^2 + 3$

Reflect in x-axis

$-y = (x + 4)^2 + 3$

$y = -(x + 4)^2 - 3$

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690. Translate right 1 and up 3.

$y - 3 = (x - 1)^2 + 3$

$y = (x - 1)^2 + 6$

Reflect in y-axis

$y = (-x - 1)^2 + 6$

$y = (-1(x + 1))^2 + 6$

$y = (x + 1)^2 + 6$

691. Reflect in x-axis

$-y = (x - 2)^2 - 3$

$y = -(x - 2)^2 + 3$

Translate left 3 and down 2.

$y + 2 = -((x + 3) - 2)^2 + 3$

$y = -(x + 1)^2 + 1$

692. Reflect in y-axis

$y = (-x + 4)^2 + 1$

$y = (4 - x)^2 + 1$

Reflect in x-axis

$-y = (4 - x)^2 + 1$

$y = -(4 - x)^2 - 1$

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693. $y = (x + 1)(x + 5)$

694. $y = (x - 2)^2 - 4 = x(x - 4)$

695. $y = 2(x - 1.5)(x - 3)$

696. $y = -(x + 2)(x - 2)$

697. $y = -2(x - 1)(x - 5)$

698. $y = -3(x - 4)^2 + 12$

$y = -3(x - 2)(x - 6)$

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699. $y = -(x + 3)(x - 1)$

700. $y = 0.5(x - 2)(x - 6)$

701. $y = 2(x - 3)^2 - 2$

702. $y = -0.5(x - 2)^2$

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703. $T = \frac{k}{2}n^2 + \text{linear}$

$= n^2 - 3$

$T(10) = 97$

Term	Sequence	First order diffs.	Second order diffs. (k)	kn²/2	Linear
1	-2			1	-3
		3			
2	1		2	4	-3
		5			
3	6		2	9	-3
		7			
4	13		2	16	-3
		9			
5	22		2	25	-3
		11			
6	33		2	36	-3
		13			
7	46			49	-3

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704. $T = \frac{k}{2}n^2 + \text{linear}$

$= 2n^2 - 1$

$T(10) = 199$

Term	Sequence	First order diffs.	Second order diffs. (k)	kn²/2	Linear
1	1			2	-1
		6			
2	7		4	8	-1
		10			
3	17		4	18	-1
		14			
4	31		4	32	-1
		18			
5	49		4	50	-1
		22			
6	71		4	72	-1
		26			
7	97			98	-1

705. $T = \frac{k}{2}n^2 + \text{linear}$

$= 3n^2 - 2n + 1$

$T(10) = 281$

Term	Sequence	First order diffs.	Second order diffs. (k)	kn²/2	Linear
1	2			3	-1
		7			
2	9		6	12	-3
		13			
3	22		6	27	-5
		19			
4	41		6	48	-7
		25			
5	66		6	75	-9
		31			
6	97		6	108	-11
		37			
7	134			147	-13

706. Not a quadratic

Term	Sequence	First order diffs.	Second order diffs. (k)	kn²/2	Linear
1	0				
		4			
2	4		10		
		14			
3	18		16		
		30			
4	48		22		
		52			
5	100		28		
		80			
6	180		34		
		114			
7	294				

707. $T = \frac{k}{2}n^2 + \text{linear}$

$= -2n^2 - 5n - 4$

$T(10) = -254$

Term	Sequence	First order diffs.	Second order diffs. (k)	kn²/2	Linear
1	-11			-2	-9
		-11			
2	-22		-4	-8	-14
		-15			
3	-37		-4	-18	-19
		-19			
4	-56		-4	-32	-24
		-23			
5	-79		-4	-50	-29
		-27			
6	-106		-4	-72	-34
		-31			
7	-137			-98	-39

708. $T = \frac{k}{2}n^2 + \text{linear}$

$= 5n^2 - 29n + 40$

$T(10) = 250$

Term	Sequence	First order diffs.	Second order diffs. (k)	kn²/2	Linear
1	16			5	11
		-14			
2	2		10	20	-18
		-4			
3	-2		10	45	-47
		6			
4	4		10	80	-76
		16			
5	20		10	125	-105
		26			
6	46		10	180	-134
		36			
7	82			245	-163

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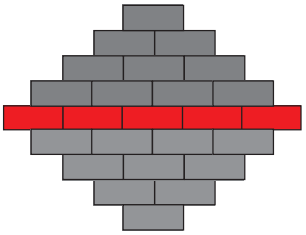
709. a)



b)

Design	Red Bricks	Grey Bricks	Total Bricks	First order diffs.	Second order diffs. (k)	kn²/2	Linear
1	2	2	4			1	3
2	3	6	9	5	2	4	5
3	4	12	16	7	2	9	7
4	5	20	25	9	2	16	9
5	6	30	36	11	2	25	11
6	7	42	49	13	2	36	13
7	8	56	64	15		49	17

c) $T = \frac{k}{2}n^2 + \text{linear}$

$= n^2 + 2n + 1$

$= (n + 1)^2$

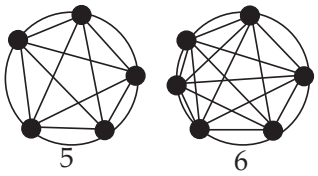
d) $(n + 1)^2 = 144$

$n + 1 = 12$

$n = 11$

e) 12 red, 132 grey

710. a)



b)

Students	Paths	First order diffs.	Second order diffs. (k)	kn²/2	Linear
1	0			0.5	-0.5
2	1	1	1	2	-1
3	3	2	1	4.5	-1.5
4	6	3	1	8	-2
5	10	4	1	12.5	-2.5
6	15	5	1	18	-3
7	21	6	1	24.5	-3.5
8	28	7		32	-4

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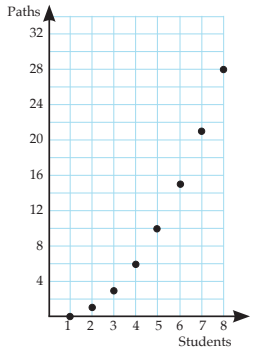
710. c)



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710. d) Quadratic because 2nd differences are constant.

e) $P = \frac{1}{2}n^2 - \frac{1}{2}n = \frac{1}{2}n(n - 1)$

f) $P = \frac{1}{2}(12)(11)$

$P = 66$

g) $105 = \frac{1}{2}n^2 - \frac{1}{2}n$

$n^2 - n - 210 = 0$

$(n - 15)(n + 14) = 0$

$n = 15$ students

711. a) $y = 0.2x^2 + 2.2$

b) $y = -0.4x + 2.8$ or

$y = 0.4x + 2.8$

712. a) Straight Line:

$H = \frac{2}{3}D + 20$

Parabola:

$H = \frac{-1}{8}(D - 45)^2 + 50$

b) After 55 metres H = 37.5 m

c) $35 = \frac{2}{3}D + 20$ and

$35 = \frac{-1}{8}(D - 45)^2 + 50$

D = 22.5 m and 55.95 m

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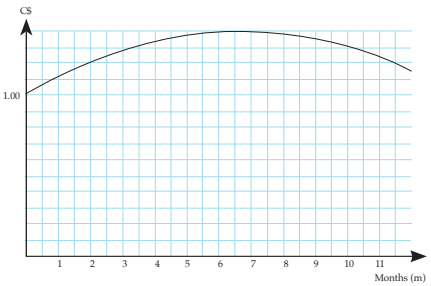
713. a) $H = 0.5(100 - T)^2$

b) 312.5 km or 312 500 m

c) $0.5(100 - T)^2 = 3200$

$T = 20°C$

714. a)



b) 13.3 months

c) 10.7 – 2.6 = 8.1 months

d) $N = -0.222m(m - 24)$

$m = 4.65$

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715. a) 9.1125 m

b) Need 4 x 2.8 = 11.2 m in width. So 13.5 – 11.2 = 2.3 or 1.15 each side. Height of hangar at 1.15 m is 2.84 m so there is enough height room.
Length of building is 18.5 ÷ 3 = 6.2 m, so there is enough room for 12 vans.

c) $y = -0.0547x^2 + 8.5$

When x = 8.8, y = 4.26 m which is the height above the ground at the lowest part of the roof.

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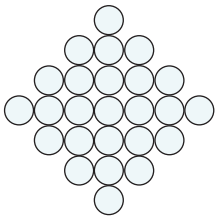
716. $O = -10M + 75$

$O = (M - 8)^2 + 20$

717. a)



b)

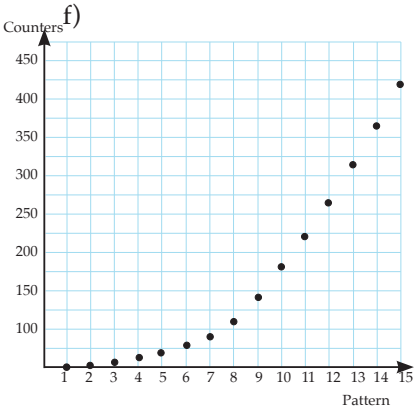
Pattern	Counters	First order differences	Second order diffs.
1	1		
2	5	4	4
3	13	8	4
4	25	12	4
5	41	16	4
6	61	20	4
7	85	24	

c) Quadratic because 2nd differences are constant.

d) $C = 2n^2 - 2n + 1$

e) 421

f)



g) $2n^2 - 2n + 1 = 761$

$2n^2 - 2n - 760 = 0$

$2(n - 20)(n + 19) = 0$

$n = 20$, Pattern number 20.

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718. Max height = 84 m after t = 4 secs.

719. Max height = 24.2 m after t = 2.2 secs.

720. App should be $7 for a maximum profit of $32 000 000

721. Produce 100 units per day to minimise their costs to $24 600 per day.

722. $A = 160x - 2x^2$ and x = 40 m, y = 80 m and maximum area is 3200 m^2.

723. $P = 48x - x^2$ and x = 24, y = 24 and maximum product is 576.

724. $P = x^2 - 12x$ and x = 6, y = ⁻6 and minimum product is ⁻36.

725. $A = 75x - x^2$, x = 37.5 m, y = 37.5 m. Max area = 1406.25 m^2

726. Must sell 20 units to minimum their costs of $250.

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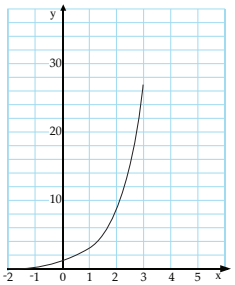
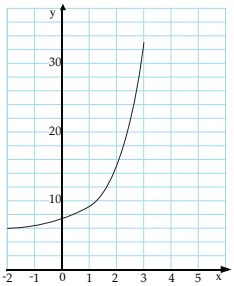
727.

x	$y = 3^x$
⁻2	0.1111
⁻1	0.3333
0	1
1	3
2	9
3	27



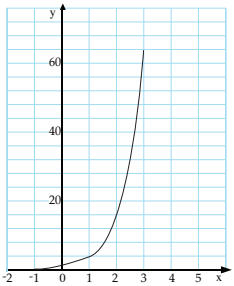
728.

x	$y = 3^x + 6$
⁻2	6.11
⁻1	6.33333
0	7
1	9
2	15
3	33



729.

x	$y = 4^x$
⁻2	0.0625
⁻1	0.25
0	1
1	4
2	16
3	64



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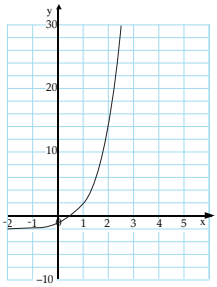
730.

x	$y = 4^x - 2$
⁻2	⁻1.9375
⁻1	⁻1.75
0	⁻1
1	2
2	14
3	62



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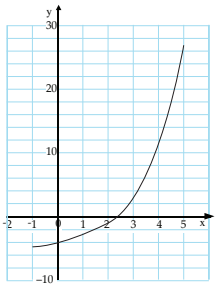
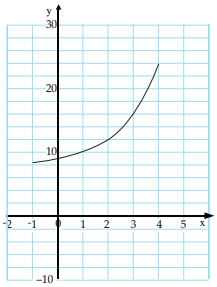
731.

x	$y = 2^x - 5$
⁻1	⁻4.5
0	⁻4
1	⁻3
2	⁻1
3	3
4	11



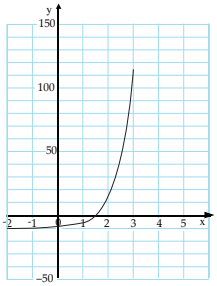
732.

x	$y = 2^x + 8$
⁻1	8.5
0	9
1	10
2	12
3	16
4	24



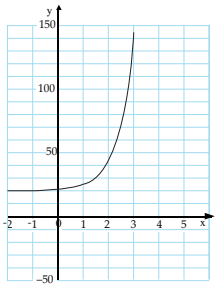
733.

x	$y = 5^x - 10$
⁻2	⁻9.96
⁻1	⁻9.8
0	⁻9
1	⁻5
2	15
3	115



734.

x	$y = 5^x + 20$
⁻2	20.04
⁻1	20.2
0	21
1	25
2	45
3	145



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735. x = 2

736. y = 2

737. x = 5

738. y = 4

739. z = 2

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740. x = 2 (or ⁻2)

741. z = 0

742. x = 2

743. k = 3

744. z = 0

745. x = 2

746. k = 4

747. $x = \frac{1}{2}$ or $\frac{-1}{2}$

748. x = 6

749. x = ⁻2

750. x = 3

751. x = 3

752. x = 1

753. m = 3

754. x = 5

755. x = ⁻2

756. $\mathbf{x = \frac{4}{3}}$

757. x = 1

758. x = 4

759. x < ⁻6

760. x ≤ 1

761. x < ⁻2

762. $x^2 = 16$

x = 4 (or ⁻4)

or x = 0

763. $n^4 = 16$ so n = 2 or ⁻2

764. $2^k \times 5^k = 2^3 \times 5^3$ so k = 3

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765.

Term	Sequence	First order differences	Ratio of first order differences
1	1		
		2	
2	3		2
		4	
3	7		2
		8	
4	15		2
		16	
5	31		2
		32	
6	63		2
		64	
7	127		

$T = 2^n - 1$

T (10) = 1023

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766.

Term	Sequence	First order differences	Ratio of first order differences
1	9		
		20	
2	29		5
		100	
3	129		5
		500	
4	629		5
		2500	
5	3129		5
		12 500	
6	15 629		5
		62 500	
7	78 129		

$T = 5^n + 4$

$T(10) = 9\,765\,629$

767.

Term	Sequence	First order differences	Ratio of first order differences
1	10		
		16	
2	26		1.375
		22	
3	48		1.273
		28	
4	76		1.214
		34	
5	110		1.176
		40	
6	150		1.15
		46	
7	196		

Not exponential

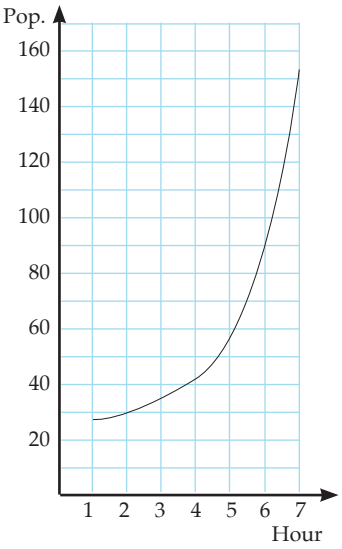
768.

Term	Sequence	First order differences	Ratio of first order differences
1	7		
		12	
2	19		4
		48	
3	67		4
		192	
4	259		4
		768	
5	1027		4
		3072	
6	4099		4
		12 288	
7	16 387		

$T = 4^n + 3$

$T(10) = 1\,048\,579$

769. a)



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769. b)

Term	Sequence	First order differences	Ratio of first order differences
1	27		
		2	
2	29		2
		4	
3	33		2
		8	
4	41		2
		16	
5	57		2
		32	
6	89		2
		64	
7	153		

c) $P = 2^h + 25$

d) $P = 2^{10} + 25$

$= 1049$

e) After 19.9 (20) hours.

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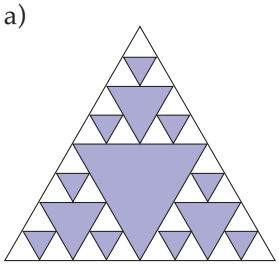
770. a)



b)

Stage	Unshaded triangles	First order differences	Ratio of first order differences
1	3		
		6	
2	9		3
		18	
3	27		3
		54	
4	81		3
		162	
5	243		3
		486	
6	729		3
		1458	
7	2187		

c) $U = 3^s$

d) $U = 3^{10}$

$= 59\,049$

e) After 14.98 (15) hours

f)

Stage	Unshaded Triangles	Shaded Triangles	Total Triangles
1	3	1	4
2	9	4	13
3	27	13	40
4	81	40	121
5	243	121	364
6	729	364	1093
7	2187	1093	3280

g) For shaded and total use

3 x Previous stage + 1

h) Stage 10 = 3 x 29 524 + 1

$= 88\,573$

i) 797 161

Shaded $= 265\,720$

Unshaded $= 531\,441$

Stage no. $= 12$

ANSWERS – Statistics

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1. Mean = 9.55
Median = 5.5
Mode = 4

2. Mean = 32.5 (1 dp)
Median = 34
Mode = 34

3. Mean = 5.7 (1 dp)
Median = 4.4
Mode = 5.8

4. Mean = 14.75
Median = 15
Mode = 8, 15 and 21

5. Mean = 28.3 (1 dp)
Median = 19
Mode = 0

6. Mean = 20, Median = 10
Best average is median as it has half the data each side of it and is not affected by the data value of 85.

7. New mean is 19.

8. Student mark = 11%

9. Mark = 78%

10. a) Mean = 7
b) Mean = 21
c) Mean is changed by the same amount that the numbers are multiplied by.
d) Mean = 37

11. Number = 15, Mean = 14

12.

Y11 Texts	Mon.	Sat.
Mean	14.7	29.2
Median	11	28.5

Year 11 appear typically to send twice as many texts on a Saturday compared to a Monday.

13.

Y 13 Texts	Mon.	Sat.
Mean	15.2	34.9
Median	15	35

Year 13 appear typically to send over twice as many texts on a Saturday compared to a Monday.

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14.

Monday	Y11	Y13
Mean	14.7	15.2
Median	11	15

Year 11 and Year 13 typically appear to send a similar number of texts on a Monday.

15.

Saturday	Y11	Y13
Mean	29.2	34.9
Median	28.5	35

Year 13 typically appear to send approximately 20% more texts than Year 11 on a Saturday.

16. a) Total of class = 1100
New mean = 57% (0 dp)
b) New student = 10%

17. a) Total of class = 850
b) Class mean = 56.7%
There are more girls and their mean mark is higher.

18. a) Mean = 1.35 hours
Median = 1.5 hours
b) Mean = 81 minutes
Median = 90 minutes

19. a) Mean = 37 minutes
Median = 30 minutes
b) Mean = 397 minutes
Median = 390 minutes

20. Best measure is median distance of 2.3 km as half the class travel each side of this figure. A few students above the median travelling a long way will raise the mean but not affect the median.

21. Best measure is median weight of 3.5 kg as half the class have bags less than or greater than this figure. If most of the bags above the median are close to 3.5 kg and most of the bags under the median are close to 0 kg then the mean will be lower than the median.

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22. Median = 15, LQ = 5 and UQ = 25.
Half the students get \$15 a week or less with a quarter of the students getting \$5 or less.

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23. Median = 205 mm, LQ = 190 mm and UQ = 225 mm.
Half the students have hand spans of 205 mm and three quarters of them have a hand span greater than 190 mm.

24. Range = 29
Interquartile = 12
No problems.

25. Range = 90
Interquartile = 21.5
0 makes the range large.

26. Mean 7.8, Median = 7, LQ = 5 and UQ = 10.
The average amount of homework for this class is 7 hours a week but 25% of students do 5 hours or less per week.

27. Median = 16 minutes, LQ = 10 minutes and UQ = 25.5 minutes
The average waiting time is 16 minutes but a quarter of patients have to wait over 25.5 minutes.

28.

Statistics	Time
Minimum	0 min.
Lower Q.	30 min.
Mean	79 min.
Median	75 min.
Upper Q.	100 min.
Maximum	250 min.

The average time spent on homework is 75 minutes and half the students spend between 30 and 100 minutes on homework.

29.

Statistics	Dollars
Minimum	\$15
Lower Q.	\$35
Mean	\$82.30
Median	\$72.50
Upper Q.	\$100
Maximum	\$275

The spending on Christmas presents averaged \$72.50 (mean \$82.30) with half the students spending between \$35 and \$100. The maximum spent was \$275.

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30.

Statistics	Texts
Minimum	32
Lower Q.	125
Mean	351
Median	260
Upper Q.	450
Maximum	1250

One quarter of the students received at least 450 texts last month. The median number of texts received was 260 and half the students received between 125 and 450 texts.

31.

Statistics	Hours
Minimum	0
Lower Q.	1
Mean	2.9
Median	2.25
Upper Q.	3.5
Maximum	11

One quarter of the students spent 1 hour or less on the computer in the weekend while another quarter spent between 3.5 hours and 11 hours on the computer. The median time was 2.25 hours.

32.

Statistics	Students
Minimum	12
Lower Q.	32
Mean	42
Median	41
Upper Q.	49
Maximum	75

The school has a mean absence rate of 42 students a day and usually (50% of days) the number of students absent varies from 32 to 49.

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33.

Statistics	Half-days
Minimum	0
Lower Q.	2.5
Mean	10.7
Median	5
Upper Q.	10
Maximum	121

One quarter of the students were absent from school 2.5 half-days or less while the maximum number of half-days a student was absent was 121. The median number of half-days absent is 5.

34.

	School 1	School 2
Min.	28 h	27 h
LQ	33 h	29 h
Mean	40.6 h	45.6 h
Median	38 h	43 h
UQ	42 h	61 h
Max.	96 h	73 h

Cleaning School 2 is taking an average of 5 hours longer than School 1. Three quarters of the time School 1 is cleaned (UQ = 42 h) below the median time (Med. = 43 h) for cleaning School 2.

35.

	Drug A	Drug B
Min.	3 days	5 days
LQ	5 days	8 days
Mean	9.1 days	11 days
Median	7.5 days	9 days
UQ	11 days	12 days
Max.	46 days	31 days

One quarter of people on Drug A recover up to 3 days faster (LQ = 5 days vs LQ = 8 days) and half the people recover up to 2 days faster but the slowest to recover (upper quartile) do not recover any faster.

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36.

	Able	Brett
Min.	0	0
LQ	6	22.5
Mean	30.3	30.7
Median	11.5	33
UQ	48.5	44
Max.	121	56

The selection of batsman will depend upon what the coach needs. Able when he gets going scores well with the highest upper quartile and maximum. Brett is more consistent with a higher median (33 versus 11.5) but his top score is not as high.

37.

	Before	After
Min.	2 min	2 min
LQ	6.5 min	7 min
Mean	10 min	9.3 min
Median	9 min	8.5 min
UQ	12.5 min	11.5 min
Max.	23 min	17 min

Although the maximum time has dropped by 6 minutes this result is from one person. The mean and median have only dropped by less than a minute so the redesigned foyer has not improved the flow of customers.

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38.

	Class 1	Class 2
Mean	58.8	57.2
Min.	19	23
LQ	53	41
Med.	61	56
UQ	69	73
Max	74	92
SD	12.6	18.8
IQR	16	32

The means are similar with Class 1's mean of 59% versus Class 2's mean of 57% but the median of Class 1 (61%) is 5 marks more than Class 2 (56%). Class 2 results are more spread out. The inter-quartile range of Class 1 was only 16% while Class 2 IQ range is 32%. The standard deviation for Class 1 was just 12.6% while this measure of spread for Class 2 was 18.8%. In conclusion the Class 1 results are more consistent (less spread out).

39.

	Farm 1	Farm 2
Mean	38.0	38.7
Min.	28	33
LQ	34	36
Med.	38	39
UQ	42	41
Max	49	49
SD	4.9	3.2
IQR	8	5

The means and medians are close with Farm 2 averaging 1 gram heavier. Farm 1 has lower minimum at 28 g compared to Farm 2 at 33 g.

There is more of a difference when looking at the measures of spread. The inter-quartile range of Farm 1 was 8 grams while that for Farm 2 was 5 grams implying the weights of the fruit are more spread out (not as consistent). The standard deviation for Farm 1 was 5 grams while this measure of spread for Farm 2 was just 3 grams.

In conclusion the farms produce similar average fruit but there is more consistency in the fruit from Farm 2.

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40. Quade has a higher mean 39.4 m and median 41.0 m than Peter 38.8 m and median 39.85 m.

Quade is also more consistent with a lower inter-quartile range 5.2 m and standard deviation 2.9 m versus Peter's inter-quartile range of 8 m and standard deviation of 5.2 m.

In a javelin competition the average result is not as important as the best throw. Peter has a higher upper quartile (top 25%) of 42.4 m which is 0.5 m further and his maximum throw is 47.2 m which is 5 metres more than Quade's throw.

41. The mean times for both Jim 41 Ken are almost the same (8.675 h and 8.64 h) while the median of Jim at 8.55 h is a little faster than Ken at 8.7 h. The range of times for Jim of 2.3 h shows he is doing the trip fast sometimes and possibly stopping on other trips.

This is supported by the other measures of spread. The inter-quartile range of Jim is 1.15 h compared to Ken at 0.35 h and the standard deviation of Jim is a lot higher at 0.7 h compared to Ken at 0.25 h.

It is possible that Jim is an inconsistent driver as he can do the route in 7.8 h and on another occasion takes 10.1 h.

42.

To 0 dp.	Home 1	Home 2
Min.	450 kWh	104 kWh
LQ	544 kWh	400 kWh
Mean	736 kWh	945 kWh
Median	693 kWh	944 kWh
UQ	850 kWh	1413 kWh
Max.	1483 kWh	1955 kWh
Range	1033 kWh	1851 kWh
IQ range	306 kWh	1013 kWh
Std. Dev.	249 kWh	567 kWh

Page 233 Q49. cont...

Home 1 is very consistent with the amount of electricity they use. For the middle 50% of days their spread of usage (IQ range) is only 306 kWh. Home 2 has higher usage (mean is 209 kWh higher) but its use is also more variable (IQR = 1013 kWh).

43.

To 0 dp.	Tau.	Te An.
Min.	14 °C	8 °C
LQ	15 °C	12 °C
Mean	17 °C	14 °C
Median	17 °C	15 °C
UQ	19 °C	17 °C
Max.	22 °C	18 °C
Range	8 °C	10 °C
IQ range	4 °C	5 °C
Std. Dev.	2.6 °C	3.5 °C

The monthly average temperature for Te Anau is 2 to 3 °C lower than Tauranga. Also Tauranga has a smaller IQ range and standard deviation indicating less fluctuation in maximum monthly temperature compared to Te Anau. Te Anau has lower cold temperatures and lower high temperatures than Tauranga through the year.

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44.

To 0 dp.	Home 1	Home 2
Min.	125 Mb	28 Mb
LQ	151 Mb	68 Mb
Mean	204 Mb	243 Mb
Median	185 Mb	257 Mb
UQ	236 Mb	393 Mb
Max.	412 Mb	543 Mb
Range	287 Mb	515 Mb
IQ range	85 Mb	325 Mb
Std. Dev.	68 Mb	165 Mb

Home 1 is very consistent with the amount of broadband they use. For the middle 50% of days their spread of usage (IQ range) is only 85 Mb. Home 2 has higher usage (mean is 39 Mb higher) but its use is also more variable (IQR = 325 Mb).

Page 234 cont...

45.

To 0 dp.	Kaitaia	NP
Min.	78 mm	95 mm
LQ	88 mm	106 mm
Mean	111 mm	119 mm
Median	96 mm	121 mm
UQ	141 mm	129 mm
Max.	166 mm	145 mm
Range	88 mm	50 mm
IQ range	53 mm	23 mm
Std. Dev.	30 mm	16 mm

The mean rainfall (hence total for the year) is very similar but Kaitaia has a greater variation with a higher inter-quartile range. If the market garden wants an even distribution of rain then New Plymouth is more reliable.

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46.

Tickets	Tally	Freq.f
2	////	4
4	𝍸	5
6	𝍸	5
8	𝍸 //	7
10	𝍸 /	6
12	///	3
	TOTAL	30

The median number of tickets is 8, but the top quarter of wardens give 10 or more tickets, therefore this should be the point where the council issue a reward.

47.

Days	Tally	Freq.f
0	𝍸 𝍸	10
2	𝍸	5
4	////	4
6	//	2
8	///	3
16	/	1
	TOTAL	25

Half the students are absent for 2 days or less, but a quarter of the students have had 5 or more absences. One student has missed 16 days.

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48.

Days	Tally	Freq.f
6	𝍸	5
7	𝍸	5
8	𝍸 //	7
9	𝍸 /	6
10	𝍸 /	6
11		0
12	/	1
	TOTAL	30

The median delivery time is 8 days and three quarters of parcels should be delivered in 9 days or less.

49.

Fish	Tally	Freq.f
0	𝍸 /	6
1	////	4
2	//	4
3	///	3
4	//	2
5	////	4
6	𝍸	5
	TOTAL	28

The median number of fish caught is 2.5, but a quarter caught 1 or none.

If the maximum catch was reduced to 5 the five boats who caught 6 would have have one less fish. The total catch would only drop by 5.

50. a)

Level of Ni (ppm)	Tally	Midpoint (x)	Frequency (f)
0 – < 5	///	2.5	3
5 – < 10	//	7.5	2
10 – < 15	𝍸	12.5	5
15 – < 20	𝍸 ///	17.5	8
20 – < 25	𝍸	22.5	5
25 – < 30	𝍸 //	27.5	7
30 – < 35	𝍸	32.5	5
	TOTAL		35

b) Mean 19.8 ppm,
LQ = 12.5 ppm,
median = 17.5 ppm,
UQ = 27.5 ppm
IQR = 15 ppm

c) 0.14 (2 dp)

d) Mean and median of the samples from the farm fall with the 15 – 25 range, but 63% of samples are either too low or too high.

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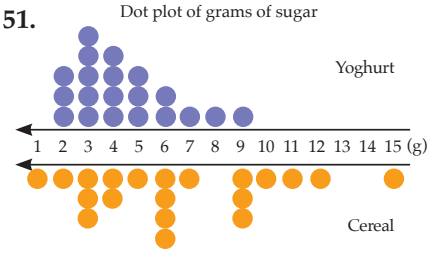
51.



Cereal:

LQ = 3.5, Median = 6, UQ = 9, IQR = 5.5 and Range = 14.

Yoghurt:

LQ = 3, Median = 4, UQ = 5.5, IQR = 2.5 and Range = 7.

Yoghurt on average has less grams of sugar (4 g compared to 6 g). The yoghurt distribution is skewed right with 75% of yoghurt varieties containing less sugar per serving than the median sugar content per serving of cereals. The range of sugar content per serving for yoghurt is considerably less than that of cereals with range 7 g compared to 14 g and IQR 2.5 g compared to 5.5 g).

52.

Stem and Leaf plot of cell phone calls

Females							Stem	Males						
					8	4	5	4						
		9	7	6	2	0	4	0	1	1				
					4	1	3	1	4					
					3	2	2	1	1	2	4			
	9	8	8	7	6	4	1	0	1	2	4	5	8	9
				3	2	1	0	5	8	9				

Male (minutes):

LQ = 11.5, Median = 20, UQ = 32.5, IQR = 21 and Range = 49.

Female (minutes):

LQ = 16.5, Median = 22.5, UQ = 44, IQR = 27.5 and Range = 57.

Female distribution of minutes is bimodal with approximately 25% of students talking 40 to 49 minutes and 25% talking 10 to 19 minutes whereas with the male distribution 75% of students talked for under 32.5 minutes. The median time talked is less for males than females (20 mins. compared to 22.5 mins.) All parameters are less for males indicating that

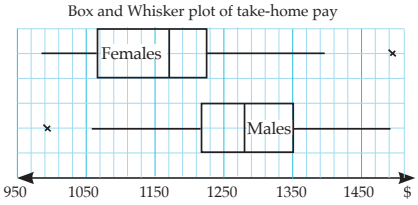
Page 241 Q52 cont...

52. it is likely that Year 11 males spend less time talking on their cell phone than Year 11 females.

53. a)

	Female ($)	Male ($)
Min.	985	991
LQ	1065	1217
Median	1170	1279
UQ	1225	1350.5
Max.	1495	1490

b)



c) The median pay for females is below the lower quartile for males meaning half the females earn less than the lowest quarter of males. The highest pay is a female on $1495 (a possible outlier). The difference in the median pay between the sexes is over $100 a week therefore the firm's claim appears incorrect.

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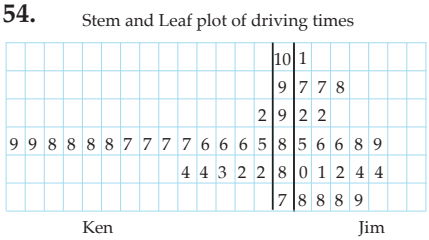
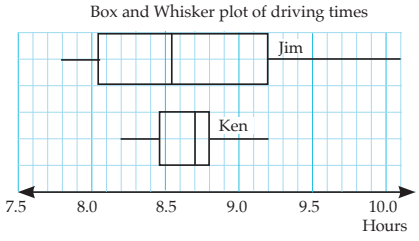
54.



Ken:
LQ = 8.45, Median = 8.7, UQ = 8.8, IQR = 0.35 and Range = 1.0.

Jim:
LQ = 8.05, Median = 8.55, UQ = 9.2, IQR = 1.15 and Range = 2.3.



Page 242 Q54. cont...

The median time of Jim at 8.55 h is a little faster than Ken at 8.7 h. The range of times for Jim of 2.3 h shows he is doing the trip fast sometimes and possibly stopping on other trips.

This is supported by the other measures of spread. The inter-quartile range of Jim is 1.15 h compared to Ken at 0.35 h.

It is possible that Jim is an inconsistent driver as he can do the route in 7.8 h and on another occasions take 10.1 h.

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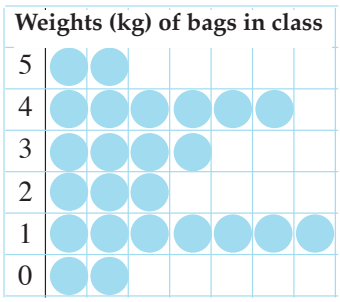
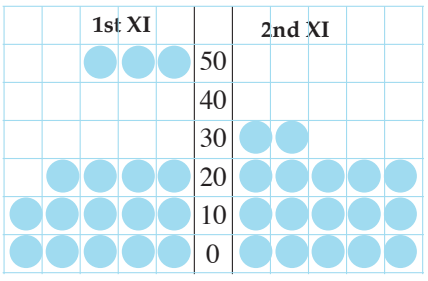
55. a)



Min. = 0.8 kg, LQ = 1.7 kg, Median = 3.1 kg, UQ = 4.15 kg, Max. = 5.2 kg

b) Appears to be two distributions (bimodal). Lighter bags from 0 to 2 kg and heavier bags ≥ 3 kg.

56. a) **Runs scored in cricket**



1st XI: Min. = 0, LQ = 1.5, Med = 12, UQ = 26, Max. = 53

2nd XI: Min. = 5, LQ = 8.5, Med = 18, UQ = 27, Max. = 38

b) The 2nd XI is more consistent with results 5 to 38 while the 1st XI are more erratic with 3 over 50, but more under 5 giving a range of 53.

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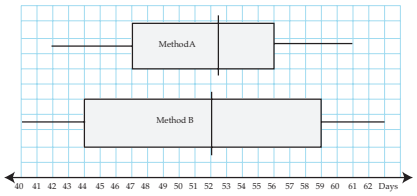
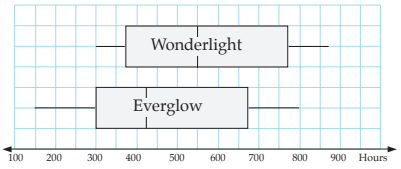
57. a) Box and Whisker – Cheese life



b) Median similar for Methods A and B, but less extremes in Method A so Method A better. The IQ range for Method B is 15 days while the IQ range for Method A is just 9 days. The minimum and LQ for B would lead to complaints.

58. a) Box and Whisker - Light bulbs



b) The difference in medians is 125 hours.

c) The Wonderlight lasts longer than the Everglow. At each of the points: minimum, LQ, median, UQ and maximum the Wonderlight last 75+ hours longer than the corresponding points on the Everglow.

59. a)

	May	August
Min.	0.5	0.3
LQ	1.3	2.3
Med	2.8	4
UQ	5.7	4.7
Max.	10.3	8.2
Mean	3.8	3.8

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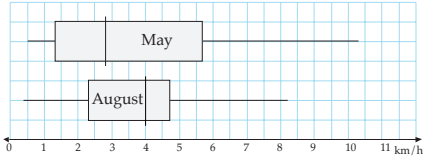
b) Box and Whisker - Wind



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c) Less wind in May. The median and lower quartile is lower by 1 to 1.2 km/h.
More winds in May.
The upper quartile and maximum is higher 1 to 2 km/h.

d) Best statistic is the interquartile range which is 4.4 km/h in May and drops to 2.4 km/h in August. There is more variation of wind in May.

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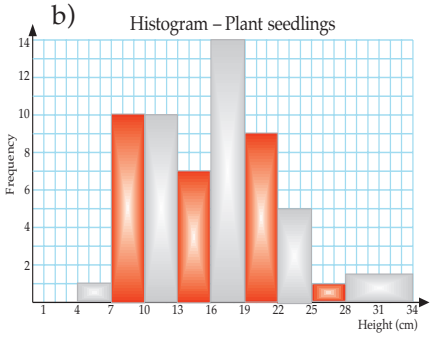
60. a)

Height (cm)	Mid-pt.	Freq. f
4 – <7	5.5	1
7 – <10	8.5	10
10 – <13	11.5	10
13 – <16	14.5	7
16 – <19	17.5	14
19 – <22	20.5	9
22 – <25	23.5	5
25 – <28	26.5	1
28 – <34	31	3
	Total	60

b)



c) $\frac{18}{60} = 30\%$

d) 16.2 cm (1 dp)

e) $\frac{28}{60} = 46.7\%$ (1 dp)

f) $\frac{28}{60} = 46.7\%$ (1 dp)

g) The best descriptor for the typical height would be the modal class 16 – <19. The mean is affected by extremes while the median in this case is too difficult to calculate. The modal class gives a good indication.

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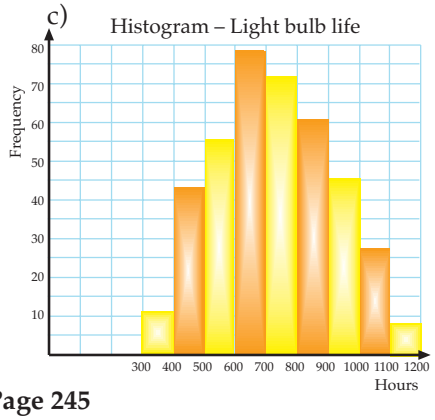
61. a) 47%

b) 0.62

c)



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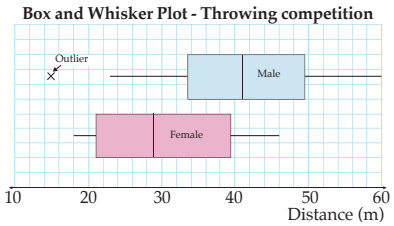
d) The mean life of a Wonderglow light bulb is 724 hours so the manufacturer would not be advised to make a claim of 750. A more realistic claim would perhaps be 700 hours.

62. a)

Results	Female	Male
Min.	18	15
LQ	21	33.5
Median	29	41
UQ	39.5	49.5
Max.	46	60

b)



c) We can see from the side-by-side box and whisker plots that the males tend to throw further. The throw of 15 m for the males is a long way from the next throw (23 m) so is marked as an outlier.
As the median for the males (41 m) is higher than the upper quartile for the females (39.5 m) we can see that in our sample half the males threw further than three quarters of the females. Also half of the females (median 29 m) threw a shorter distance than over three quarters of the males (lower quartile 33.5 m).

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63. a) The median swim time for both samples is about 15 seconds (20 results each side). As both distributions are fairly symmetrical, the means should be similar and hence approximately 15 seconds.

b) Sample A's IQR is about 3 seconds (16.5 – 13.5 seconds). Sample B's IQR is about 6 seconds (18 – 12 seconds). Based on counting in 10 results from each end.

c) Sample A's results are more consistent (lower spread as shown by IQR) while sample B has more very fast and very slow swimmers.

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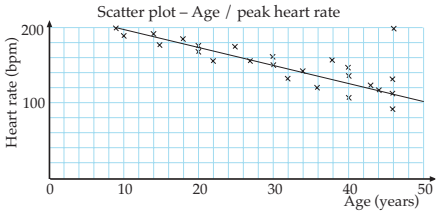
64. a) Explanatory – Age
Response – Heart rate

b) 25

c)



d) 46, 200

e) 9 years

f) Approximately 170 bpm

g) Approximately 26 years old

h) 9 out of 25 = 36%

i) As age increases the peak heart rate drops and the variation in peak heart rate between individuals of similar ages' increases.

j) 100 bpm

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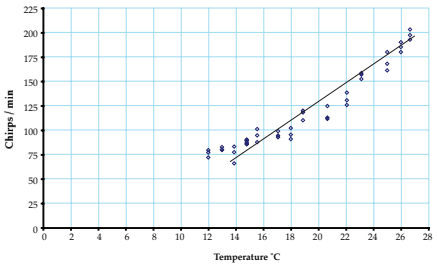
65. a) Explanatory – Temperature
Response – Chirps (min)

b)



c) Chirps = 178 / minute

d) Chirps (max) = 180
Chirps (min) = 160

e) Unlikely. Probably they would overheat and die.

f) Possibly crickets only chirp when the temperature is above a certain level.

g) All the data points in the middle are below the trend line.

h) Either 2 straight lines, one from 12°C to 18°C and a second steeper one above 18°C OR a curve.

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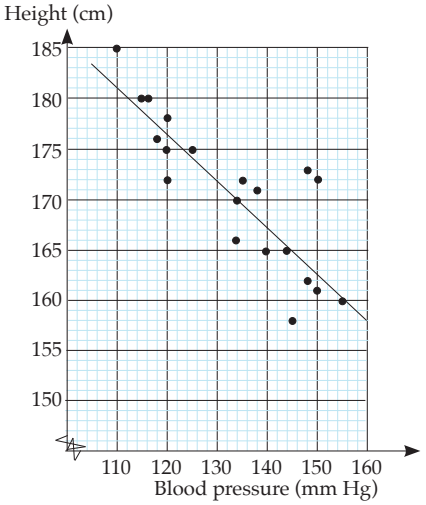
66. a) and b)



c) No obvious outliers. Perhaps worth checking points (150, 172) and (148, 173).

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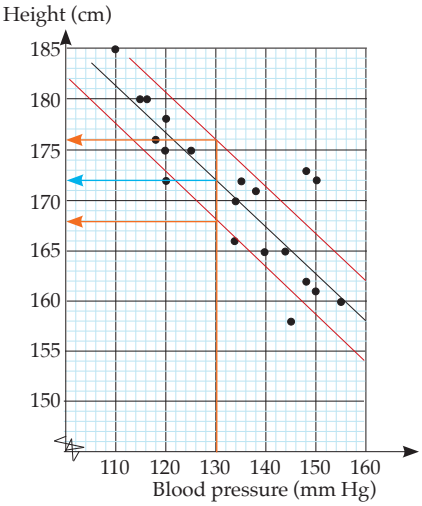
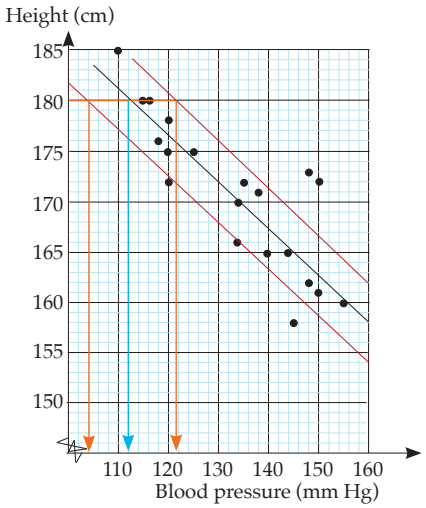
d) Answer will vary.



e) Answers will vary. Prediction interval 168 to 176 cm.

f) Because the relationship appears strong between blood pressure and height our estimate of an average height of 172 cm for a male with blood pressure of 130 mm Hg is precise.

g) Answers will vary.



Prediction interval 104 to 121 mm Hg.

h) Because the relationship appears strong between blood pressure and height our estimate of the average blood pressure for a male 180 cm tall of 112 mm Hg is precise.

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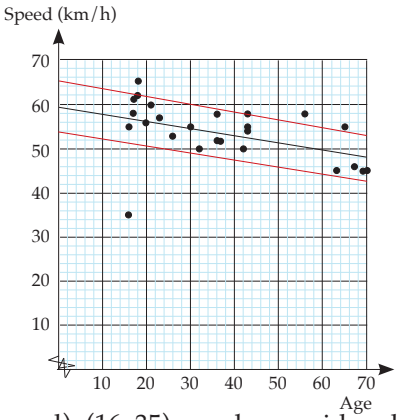
i) There appears to be a strong negative (inverse) relationship between the average blood pressure of males and their height, however the sample size is small (20) and we do not know the makeup of the sample in terms of ages etc. Further investigation would be required before a conclusion for the entire male population could be drawn.

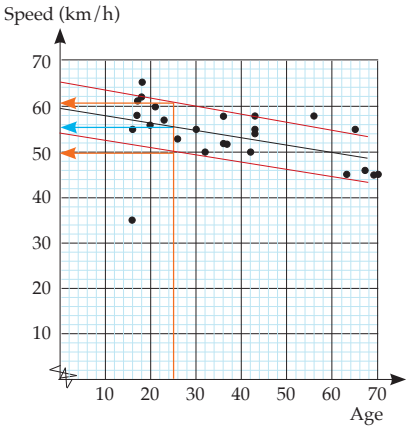
67. a) Drivers' ages range from 16 to 70. Speeds range from 35 km/h to 65 km/h in an area where the expected speed would be 50 km/h.

b) and c) Answers will vary.



d) (16, 35) may be considered an outlier but possible since a learner driver (16) may just be driving slowly because they lack confidence or experience.

e) Prediction interval 50 - 61 km/h. Answer will vary.



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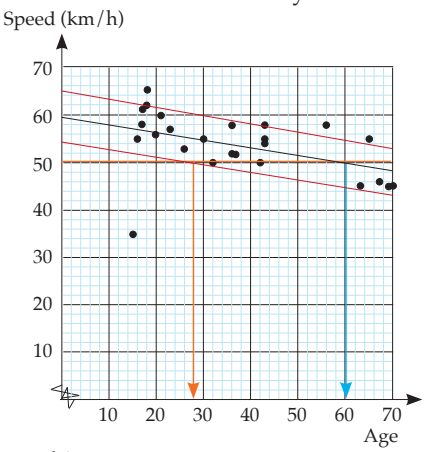
f) Because the relationship appears moderately strong between age and average driving speed our estimate of 55.5 km/h for a 25 year old is reasonably precise.

g) Prediction interval 28 - 92 years of age. Answers will vary.



h) Prediction interval is wide because the gradient of the trend line is not that steep meaning that drivers over a wide age range keep to an average speed of 50 km/h.

i) From the driver study it appears that there is a moderate negative linear relationship between the age of a driver and the average speed that they drive at. It seems from this investigation of 25 drivers that the younger you are the faster your average driving speed. Because the gradient of the trend line is quite flat prediction intervals for a driver's age given their speed, will be wide.

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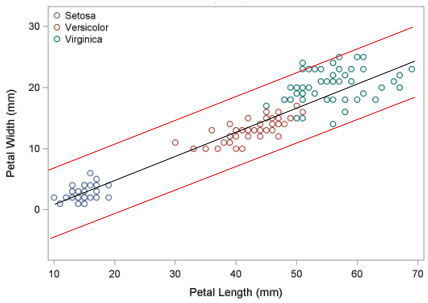
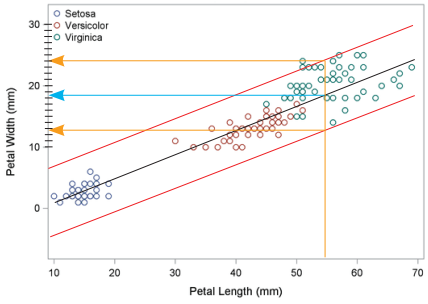
68. a) The explanatory variable is petal length (mm) and the response variable petal width (mm).

b)



c) The trend is a strong positive linear one. There are three groupings or clusters within the scatter plot reflecting the three different varieties of irises. The amount of scatter is consistent over the scatter plot except in the petal length range 20 – 30 mm where there are no points. There are no outliers that go against the trend but the divergence from the trend line increases as petal length increases.

d) Prediction interval for petal width of an iris with petal length of 55 mm is 13 mm to 24 mm (see graph below).



e) Because the relationship is moderately strong between iris petal length and width our estimate of an average petal width of 18 mm for a petal length of 55 mm is reasonably precise (see graph above).

f) Yes it would appear to be true for the three varieties in this study. However varieties with smaller petal length would appear to have less variation than varieties with longer petal length. This is evident in the

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f) scatter plot because of the tightness of the clusters. The cluster for the variety Sentosa is a lot tighter than that for Virginica.

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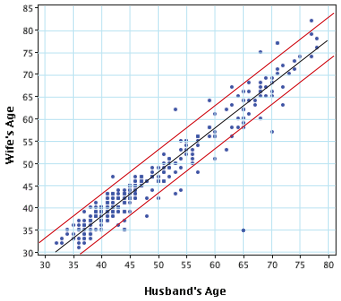
69. a) Answers will vary.

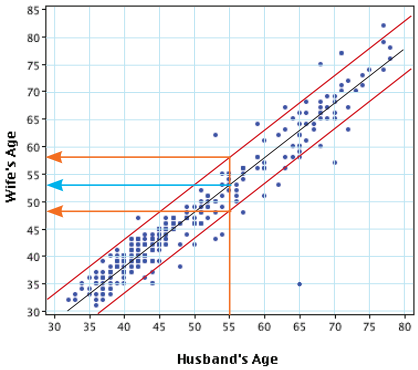


b) (65, 35). Yes, realistic that a 65 year old man can be married to a 35 year old woman.

c) Divorce or death of one partner – less couples married.

d) Yes, husbands are generally older than their wives. If a line was drawn through (30, 30), (80, 80), i.e. representing couples being the same age, then the majority of points are below this.

e) Prediction interval of wife's age is between 48 and 58 years of age. Answers will vary.



f) Because the relationship appears moderately strong between husband's age and wife's age our estimate of the average wife's age of 53 when a husband is 55 years of age is reasonably precise.

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g) Moderately strong to strong positive relationship especially for ages less than 50. The sample size is large giving a good level of confidence. Husbands generally appear to be older than their wives. The points are tightly clustered indicating that wives are up to ten years younger than their husbands. The density of points is less as age increases due likely to separation or death. One unusual point is (65, 35) but it is still realistic.

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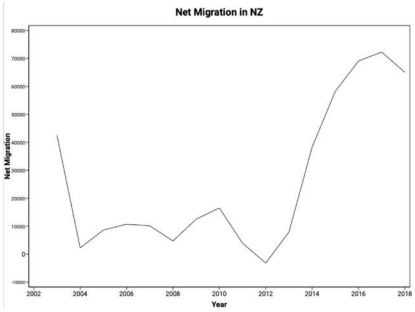
70. a)



b) Greatest period of increase is from 2013 to 2014 when there was a net increase of 30 400 (38 300 – 7900). Can tell from the graph because of the steepness of the graph from 2013 to 2014.

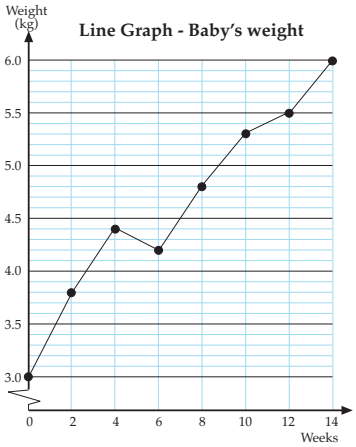
c) In 2012 net migration was ⁻3200 which indicates that more people left (emigrated) NZ than arrived (immigrated).

d) From 2003 to 2004 there was a significant drop in net migration. From 2004 to 2012 net migration fluctuated reaching a low of ⁻3200 in 2012. From 2012 net migration increased significantly reaching a peak of 72 300 in 2017.

e) From 2012 NZ's net migration has increased each year, but after 2015 at a decreasing rate. Further figures after 2018 would be required to confirm a decreasing trend.

Page 254 cont...

71. a)



b) 3 kg

c) 4.5 kg

d) Illness or change of feeding.

e) Week 10 – 12

f) Gradient of the line is less.

g) From birth the baby puts on weight for the first 4 weeks then loses 0.2 kg over the next two weeks, perhaps due to illness. From week 6 the baby puts on weight weekly.

Page 255

72. a) 10 000 consents

b) September quarter of 2021.

c) Second quarter of 2021. Line steepest in this quarter.

d) Less residential building permits issued in the first quarter of the year. Likely to be due to the Christmas, summer break.

e) Most residential building permits issued in the third quarter of the year. Likely to be due in preparation for building in the non winter months.

f) Long term trend is an increasing one showing a constant increase until 2020 then a significant jump in consents issued. From mid 2021 building consents issued have slowed.

Page 255 Q72 cont...

g) Cost to build has increased. Demand for housing has reduced, less immigrants coming into NZ. Mortgage interest rates have increased.

73. a) Covid - 19 pandemic when NZ closed its borders.

b) Peak numbers of visitors to NZ during the warmer months Dec and Mar quarters and reduced numbers in the colder seasons Jun and Sep.

c) Increase in visitor numbers to NZ in June quarter of 2021 when NZ opened up its borders to Australia during the panandemic.

d) Constant trend from the first quarter of 2017 to the first quarter of 2020. Clear seasonal pattern up to this period with more visitors arriving during the summer months. When Covid-19 hit visitor numbers collapsed. After the panademic ended visitor numbers have started to increase.

e) Expect them to return slowly to pre pandemic levels with the same seasonal variation or cyle as prior to the pandemic.

Page 256

74. a) 11 000 000 litres.

b) Fourth quarter of 2020.

c) Range = max – min

Range = 11.3 – 7.2

= 4.1 million litres.

d) Less total alcohol consumption in NZ in the second quarter of the year, June, probably due to the fact that it is Winter and less people socialising and going out.

Page 256 cont...

74. e) Most total alcohol consumption in NZ in the fourth quarter of the year (Oct to Dec), probably because of the lead up to and including Christmas.

f) Long term trend is an increasing one until 2021 and then a levelling off in total alcohol consumption in NZ. There is a strong seasonal cycle with lower consumption in the March and June quarters and significantly higher alcohol consumption in the December quarter.

g) The price of alcohol could have risen. Cost of living may have increased and people have cut back on luxuries like going out etc.

75. a) Range = max – min

Range = 1530 – 740

= $790 million.

b) Second quarter of 2020.

During Covid-19 NZ was in lockdown. Shops were closed and a large number of the population were working from home.

c) December quarter because of summer and Christmas.

d) Long term trend is an increasing one and there is a clear seasonal cyle with high sales in the fourth quarter of each year and lower sales in the third quarter of the year (winter). A slump in sales is evident over the Covid-19 pandemic (mid 2019 to mid 2021.

Page 257

76. a) 24.1 billion dollars.

b) Fourth quarter of 2017.

c) Covid-19 pandemic and NZ in lockdown. Imports to NZ dropped less international shipping and flights.

d) Fourth quarter of each year total value of imports to NZ are greater. Likely to be because of the Christmas period and shopping for Christmas.

e) Long term trend is an increasing one and there is a clear seasonal cyle with higher imports to NZ in the fourth quarter of each year and lower imports in the first and second quarters of the year. A significant drop in total imports to NZ is evident over the Covid-19 pandemic fourth quarter 2019 to second quarter 2020. Since mid 2020 value of total imports to NZ have continued to increase.

77. a) Third quarter of 2017.

b) Little or no seasonal cycle in this time series. Quarters 1, 2 and 3 show little variation, but quarter 4 shows a slight drop in numbers employed in Information Media and Telecommunications.

c) Likely to be an increase in demand for people employed at the end of the Covid-19 pandemic hence the small peak.

d) The long term trend is a decreasing one and there is no clear seasonal cyle. Employment numbers reached a low in the fourth quarter of 2020 and have been increasing since, but have not reached the same levels of employment as in 2017.

Page 258

78. a) Females, in all age categories the female percentage is greater than that of males.

b) Distribution is skewed to the right (positive skewed) because users have to be 13 years of age or older to have an Instagram account. Instagram is most popular among people aged 18 to 34, which accounts for 56% of all instagram users in NZ. Users of instagram drop off, for both genders in higher age categories. Females use instagram more than males in all age categories.

c) 2 462 000 ÷ 0.484
= 5 087 000 (4 sf).

d) 2 462 000 x 0.153
= 376 686

e) 2 462 000 x (0.035 + 0.018 + 0.011)
= 157 568

79. a) Three bedrooms.

b) Dwelling not owned and not held in a family trust.

c) 230 000 + 80 000 + 82 000
= 392 000

d) Occupants either own or have a mortgage on the property which they are paying off.

e) Predominant ownership for three, four and five bedroom dwellings in NZ is 'Dwelling owned or partly owned' reflecting family housing. One and two bedroom dwellings are in the main investments and probably rental properties.
A good proportion of two bedrooms properties are owned or partly owned reflecting people moving from larger homes when they get older.

Page 258 cont...

80. a) There is no meaning to points in between the bars and the sales of different makes of cars can be compared.

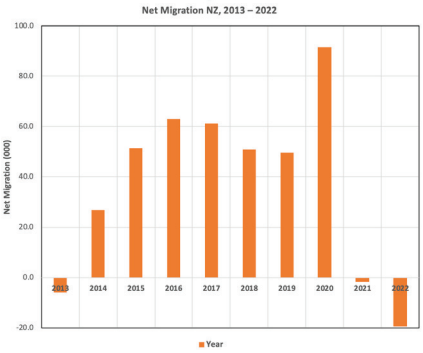
b) 17 219 ÷ 116 122 x 100 = 14.8% (1 dp)

c) Some truth to the claim made by Mitsubishi, because in 2021 Mitsubishi had a market share of 13.0% in NZ and in 2022 this had increased to 14.8%, although total new car sales in NZ had increased by 3.9% in the year.

d) Tesla, Hyundai and Mitsubishi.

Page 259

81. a)



b) More people leaving NZ than arriving for the year.

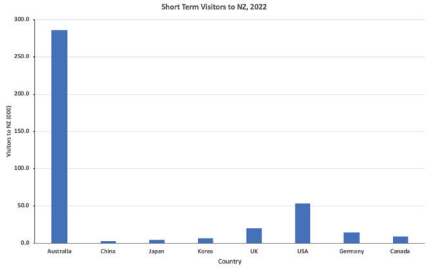
c) Net gain of 368 000.

d) Net gain in seven of the ten years with an increasing gain from 2014 to 2016 and then a fall in net migration for 2018 and 2019. 2020 saw a large increase in net migration and significant losses in the following two years.

e) 2020 Covid-19 pandemic which saw large numbers of New Zealanders return home from overseas.

Page 259 cont...

82. a)



b) 1.1%

c) The visitors are in New Zealand for only a short time so there were never 395 700 visitors in the country at one time in 2022. Visitor numbers are spread throughout the whole year.

d) China. The numbers coming at 2700 in 2022 are a tiny percentage of the population, so huge capacity to expand. Visitor numbers from China in 2022 were low because China was still in lockdown after Covid-19 and Chinese citizens could not travel to foreign countries.

Page 260

83. a) (988 + 410) = 1398 million km. Includes car driver only and car passenger.

b) Predominant trend in NZ is to travel by car either as a driver or passenger. Car - driver and passenger accounts for nearly 82% of all kilometres travelled.

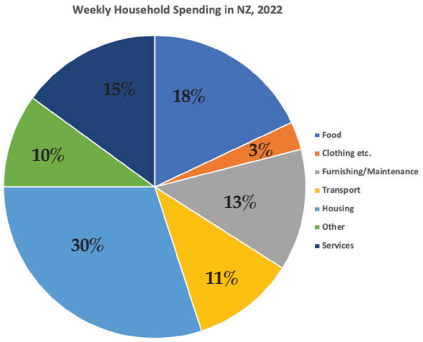
c) Total million of hours travelled is 1707 (from pie chart) and total distance travelled is 58 866 million km. So average km travelled per hour is 58 866 ÷ 1707 = 34.5 km

d) Included with Pedestrian.

e) Aircraft, mobility scooters etc.

Page 260 cont...

84. a)



b) Rent or Mortgage

c) 0.30 x 1349 = $404.70

d) Electricity, Gas, Internet etc.

e) If roughly the same amount is being spent on Housing and Food and the total is lower, then the proportion on these two items will be greater. As some items must be scaled back the proportion being spent on other items such as Furnishing/Maintenance must be less.

Page 261

85. a) 498 x 0.203 = 101.1 million litres

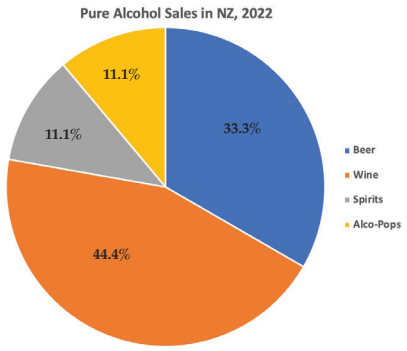
b) Beer and wine make up nearly 80% of all alcohol sales in NZ (395 million litres).

c) 498 ÷ 3.9 = 128 litres per head of the legal population of NZ in 2022.

d) Likely that the litres per head is less than that quoted in c) above because a large amount of alchol is drunk by New Zealanders less than the legal age of 18. Assumption made in calculation was that only people over the legal age in NZ drank alcohol.

Page 261 Q85 cont...

e)



f) Proportion for beer has dropped and that for wine has increased from the first pie graph, because the alcohol content for wine is significantly more than for beer. Percentage of spirits has also increased in this pie chart because of its high alcohol content.

86. a) $77 \div 191 \times 100 = 40.3\%$

b) North Island = 148
South Island = 42
Doesn't total 191 because one of the GPs is training overseas.

c) $7 \div 191 = 3.7\%$ (1 dp).

d) $191 \div 2639 \times 100 = 7.2\%$ increase.

e) Pie charts are often used for showing the relationship of parts to the whole. It represents the data visually and is an effective communication tool for making a comparsion at a glance. The GP data is an example of this. The only drawback in this situation is the number of different categories. A smaller number would be preferable and make it easier to read the pie graph.

Page 264

87. Temperature (x)
Chirps (y)

88. Either, it would depend on the wording of the question.

89. Gestation time (x)
Lifespan (y)

90. Height (x)
Average score (y)

91. Size (x)
Value (y)

92. Engine capacity (x)
Top speed (y)

93. Weight (x)
Consumption (y)

94. Father height (x)
Son's height (y)

95. Age of car (x)
Value of car (y)

96. Speed (x)
Braking distance (y)

97. Temperature (x)
Sales (y)

98. Possibly Weight (x) and Percentage body fat (y), but either as it could depend on the wording of the question.

99. Weight of mother (x)
Birth weight of child (y)

100. Age (x)
Income (y)

Page 265

101. Variable not identified. Mode of transport cannot be measured. Possibly the number of one subgroup (e.g. students who live in the country) is very small and comparisons will be suspect.

102. 'Bikers' is not good enough as a definition of a population. Could be comparing mainly students in town to mainly adults in the country. Subgroups should only have one point of difference.

103. Quantitative variable open to confusion. The same question with cars should be okay but does vehicle include farm vehicles?

Page 265 cont...

104. Students who play rugby are likely to be predominantly male while netball players are likely to be predominantly female so it is possible that any differences in bag weight may reflect gender differences and not the selected subgroups. If possible subgroups should only have one point of difference. Also a problem at single sex schools as one subgroup may be very small.

105. Time can be measured but the definition of the quantitative variable is vague. What activities qualify as playing sport? Is playing a game at lunch time counted? Is sport practice or physical education counted as playing sport?

106. Population is not defined. Also the schools may have a different policy on use of phones during school time. If possible subgroups should only have one point of difference.

These are just possibilities. Other answers are acceptable.

107. Do Year 10 students at our school tend to spend more time online in a school week than Year 11 students? Must have a variable that can be measured and will reflect an aspect of the typical day at school.

108. Do Pakeha students at our school tend to spend more time outside in a typical day than Asian students? Must have a variable that can be measured and will reflect an aspect of the out of school day.

109. Do female Year 11 students at our school typically send more text messages than Year 11 male students at our school? Could be minutes of phone calls or time on the internet for smart phones. Variable must be able to be measured or counted.

Page 265 cont...

110. Do female Year 11 students at our school typically bring a lighter lunch than Year 11 male students at our school? Do female Year 11 students at our school bring a greater number of items in their lunch than Year 11 male students at our school?

111. Do Year 10 students typically spend more time using facebook than Year 13 students at our school? Needs to be time (measurable) but sites may vary depending upon level.

112. Do students who prefer soccer typically spend more time going to the movies (or going on dates) than students who prefer rugby?

The following are examples of possible answers but other answers are acceptable.

113. In New Zealand high schools do females tend to have heavier bags than male students?

114. In New Zealand high schools do students who walk to school tend to have lighter bags than students that come by car or bus?

115. In New Zealand high schools do students born in New Zealand tend to sleep longer than students that were born outside New Zealand?

116. Possible answer. Whether the student was a junior or senior student. Older teenagers may need (or have) less sleep.

Page 266

117. Variable is the quarterly number of people employed in Media and Telecommunications in NZ and the group of interest is people employed in Media and Telecommunications in NZ across 2017 to 2022.

118. Variable is the quarterly sales in millions of litres of alcohol in NZ and the group of interest is alcohol sales in New Zealand across 2015 to 2022.

Page 267

119. Variable is the quarterly sales in millions of dollars of clothing and footwear in NZ and the group of interest is clothing and footwear sales in New Zealand across 2017 to 2022.

120. Variable is the quarterly value in billions of dollars of all NZ imports and the group of interest is value of imports to New Zealand across 2015 to 2022.

121. Variable is the quarterly percentage unemployment rate in NZ and the group of interest is the unemployment rate in NZ across 2017 to 2022.

122. Variable is the quarterly average house price in dollars in NZ and the group of interest is the avearge house price in NZ across 2017 to 2022.

123. Variable is the quarterly government debt as a percentage of GDP in NZ and the group of interest is the government debt to GDP ratio in NZ across 2017 to 2022.

124. Variable is the quarterly government spending in NZ in millions of dollars and the group of interest is government spending in NZ across second quarter 2017 to first quarter 2023.

Page 273

125. Row 7, armspan missing so row needs to be removed.
Row 16 armspan 1.81 probably recorded in metres supposed to be 181 cm so change.
Row 18, height of 435 cm is inappropriate and impossible so remove.
Row 21 height of 17 cm should be 170 cm. Left off the digit 0. Change to 170 or remove the row.
Row 24 no height (n/a) so remove the row.
Row 27 armspan of 145.8 change to nearest centimetre, i.e 146.

Page 273 cont...

126. Row 3, bag weight looks like it was recorded in grams, should be 4.0 kg. Row 6, bag weight of 0.0 kg means no bag was carried to school so delete row.
Row 11, no shoulder width recorded so remove row.
Row 15, n/a likely to mean no bag carried to school so remove row.
Row 17, shoulder width of 430 probably means measured in mm, change to 43 cm.
Row 22, shoulder width of 0.36 measured in metres, change to 36 cm. Row 24, bag weight measured to 2 dp, change to 2.6 kg.

127. Row 6, weight possible recording error and decimal point left out, probably should be 45.5 kg so change.
Row 16, reaction too small to be credible so remove. Row 18, weight, possible recording error, decimal point in wrong place, probably should be 88.5 kg.
Row 20, reaction time too large to be credible, so remove.
Row 22, weight too large to be credible, so remove. Row 25, weight, possible recording error, decimal point in wrong place, probably should be 53.8 kg.
Row 28, weight too light to be credible, so remove.

128. Row 2, 0 is fine as it refers to a city at sea level.
Row 4, temperature inappropriate, possibly decimal point is in the wrong place and it should be 7.60 ˚C. Change to 7.6 if able to confirm otherwise remove.
Row 10, city unlikely to have a mean average temperature of 25.1˚ C at 1000 metres elevation. Data not credible remove data pair.
Row 19, mean temperature is high for elevation at 1400 metres above sea level, but may be possible so further investigation needed.

Page 273 Q128 cont...

Row 25, elevation does not tie in with temperature. Looks like a transcription error and elevation should be 1200 m. Change or investigate further.

Page 274

129.
- Student A with 30 in homework probably refers to minutes as there are only 24 hours in a day.
- Student B with 0 for texts looks suspicious as they may not have a phone or no charge on their phone that day.
- Another outlier is Student A with 350 texts as that is 10 000 texts a month and it is unlikely a student will get that many.
- Hours of sport may be an inappropriate variable as many students are not playing sport.

130.
- The Forward / Back variable will be used to make the subgroups so a player cannot be in both. Decide on predominant position.
- Player A with 1 game looks wrong. Maybe new to the team or injured so check.
- Player E with games of 26 looks wrong as there are not 26 weeks in a playing season. Check or remove.
- Units of weight should be the same. Player B at 10.5 could be 10 and half stone or a typing error for 105 kg. Check or remove.
- Definition of an injury makes this variable suspect as a numeric variable. Player A may have had one serious injury all year.

Page 274 cont...

131.
- Sex needs same units so change boy to M and girl to F.
- Facebook. Student A is fine. Student B at 5 looks wrong and could be minutes, check.
- Facebook. Student F at 0 may not have a Facebook page in which case *na* is better.
- Units need to be the same so change all of Facebook to minutes. Student G looks like 1 hour 20 minutes so check.
- Texts. Check Student B.
- Time to get home. Student C either has a job or there is something suspicious in the time. It is an outlier. Student F lives very close or the units are hours, check.

132.
- Age needs <18 or ≥18 so correct Shopper C and Shopper G.
- Time in Mall may be suspicious. If taken when they leave could be fine but if taken inside they may have just arrived.
- Number of parcels looks a poor choice of variable particularly as C has 0 but has spent $25 while G has 11 but only spent $30.
- Amount spent should be limited to types of purchase. Check if F intends to shop and if necessary replace with na.

Page 276

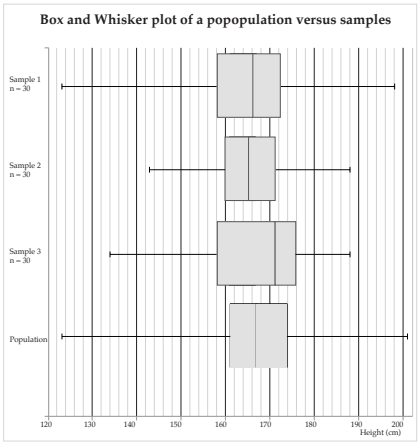
133. Need 30 pairs of random integers. The first integer in each pair is from 1 to 13 which selects the class. The second integer 1 to 24 selects the student in the class.

134. Need one or two samples. If one sample then the same 30 days are selected for each of the two cities. If two samples then different days are selected. For each random number 1 to 365 the corresponding month and day must be worked out.

Page 277

135. These are the author's results. Two of the three medians are close to the population median, but the other statistics vary. When we take samples of size 30 we get an estimate of the population median that varies with the random process of taking a sample.

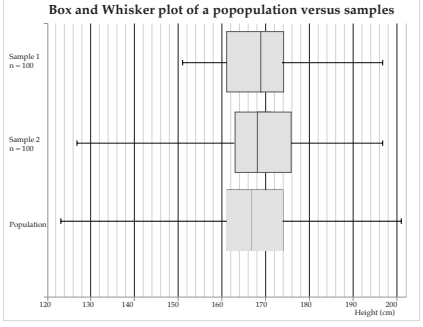
	Pop. data	S. 1	S. 2	S. 3
Min.	123	123	143	134
LQ	161	158	160	158
Med.	167	166	165	171
UQ	174	172	171	176
Max.	201	198	188	188



136. These are the author's results with n = 100. A sample size of 100 has the medians and quartiles close to the population parameters.

One median of one sample is 3 cm above the population median and the minimum of the same sample is 151 cm.

	Pop.	S. 1	S. 2
Min.	123	127	151
LQ	161	163	161
Med.	167	168	170
UQ	174	176	174
Max.	201	197	197

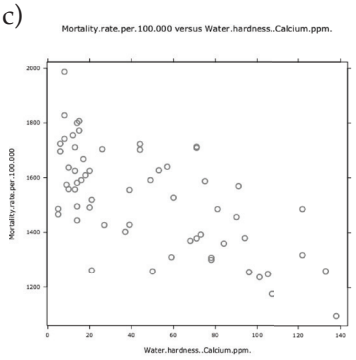


Page 284 (Answers will vary)

137. a) Concentration of calcium (explanatory variable, x), mortality rate per 100 000 males (response variable, y), because we are trying to ascertain whether there is a relationship between water hardness and the mortality rate of males not the other way around.

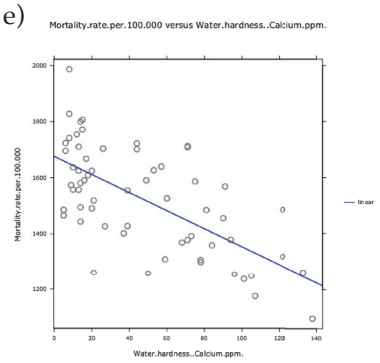
b) In England, between 1958 - 1964 was there a relationship between the hardness of the water and the mortality rate of males?

c)



d) Moderate negative linear relationship between water hardness and mortality rate of males. As water hardness increases the mortality rate drops. Amount of scatter tends to reduce over the range of the plot and there is a greater cluster of points for lower levels of water hardness. No outliers that go against the trend.

e)

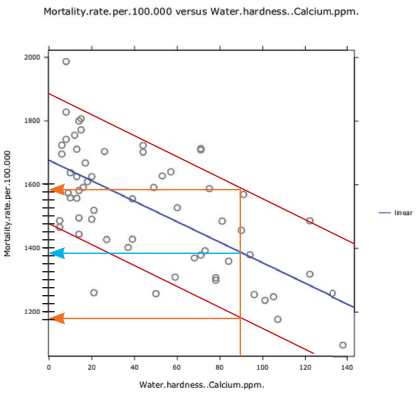


Page 284 Q137 cont...

f) Equation of trend line

Mortality rate per 100 000 = −3.2261*Water hardness + 1676.4

g) Mortality rate prediction interval is 1175 to 1580. The average estimated mortality rate for a water hardness level of 90 ppm using the equation of the trend line is 1386 per 100 000 males. Because the relationship is a moderately strong one our average estimated mortality rate for a hardness level of 90 ppm should be reasonably precise.

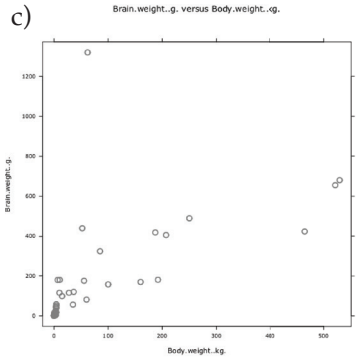


Page 285 (Answers will vary)

138. a) Body weight of different land animals (explanatory variable, x), brain weight (response variable, y), because we are trying to ascertain whether there is a relationship between the body weight of an animal and its brain weight not the other way around.

b) In the study of different land animals was there a relationship between their body and brain weights?

c)

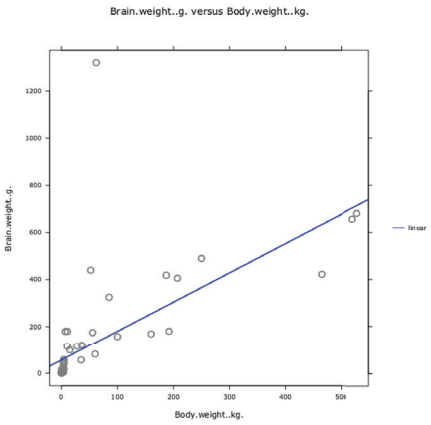


Page 285 Q138 cont...

d) Moderately strong positive linear relationship between body weight and brain weight. Amount of scatter tends to reduce over the range of the plot and there is a greater cluster of points for lower body weights. One outlier that would need further investigation and justification is the point (62, 1320).

e) The point (62, 1320) appears to be an outlier. It is the paired point for a human and is correct, however whether you would include it in an investigation of the body weight and brain weight of land animals could be debated. Other points that my be considered to go against the trend somewhat could be cow (465, 423) and chimp (52, 440), but both should remain in the dataset.

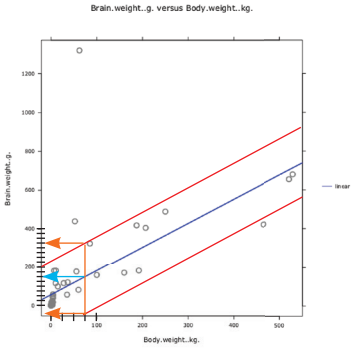
f) Linear trend line is the best fit for the data because as body weight increases it appears so does brain weight.



g) Equation of trend line
Brain weight (g) = 1.2427*Body weight (kg) + 55.952

Page 285 Q138 cont...

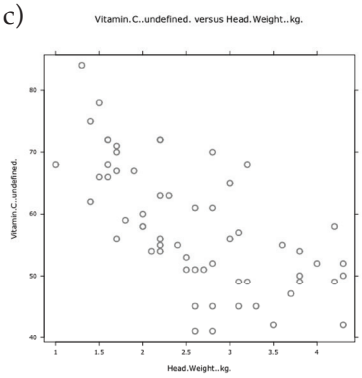
h) Brain weight prediction interval is 0 to 325 g. The average estimated brain weight rate for a land animal of weight 75 kg using the equation of the trend line is 149 g. Because the relationship is a moderately strong one our average estimated brain weight for a land animal weighing 75 kg should be reasonably precise.



139. a) Vitamin C level (response variable, y), head weight (explanatory variable, x), because we are trying to ascertain whether there is a relationship between the head weight of a cabbage and its Vitamin C level not the other way around.

b) In a particular variety of cabbage is there a relationship between the head weight of the cabbage and its Vitamin C content?

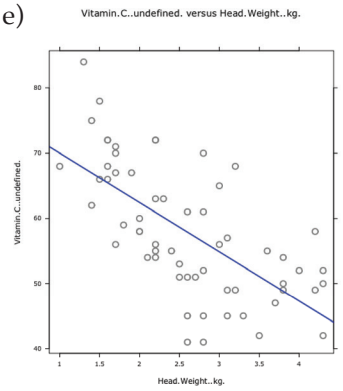
c)



Page 285 Q139 cont...

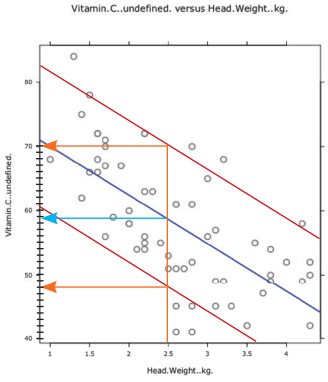
d) Moderate negative linear relationship between the head weight of cabbages and the Vitamin C content. The amount of scatter is consistent over the range of the plot with no evidence of clusters. There are no outliers that need further investigation.

e)



f) Equation of trend line Vitamin C = ⁻7.5673*Head weight (kg) + 77.574

g) Vitamin C content prediction interval is 48 to 70 for a cabbage head weight of 2.5 kg. Using the equation of the trend line we get a value of 59. Because the relationship is a moderately strong one our average Vitamin C content value for a cabbage head weight of 2.5 kg should be resonably precise.



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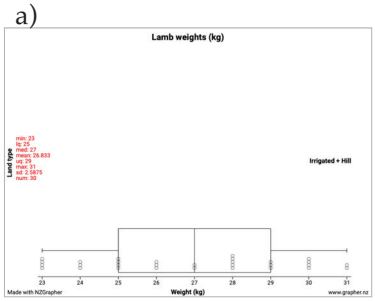
140. a)



b)

	Irrigated + low	Irrigated + hill
Mean	24.0 kg	26.8 kg
Min.	19.0 kg	23.0 kg
LQ	22.0 kg	25.0 kg
Med.	24.0 kg	27.0 kg
UQ	26.0 kg	29.0 kg
Max.	29.0 kg	31.0 kg
IQR	4.0 kg	4.0 kg

c) The data for the sample from the irrigated lowland pasture shows an almost normal distribution around the median of 24 kg.

The median is also the mean which shows how symmetrical the distribution is. The interquartile range of 4.0 kg shows how little spread there is as half the data is within 2 kg either side of the median.

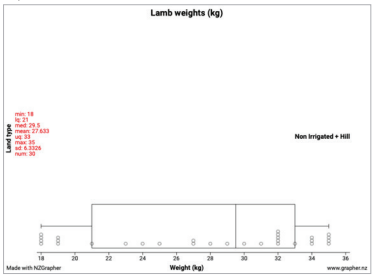
The data for the irrigated hill country pasture shows a general shift to heavier lambs compared to the irrigated lowland sample of around 3 kg per lamb. The lower quartile at 25 kg, the median at 27 kg and the upper quartile at 29 kg are all 3 kg heavier.

The distribution of weights of lambs for irrigated hill country is grouped around the median. The similarly tight grouping (lack of spread) is supported by an identical IQR of 4 kg. There are no outliers.

The small spread of results could be reflective of the consistent growing conditions for the relevant pastures as a result of irrigation.

Page 289 cont...

141. a)



b)

	Non-irrigated + low	Non-irrigated + hill
Mean	29.9 kg	27.6 kg
Min.	22.0 kg	18.0 kg
LQ	27.0 kg	21.0 kg
Med.	31.0 kg	29.5 kg
UQ	33.0 kg	33.0 kg
Max.	35.0 kg	35.0 kg
IQR	6.0 kg	12.0 kg

c) The data for the sample from non-irrigated lowland pasture is skewed to the left with half the lambs being between 31 kg and 35 kg inclusive.

The data for the sample from the non-irrigated hill country pasture shows a bimodal distribution with one mode at 18 kg and the second at 32 kg.

The mean for the non-irrigated hill country lambs is 2.3 kg lighter than the non-irrigated lowland lambs. The lower quartile at 21.0 kg is 6.0 kg lighter while the upper quartiles are identical. This shows the non-irrigated hill country lambs have a similar distribution of heavier lambs with the marked difference being the cluster of lambs under 21 kg.

This is supported by the IQR which is 12.0 kg for the sample from non-irrigated hill country pasture compared to 6.0 kg for the non-irrigated lowland pasture.

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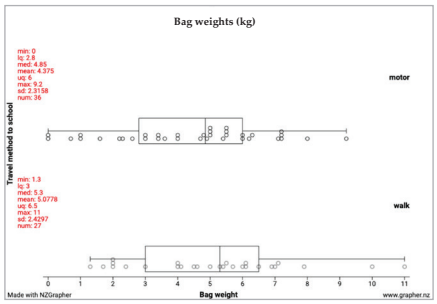
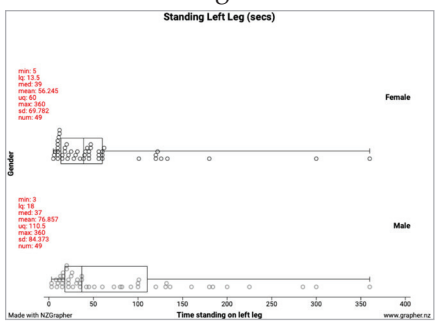
142. The 100 Year 9 students in our sample are spread through a number of categories, but the two we are concerned with are motor (36) and walking (27). The distribution and measures of the middle (medians 4.9 kg and 5.3 kg and the means 4.4 kg and 5.0 kg) are similar as well as the IQRs (3.2 kg and 3.5 kg). For these two categories there is no basis for concluding that bag weights of Year 9 students that travel by car tend to be heavier (or lighter) than students that choose to walk.

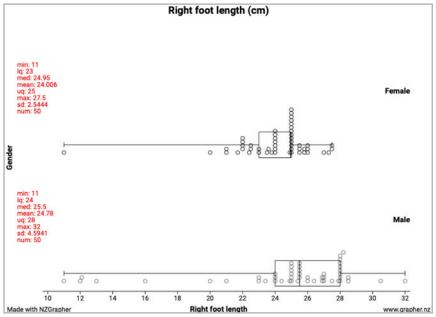


143. Half the Year 9 students could only stand on their left leg for 37 to 39 seconds. The spread of standing times on the left leg is a lot less for females than the males (IQR = 46.5 secs compared to 92.5 secs for males). There are more extreme left leg standing times values for males than females thus resulting in a higher mean male standing time.



Page 290 cont...

144. As expected male right foot lengths tend to be bigger than female right foot lenghs. Three quarters of the males had a right foot length of 24 cm or larger (LQ = 24 cm) while three quarters of the females have a right foot length under 25 cm (UQ = 25 cm). The spread of the male right foot length was also greater (IQR males = 4 cm versus IQR females of 2 cm).



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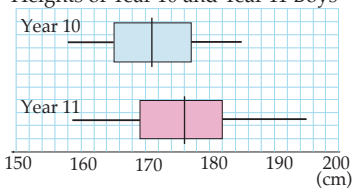
145. a)



The Year 11 quartiles and median are from 4 to 6 cm higher. The maximum has increased by 10 cm.

b) These samples fail the 75% better than 50% guide line.
Checking the spread of spreads. The difference in the medians is 5 cm and the spread of the spreads is 17 cm
(LQ Y10 = 165 cm to UQ Y11 = 182 cm). As three times the mean of 5 cm = 15 cm is NOT greater than the spread of spreads of 17 cm we cannot conclude that there is a difference in the heights of boys Y10 to Y11.

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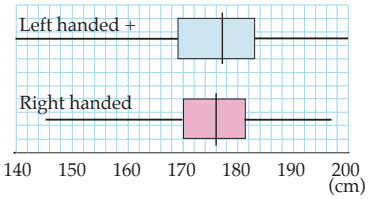
146. a)

Heights of different handed boys in Year 11

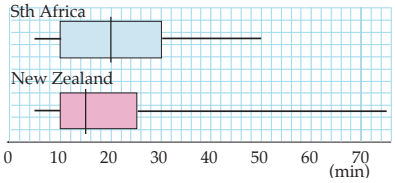


The ranges are different (right-handed students are 5 cm taller and 3 cm shorter) but quartiles and median are close. The median of the right-handed students is 1 cm shorter.

b) The difference in the median is 1 cm and three times this is 3 cm. The spread of the spreads is 14 cm and as this is NOT smaller than 3 cm so we cannot make any inference for a difference in the height for the population of Year 11, right-handed boys versus left-handed / ambidextrous boys.

147. a)

Travel times of students in South Africa versus New Zealand



There is a difference in the sample median of 5 minutes. The range for NZ at 70 minutes is higher than the range for South Africa at 45 minutes.

b) The difference in the medians is 5 minutes and the spread of the spreads is 20 minutes (LQ 10 minutes to UQ 30 minutes). As three times the mean of 5 minutes is NOT greater than 20 minutes we cannot conclude that there is a difference in the travelling times.

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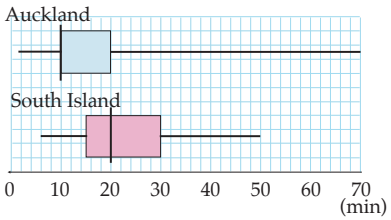
148. a)

Student travel times to school, Auckland versus South Island



The range of times in Auckland is larger at 69 minutes versus 44 minutes for the South Island. The median and quartiles for the South Island are all higher. The median of the South Island is on the upper quartile for Auckland.

b) These samples meet the 75% better than 50% guide line. The median for the South Island is 20 minutes which is the upper quartile for Auckland. The median for Auckland is below the lower quartile time for the South Island. South Island 15 year old students take longer travelling to and from school.

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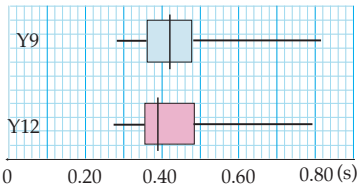
149. a)

	Year 9	Year 12
Number	40	36
Minimum	0.280 s	0.266 s
LQ	0.359 s	0.357 s
Median	0.420 s	0.389 s
UQ	0.482 s	0.485 s
Maximum	0.813 s	0.795 s

Student reaction times Year 9 versus Year 12



b) The difference in the medians is 0.031 s and the spread of the spreads is 0.128 s. As three times 0.031 = 0.093 s is NOT greater than 0.128 s we cannot conclude that there is a difference in the reaction times between Year 9 and Year 12 from this population.

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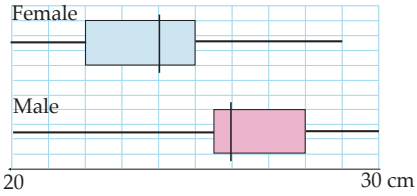
150. a) Length 90 was removed from the females and length 255 changed to 25.5 in the males. Length 2 could either be changed to 20 or removed in the females. Lengths 12 and 40 were removed from the males. 40 cm was removed as it was 10 cm above the next data point but it may be valid.

b)

	Female	Male
Number	44	43
Min.	20 cm	20 cm
LQ	22 cm	25.5 cm
Median	24 cm	26 cm
UQ	25 cm	28 cm
Max.	29 cm	30 cm

Foot size Year 10 girls versus boys



c) This result meets the 75% better than 75% criteria. Yes, there is a difference in the population.

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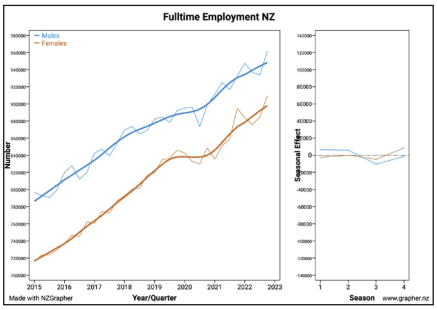
151. a)



b) The long term trend for full time employment in NZ from 2015 to 2022 for both sexes is an increasing one. Full time employment for males in NZ is greater than for females.

Page 298 Q151 cont...

151. c) Very little seasonality variation in the two series. Male fulltime employment drops more than female fulltime employment in the third (September) quarter of the year. There is a slight rise in fulltime employment for males in the first and second quarters of the year. This is not the case for females.

d) Fulltime employment drops for both sexes in the third quarter of the year, probably because of winter, when some industries slow down or reduce production.

e) The drop is a result of the Covid-19 panademic when many fulltime workers lost their jobs. Females appear to be more affected than males. For males there was a steep drop in employment which recovered reasonably quickly, whereas female numbers dropped not as much as males, but recovery took longer.

f) Fulltime estimates for 2023Q1 are
Males 969 900 (956 000 to 985 000)
Females 895 930 (881 000 to 911 000).

g) Looking at the two series the male and female series appear to be converging slightly as the years progress suggesting that female fulltime employment numbers are increasing faster than that of males.

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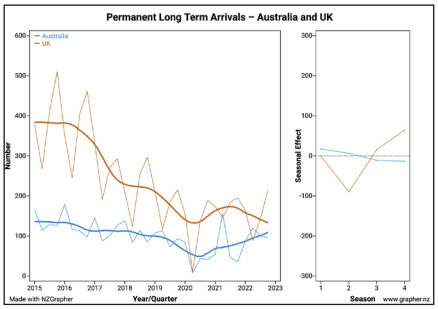
152. a)



b) The long term trend for permanent long term arrivals from 2015 to 2022 from the UK and Australia vary significantly. The UK trend has been a declining one over the seven year period whereas the Australian, although it has decreased has done so at a lot slower rate and has started to recover since 2020.

c) Permanent long term arrivals from the UK show a strong seasonal cycle with greater numbers arriving in the fourth quarter of the year and less in the second quarter. Australian arrivals has a weak seasonal cycle with increased numbers in the first quarter of the year and less in the third and fourth quarters.

d) More arrivals from the UK in the fourth quarter of the year, probably because it is summer in NZ at this time.

e) The drop is a result of the Covid-19 panademic when many countries were in lockdown. UK was affected more than Australia, because NZ did open up to Australia during the panandemic which was not the case for the UK.

f) Fulltime estimate for 2023Q1 are
Australia 89 (28 to 150)
UK 173 (100 to 250).

Page 298 Q152 cont...

152. g) Comparing the number of permanent long term arrivals as a percentage of the population of each country, Australia would be higher and with the falling arrival numbers from the UK, this would have increased over the seven year period. Pop. of UK 68 million, pop. of Australia 25 million. So would agree with the newspaper article, in terms of a percentage of the countries population.

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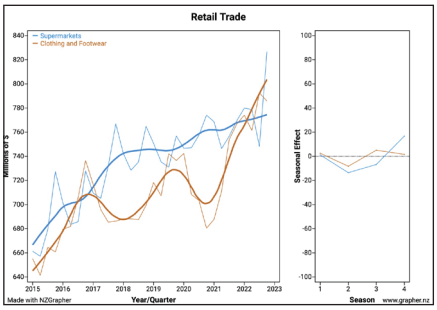
153. a)



b) The long term trend for supermarkets over the period 2015 to 2022 is a consistent one, with no significant drops. From 2017 there was a bulge in supermarket sales until 2019. The clothing and footwear sales long term trend is one with two significant drops, one in 2018 and the other in 2020. Clothing and footwear sales is a more volatile market in comparison with supermarkets probably because of the nature of the goods. Food is a necessity whereas clothing and footwear sales increase when the economy is performing better and people have more disposable income.

Page 299 Q153 cont...

153. c) Supermarket sales show a seasonal cycle with stronger sales in the fourth quarter of the year and lower sales in the second and third quarters. Clothing and footwear sales are stronger in the third quarter, but there is not a strong seasonal cycle overall.

d) Supermarket sales increase in the fourth quarter due to the Christmas and summer holiday period.

e) Groceries are a necessity as people have to eat so sales are less affected by the state of the economy. Clothing and footwear sales are more linked to extra disposable income so when the economy is performing well footwear and clothing sales increase and the converse is true when the economy is not performing as well.

f) Fulltime estimate for 2023Q1 are
Supermarket sales $million
801 (770 to 830)
Clothing and footwear sales $million
800 (760 to 840).

g) When the economy is not performing well and people's disposable income is reduced their spending falls significantly on clothing and footwear, but they spend a little more on luxuries at the supermarket to perhaps compensate.

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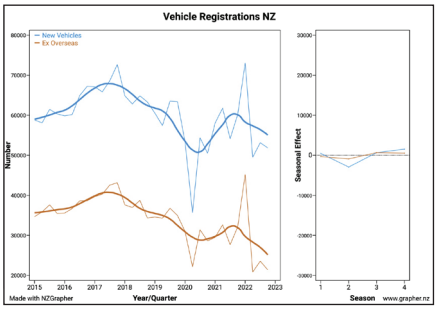
154. a)



b) The long term trend for new vehicle registrations and ex-overseas registrations are very similar, the only difference between them is the volume of new registrations is more than that of ex-overseas registrations.
Both series reached a peak in 2017 to 2018 and have been declining since. A steep drop occurs in both series when the Covid 19 pandemic occurred, but the affect was greater on new vehicle registrations.

c) Little or no seasonal variability in ex-overseas registrations. For new vehicle registrations they drop in the second quarter of the year and there is a small increase in the fourth quarter.

d) New vehicle registrations are higher in the fourth quarter, perhaps due to the Christmas and summer holiday period. Also car dealers have yearly quotas to meet so offer better deals in the fourth quarter.

e) Little or no difference, between new and ex-overseas vehicle registrations. The two series have maintained a similar difference apart, indicating a constant difference between the two.

Page 299 Q154 cont...

154. f) Fulltime estimate for 2023Q1 are
New vehicles
54 203 (41 000 to 68 000)
Ex-overseas vehicle
27 171 (18 000 to 36 000).

g) Difficult to get stock of new or ex-overseas vehicles after the pandemic. Takes time for manufacturers of new vehicles to build up production to meet world supply needs. Also ex-overseas vehicle demand world wide after the pandemic was high, but only a small proportion available to the NZ market.

Page 302

155. a) Sales figures for all brands by country are readily available, so no need to sample, as actual figures available for both countries.

b) All mobile phone users in the USA and NZ.

c) Apple is a USA designed and made phone so likely brand loyalty is a possible reason.

d) P(NZ Samsung)
= 0.3512 x 0.3512
= 0.1233 (12.3%)

e) The percentages only total 95.93% not 100%.

f) 6 400 000 x 0.4634
= 2 965 760 apple phones

g) Large number of people could have two phones (a work phone and the other for personal use).

Page 303

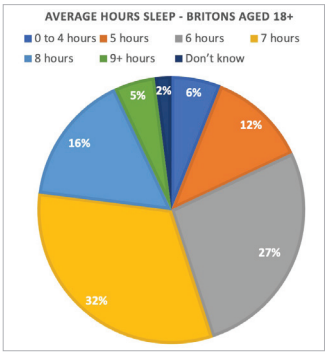
156. a) Yes because based on the figures 77% (32 + 27 + 12 + 6) of Great Britons aged 18+, get less than 8 hours sleep per day.

b) All Great Britons aged 18+.

Page 303 Q156 cont...

c) P(8 or more hours)
= 0.21 x 0.21
= 0.0441 (4.4%).

d) Pie Graph good for showing the relationship of parts to a whole.



e) 7 hours

f) Those aged 18+ are regarded as adults. If the poll included those aged less than 18 there would be wide differences in sleeping patterns because it would include baby's and children.

Page 304

157. a) Population is adults in the USA that are pet owners.

b) Category should be those owners that do not consider their pets as part of the family or those respondents who did not offer an answer.

c) P(FH, FNH) = 0.43 x 0.52
= 0.2236 (22.4%).

d) Urban area at 61%

e) Yes, agree because Married and Parent categories have the lowest percentage who consider their pets as part of the family and as a human. Possible reason is because in the Parents and Married category, adults are busy with children and work so may have less time to think of their pets as human.

Page 304 Q157 cont...

157. f) Lower income U.S. pet owners are more likely to think of their pets as part of the family and as a human member. Possibly as a result of spending more time with the pet because they spend more time at home and don't have the disposable income to do other things. *(Other answers possible).*

Page 305

158. a) Time series graph. Vertical lines between successive January's represent April, July, and October the start of the second, third and fourth quarters of the year.

b) November 2021.

c) May 2023, Had fallen 18% (-18%).

d) Agree with the comment. The time series graph is beginning to flatten off, indicating the bottom of the fall in property prices.

e) 2004. Between 121 000 and 122 000.

f) 2002 to 2007 and 2021 so seven years in total.

Page 306

159. a) If the % change in crime is a fall (negative) then the corresponding bar is drawn in red. If the % change in crime is an increase (positive) then the corresponding bar is drawn in green.

b) 0.74 to 1.55
Percentage increase
= (1.55 – 0.74)/0.74 x 100%
= 109.5% (110%).

c) Percentage increase appears so large because in 2017 the crime rates dropped by such a large amount, -31%.

d) Long term trend in crime rates in NZ, from 1990 to 2017 was a decreasing one. Large spike in crime after 2017 which continued up until 2019.

Page 306 Q159 cont...

159. e) Drops occurred during Covid-19 pandemic when NZ was in lockdown. Most people at home, during lockdowns, so opportunity for burglary was reduced.

f) Most January's sees a spike in the graph, i.e in thefts in NZ. Likely because a large numbers of people are on holiday and greater opportunity for burglars.

g) Long term trend in thefts from July 2017 to July 2019 was relatively constant, followed by an increase and then a steep ramp when New Zealanders were in lockdown with Covid-19 (April 2020). Theft increased rapidly after lockdown until July 2021, when it dropped again when Auckland went into lockdown. Since then theft in NZ has been increasing.

ANSWERS – PROBABILITY

Page 309

1. a) $P(\text{red}) = \frac{1}{2}$

b) $P(\text{J, Q, K}) = \frac{3}{13}$

c) $P(B < 5) = \frac{3}{26}$

2. a) TT, TH, HT, HH

b) $P(1\text{ H}) = \frac{1}{2}$ (0.5)

c) $P(\geq 1\text{T}) = \frac{3}{4}$ (0.75)

3. a) $P(\text{red}) = \frac{1}{3}$ (0.33)

b) $P(\text{not black}) = \frac{5}{9}$ (0.556)

c) $P(\text{W or R}) = \frac{5}{9}$ (0.556)

4. a) $P(13) = \frac{1}{40}$ (0.025)

b) $P(\text{odd}) = \frac{1}{2}$ (0.5)

c) $P(\text{mult. 3}) = \frac{13}{40}$ (0.325)

5. a) $P(13) = \frac{1}{39}$ (0.026)

b) $P(\text{odd}) = \frac{19}{39}$ (0.487)

c) $P(\text{mult. 3}) = \frac{4}{13}\left(\frac{12}{39}\right)$ (0.307)

6. a) $P(\neq \text{A} \mid \text{A}) = \frac{16}{17}\left(\frac{48}{51}\right)$ (0.941)

b) $P(\text{A} \mid \text{A}) = \frac{1}{17}\left(\frac{3}{51}\right)$ (0.059)

c) $P(\text{4th ace}) = \frac{1}{49}$ (0.020)

7. a) $P(\text{B}) = \frac{5}{24}$ (0.208)

b) $P(\text{D or E})' = \frac{17}{24}$ (0.708)

c) $P(\text{A or C}) = \frac{1}{2}\left(\frac{12}{24}\right)$ (0.5)

Page 310

8. a) $\frac{6}{36} = \frac{1}{6}$ (0.1667)

b) $\frac{1}{36}$ (0.0278)

c) $\frac{3}{36} = \frac{1}{12}$ (0.0833)

d) $\frac{15}{36} = \frac{5}{12}$ (0.4167)

e) $\frac{1}{36}$ (0.0278)

f) $\frac{5}{6} \times \frac{5}{6} = \frac{25}{36}$ (0.6944)

9. a) $\frac{1}{10}$ (0.1)

b) $\frac{9}{10}$ (0.9)

c) $\frac{4}{10} = \frac{2}{5}$ (0.4)

10. a) $\frac{1}{8}$ (0.125)

b) $\frac{3}{8}$ (0.375)

c) $\frac{7}{8}$ (0.875)

11. a) $\frac{1}{13}$ (0.077)

b) $\frac{4}{13}$ (0.308)

c) 0

d) $\frac{1}{12}$ (0.083)

e) $\frac{3}{12}$ (0.25)

f) $\frac{4}{12} = \frac{1}{3}$ (0.333)

Page 312

12. a) $P(4 \text{ given even}) = \frac{1}{5}$ (0.2)

b) $P(1 \text{ or } 2 \text{ given} \leq 7) = \frac{2}{7}$ (0.286)

c) $P(9 \text{ given} > 5) = \frac{1}{5}$ (0.2)

d) $P(5 \text{ or } 7 \text{ given O}) = \frac{2}{5}$ (0.4)

13. a) $P(\text{Fr.}) = \frac{5}{127}\left(\frac{15}{381}\right)$ (0.039)

b) $P(\text{Japan given} \geq 40) = \frac{35}{198}$ (0.177)

c) $P(\leq 20 \text{ given Aust.}) = \frac{1}{9}\left(\frac{9}{81}\right)$ (0.111)

d) P(21-39 given not Aust) $= \frac{101}{300}$ (0.337)

Page 312 cont...

14. a) Expect 25 times.

b) Miss 18 times.

15. a) $P(\div \text{ by } 5) = 0.2$

b) Expect 8 times.

c) 90 and 95 out of 19.
$P(\div \text{ by } 5) = \frac{2}{19}$ (0.105)
Expect 4 or 5 to be divisible by 5 in 40 trials.

16. a)

	A	B	C	1	2	3
A		AB	AC	A1	A2	A3
B	BA		BC	B1	B2	B3
C	CA	CB		C1	C2	C3
1	1A	1B	1C		12	13
2	2A	2B	2C	21		23
3	3A	3B	3C	31	32	

b) P(one vowel given 2 letters)
$= \frac{2}{3}\left(\frac{4}{6}\right)$ (0.667)

c) P(add to 4 given 2 numbers)
$= \frac{1}{3}\left(\frac{2}{6}\right)$ (0.333)

d) P(number given C)
$= \frac{3}{5}\left(\frac{6}{10}\right)$ (0.6)

e) $P(\text{B given A}) = \frac{1}{5}\left(\frac{2}{10}\right)$ (0.2)

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17. a)

	1	2	3	4	5	6
1	1	2	3	4	5	6
2	2	4	6	8	10	12
3	3	6	9	12	15	18
4	4	8	12	16	20	24
5	5	10	15	20	25	30
6	6	12	18	24	30	36

b) $P(X \geq 20) = \frac{8}{36}$ (0.2222)

c) Expect = 44 or 45

d) $P(X \geq 20) = \frac{8}{24}$ (0.3333)
Expect = 66 or 67

e) $P(X \geq 20) = \frac{5}{11}$
Expect = 90 or 91

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18. a) $\frac{4}{32} = \frac{1}{8}$ (0.125)

b) $\left(\frac{4}{32}\right)^2 = \frac{1}{64}$ (0.016)

c) $\left(\frac{1}{2}\right)^3 = \frac{1}{8}$ (0.125)

d) $\frac{1}{8} \times \frac{1}{8} \times \frac{1}{8} = \frac{1}{512}$ (0.002)

19. a) $\frac{3}{10}$ (0.3)

b) $\left(\frac{1}{10}\right)^2 = \frac{1}{100}$ (0.01)

c) $\frac{1}{1000}$ (0.001)

d) $\frac{4}{1000}$ (0.004)

20. a) hhh, hht, hth, htt, thh, tht, tth, ttt.

b) $\frac{3}{8}$ (0.125)

c) $\frac{2}{8} = \frac{1}{4}$ (0.25)

21. a) GBBB, GBBG, GBGB, GBGG, GGBB, GGGB, GGBG, GGGG

b) $\frac{6}{16} = \frac{3}{8}$ (0.375)

22. P(4 heads) = $\frac{1}{16}$ (0.0625)

23. P(5 girls) = $\frac{1}{32}$ (0.03125)

24. P(3 hearts) = $\frac{1}{64}$ (0.0156)

25. P(3 not hearts) = $\frac{27}{64}$ (0.422)

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26. a) P(8 out of 8) = $\left(\frac{1}{2}\right)^8 = \frac{1}{256}$

b) P(4 right 1 wrong)

= P(4 right) **x** P(wrong)

= $\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)$

= $\frac{1}{32}$

c) Yes. Although the probability of a team winning may not be 0.5, the probability Paul selects any result should be 0.5, if random. Paul's results may or may not be independent depending on if he is attracted to one colour flag or another. The result of the soccer game is unlikely

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26. to be independent as the result of one game affects the next.

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27. a) P(red) = $\frac{17}{54}$ (0.315)

b) P(green) = $\frac{5}{27}$ (0.185)

c) P(≠ yellow) = $\frac{17}{18}$ (0.944)

d) There may be one (or more) white balls in the box that have never been selected.

e) Yes. The same ball could have been selected 3 times as they are replaced.

28. a) 0.35

b) 0.04

c) $(0.4)^4 = 0.0256$

d) $(0.6)^4 = 0.1296$

e) 0.4 x 0.6 + 0.6 x 0.4 = 0.48

29. a) 0.36

b) $0.95^{20} = 0.358$ (3 dp)

c) 0.96

d) $1 - 0.96^{20} = 0.558$ (3 dp)

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30. a) P(Pakeha) = $\frac{5190}{34\,413}$ (0.151)

b) P(Asian) = $\frac{96}{981}$ (0.979)

c) P(Not pakeha) = $\frac{2742}{11\,046}$ (0.248)

d) P(smoke given Mäori) = $\frac{1476}{4275}$ (0.345)

31. a) 0.6050

b) 0.2390

c) 0.4780

d) 1 – 0.4780 = 0.5220

32. a) 0.767 (3 dp)

b) 0.044 (3 dp)

33. a) 40 students

b) P(b and 1) = $\frac{1}{20}\left(\frac{2}{40}\right)$ (0.05)

c) P(g and 30)′ = $\frac{7}{8}\left(\frac{35}{40}\right)$ (0.875)

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34. a) P(walking) = $\frac{164}{304}$ (0.539)

b) P(vehicle) = $\frac{105}{304}$ (0.345)

c) P(late) = $\frac{19}{304}$ (0.0625)

d) P(late) = $\frac{3}{40}\left(\frac{45}{600}\right)$ (0.075)

e) P(vehicle) = $\frac{191}{600}$ (0.318)

f) P(Y10) = $\frac{296}{600}$ (0.493)

g) P(walked given late)

= $\frac{28}{45}$ (0.622)

h) P(Y10 given late)

= $\frac{26}{45}$ (0.578)

i) P(not bus given late) = 1

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35. a) P(1) = 0

b) P(prime) = $\frac{9}{25}$ (0.36)

c) P(> 4) = $\frac{14}{25}$ (0.56)

d) Conduct a large number of repeated experiments.

36. a) P(girl) = $\frac{23}{45}\left(\frac{115}{225}\right)$ (0.511)

b) P(netball) = $\frac{8}{45}\left(\frac{40}{225}\right)$(0.178)

c) P(not rugby) = $\frac{167}{225}$ (0.742)

d) P(rugby given male) = $\frac{21}{55}\left(\frac{42}{110}\right)$(0.382)

e) P(male given netball) = $\frac{1}{10}\left(\frac{4}{40}\right)$ (0.1)

f) P(girl given football) = $\frac{11}{28}$ (0.393)

37. a) P(cartoons) = $\frac{37}{186}$ (0.199)

b) P(female given films) = $\frac{27}{35}$ (0.771)

Page 319 Q37 cont...

37. c) In the afternoon programmes the least favourite is drama in this sample but this will not be true of all TV as drama watchers may watch at a different time.

d) Cartoons are not the most popular for males (sport) or females (films) but it is in total so true for this sample.

e) P(male likes sport) = 0.282 so more like sport in the afternoon than other types but most males (71.8%) do not prefer sport.

f) Biggest category is none or no answer but that does not mean they do not have an answer. Nor are they a majority as the None plus no answer represent 34.4% of answers.

g) Reason 1
Uneven number of male (85) and female (101) results.
Reason 2
High support for cartoons which are normally watched by children.

38. a) P(2 spoilt)

$= \left(\frac{1}{4}\right)^2 = \frac{1}{16}$ (0.0625)

b) P(2 fine)

$= \left(\frac{3}{4}\right)^2 = \frac{9}{16}$ (0.5625)

c) Just because 25% of the cartons have spoilt fruit does not mean that 25% of the kiwifruit are spoiled. It only takes one kiwifruit to spoil the carton but most of the fruit in that carton is fine.

d) As 75% of the cartons in the sample are fine it is likely that 75% of the shipment of 2460 = 1845 are fine. Therefore the figure seems reasonable.

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39. a) P(not late)

$= \frac{7}{15}\left(\frac{14}{30}\right)$(0.467)

b) P(2 called from class)

$= \left(\frac{10}{50}\right)^2 = \frac{1}{25}$ (0.04)

c) P(morning inter.) = 0.6 but the school may have more classes in the morning. If the school has 3 lessons in the morning and 2 in the afternoon then the rate of interruptions is the same so it depends.

d) The probability a school notice is sent in the afternoon is 0.667 and in the morning it is 0.333 so this conclusion seems valid.

40. a) P(smoked) = $\frac{9276}{25\,764}$ (0.360)

b) If a student smokes one cigarette they are classed as having smoked. A student who smokes 10 a day is likely to be different from a student who smokes one cigarette in three years.

c) P(daily 1999) = 0.156

P(daily 2009) = 0.056.

The 1999 figure is 2.8 times as high.

d) Example only as other definitions are possible. Change to at least weekly

P(regular 1999) = 0.223

P(regular 2004) = 0.138

P(regular 2009) = 0.083

e) P(expt. 1999) = 0.255

P(expt. 2004) = 0.277

P(expt. 2009) = 0.199

A drop of 22%. All other categories have dropped to about 1/3 of 1999 levels.

f) Because some people who used to smoke and no longer do are counted as experimented. You can stop being a regular smoker, you can't stop being an experimenter.

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41. a) P(dissat.) = $\frac{60}{290}$ = 0.207 (3 dp)

b) P(civil) = $\frac{155}{290}$ = 0.534 (3 dp)

c) P(civil and dissatisfied)

$= \frac{30}{290}$ = 0.103 (3 dp)

d) P(satisfied given elect.)

$= \frac{57}{75}$ = 0.76

e) P(satis. given chem or elect.)

$= \frac{105}{135}$ = 0.778 (3 dp)

42. a) P(low cal.) = $\frac{28}{75}$ = 0.373 (3 dp)

b) P(medium fibre)

$= \frac{34}{75}$ = 0.453 (3 dp)

c) P(low fibre and calories)

$= \frac{15}{75}$ = 0.2

d) P(medium or high fibre)

$= \frac{52}{75}$ = 0.693 (3 dp)

e) P(high cal. given low in fibre)

$= \frac{8}{23}$ = 0.348 (3 dp)

f) P(low cal. given high in fibre)

$= \frac{3}{18}$ = 0.167 (3 dp)

43. a) P(under 25 one or more)

$= \frac{81}{256}$ = 0.316 (3 dp)

b) P(3+ claims and 25 or over)

$= \frac{21}{38}$ = 0.553 (3 dp)

c) P(1-2 claims and under 25)

$= \frac{64}{176}$ = 0.364 (3 dp)

44. a) P(non-smoker)

$= \frac{40}{100}$ = 0.4

b) P(cancer or heart disease)

$= \frac{52}{100}$ = 0.52

c) P(can. or hrt. given smokes)

$= \frac{43}{60}$ = 0.717 (3 dp)

d) P(can. or hrt. given heavy)

$= \frac{28}{35}$ = 0.80

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e) P(heavy died can. or hrt.)

$= \frac{28}{100} = 0.28$

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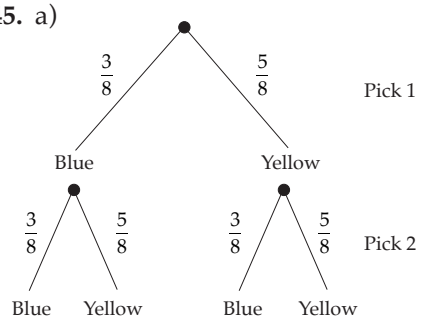
45. a)



b) Blue Blue, Blue Yellow, Yellow Blue, Yellow Yellow.

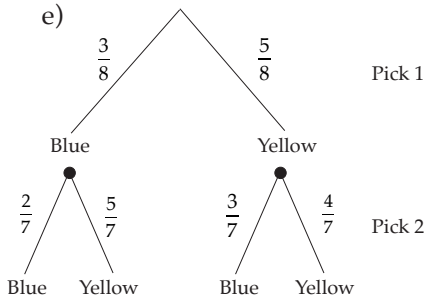
c) P(blue blue)

$= \frac{3}{8} \times \frac{3}{8} = \frac{9}{64}$

d) P(yellow blue, blue yellow)

$= \left(\frac{3}{8} \times \frac{5}{8}\right) + \left(\frac{5}{8} \times \frac{3}{8}\right) = \frac{30}{64}\left(\frac{15}{32}\right)$

e)

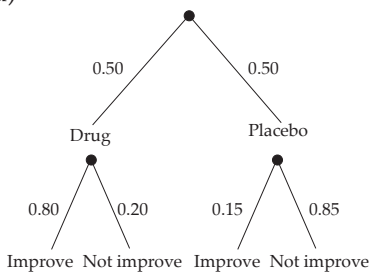


f) P(blue blue)

$= \frac{3}{8} \times \frac{2}{7} = \frac{6}{56}\left(\frac{3}{28}\right)$

Probability is more in Part c) above because there are 8 balls each time a draw is made whereas there is only 7 balls in the second draw in Part f).

46. a)



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b) P(receives drug and improves) = 0.50 x 0.80 = 0.40

c) (0.40 + 0.075) x 150

= 71 or 72 people

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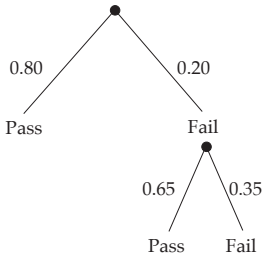
47. a)



b) P(FP) = 0.20 x 0.65 = 0.13

c) P(Pass) = 0.80 + 0.13 = 0.93

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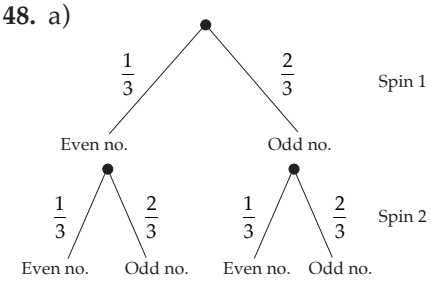
48. a)

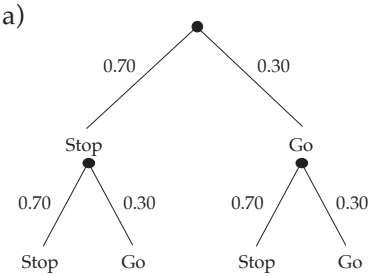


b) P(EO) = $\frac{2}{9}$

c) P(OO) = $\frac{4}{9}$

d) P(EE) = $\frac{1}{9}$

49. a)



b) P(SS) = 0.70 x 0.70 = 0.49

c) P(SG, GS) = (0.70 x 0.30) + (0.30 x 0.70) = 0.42

d) 0.30 x 0.30 x 225

= 20 or 21 times

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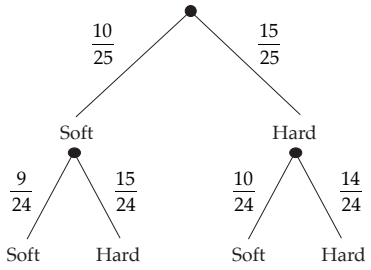
50. a)



b) $\frac{15}{25} \times \frac{14}{24} = \frac{7}{20}$

c) $\frac{15}{25} \times \frac{10}{24} = \frac{1}{4}$

d) $\frac{15}{25} \times \frac{14}{24} \times \frac{13}{23} = \frac{91}{460}$ (0.198)

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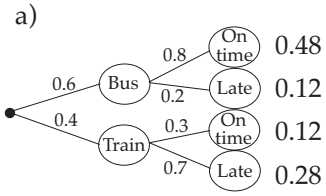
51. a)



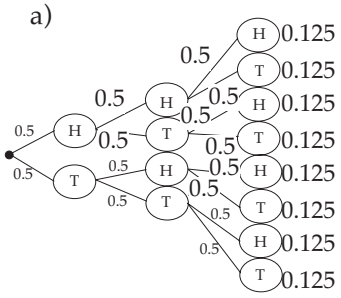
b) P(bus and late) = 0.12

c) P(train on time) = 0.12

d) P(on time bus or train)

= 0.6

52. a)



b) P(3H) = 0.125

c) P(2H1T) = 0.375

d) P(1H+) = 0.875

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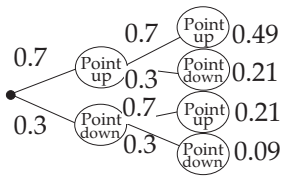
53. a)



b) P(one pt. down) = 0.3

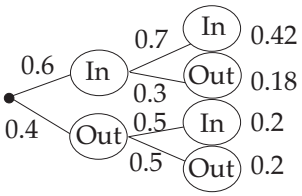
c) P(two pt. up) = 0.49

d) P(two pt. down) = 0.09

e) P(1 pt. up 1 pt dn.) = 0.42

f) 5 drawing pins

54. a)



b) P(Both in) = 0.42

c) P(Both miss) = 0.2

d) P(1+ in) = 0.8

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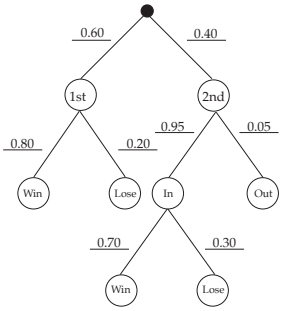
55. a)



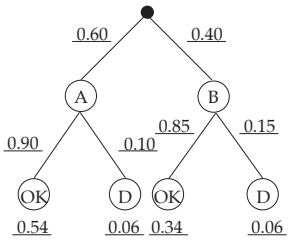
b) P(double faults) = 0.02

c) P(loses on first serve) = 0.12

d) P(wins point) = 0.746

e) P(given wins on 2nd serve) = 0.357 (3 dp).

56. a)



b) P(B and defective) = 0.06

c) P(defective) = 0.12

d) P(given defective prod. A) = 0.5

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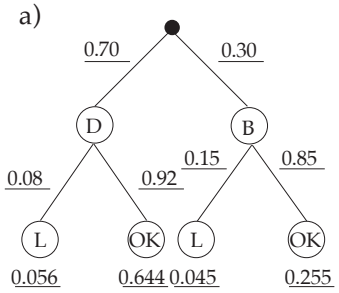
57. a)



b) P(bike and gets flat) = 0.045

c) P(late) = 0.101

d) P(car breaks down given late) = 0.056 ÷ 0.101 = 0.554

e) P(late two successive days) = 0.101^2 = 0.010 (3 dp)

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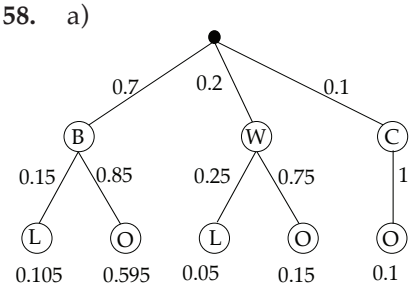
58. a)

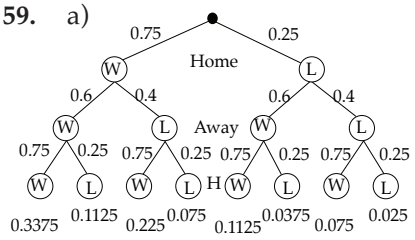


b) P(late) = 0.105 + 0.05 = 0.155

c) P(bike given late) = $\frac{0.105}{0.155}$ = 0.677

d) Days = 27.9 (27 or 28)

59. a)



b) P(win 3) = 0.3375

c) P(win 2) = 0.1125 + 0.225 + 0.1125 = 0.45

d) P(Home given 2 games) = $\frac{0.225}{0.45}$ = 0.5

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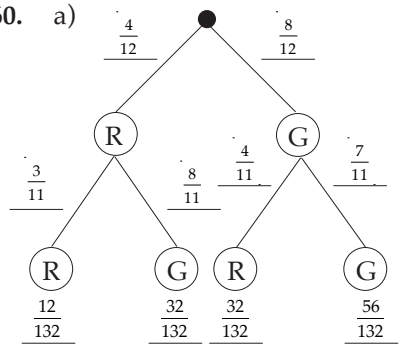
60. a)

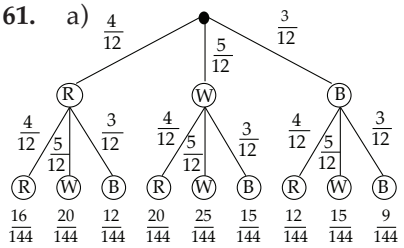


b) P(both green) = $\frac{56}{132}$ = 0.424 (3 dp)

c) P(RG or GR) = $\frac{64}{132}$ = 0.485 (3 dp)

d) P(sec. red given first red) = $\frac{3}{11}$ = 0.273 (3 dp)

61. a)



b) P(R and B) = $\frac{24}{144}\left(\frac{1}{6}\right)$ = 0.167

c) P(2 same) = $\frac{16}{144}+\frac{25}{144}+\frac{9}{144}$ = $\frac{25}{72}$ = 0.347 (3 dp)

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62. a) $P(CD) = \frac{65}{100} = 0.65$

b) $P(W \text{ and } CD) = \frac{35}{100} = 0.35$

c) $P(M,NCD) = \frac{25}{55} = 0.45$ (2 dp)

d) $P(NCD,F) = \frac{10}{35} = 0.29$ (2 dp)

e) $P(MC) = \frac{30}{55} = 0.54$ (2 dp)

$P(FC) = \frac{35}{45} = 0.78$ (2 dp)

From the survey it would suggest that more females are regular coffee drinkers than males (78% compared to 54%).

63. a) $P(G) = \frac{93}{120} = 0.78$ (2 dp)

b) $P(>40,NG) = \frac{13}{120} = 0.11$ (2 dp)

c) $P(NG, \leq 40) = \frac{14}{27} = 0.52$ (2 dp)

d) $P(\leq 40, NG) = \frac{14}{55} = 0.25$ (2 dp)

e) $P(G>40) = \frac{52}{65} = 0.8$

$P(G \leq 40) = \frac{41}{55} = 0.75$ (2 dp)

From the survey it would appear that you are more likely to wear glasses for reading if you are older than 40 years of age, although the difference is small. Further investigation (surveying) is perhaps indicated.

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64. a) $P(P) = \frac{1}{2} = 0.50$

b) $P(I) = \frac{70}{150} = 0.47$ (2 dp)

c) $P(M \text{ NI}) = \frac{17}{75} = 0.23$ (2 dp)

d) $P(MI) = \frac{58}{75} = 0.77$ (2 dp)

$P(PI) = \frac{12}{75} = 0.16$

Significant improvement if you are on the medication 77% compared to 16%.

e) Not quite because 5 x 0.16 = 0.80, but in reality test shows only 0.77, but accurate to one significant figure.

Page 330 cont...

65. a) Smokers $= \frac{150}{250} = 60\%$

b) $P(NS,L) = \frac{60}{250} = 0.24$

c) $P(NS\ L) = \frac{60}{100} = 0.60$

d) $P(SL) = \frac{90}{150} = 0.60$

$P(NS\ L) = \frac{60}{100} = 0.60$

No the prevalence of lung disease is the same for non smokers and smokers in this group as both probabilities are the same.

e) No it isn't. You would expect smokers to have a higher rate of lung disease than non smokers. Could be a biased sample and further investigation may be necessary. Possibly the rate of lung disease could be caused by another factor, e.g. enviromental, i.e. pollution.

66. a) $P(HD) = \frac{223}{1500} = 0.15$ (2 dp)

b) $P(O,D) = \frac{529}{996} = 0.53$ (2 dp)

c) $P(RH) = \frac{281}{748} = 0.38$ (2 dp)

d) $P(HD) = \frac{223}{504} = 0.44$ (2 dp)

$P(OD) = \frac{529}{996} = 0.53$ (2 dp)

If we compare the two $0.53 > 0.44$ if you have a BMI in the obese range.

e) Increased risk of dying
$= (0.53 - 0.44)/0.44 \times 100\%$
$= 20.0\%$ (1 dp)

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67. a) P(dying)
$= \frac{215}{605} = 0.355$ (3 dp)

b) P(< 50 dies)
$= \frac{180}{320} = 0.563$ (3 dp)

c) P(≥ 50 dies)
$= \frac{35}{285}$ 0.123 (3 dp)

d) $RR = \frac{\frac{180}{320}}{\frac{35}{285}} = 4.6$

e) A person under 50 who contracts the disease is 4.6 times more likely to die within one year of diagnosis, than a person 50 years or older.

68. a) P(sex content)
$= \frac{150}{350} = 0.429$ (3 dp)

b) P(comedy contain sex)
$= \frac{70}{180} = 0.389$ (3 dp)

c) P(drama contain sex)
$= \frac{80}{170} = 0.471$ (3 dp)

d) $RR = \frac{\frac{70}{180}}{\frac{80}{170}} = 0.83$

e) A comedy show is 0.83 times less likely than a drama show to contain sexual content or conversely a drama show is 1.2 times more likely to contain sexual content than a comedy show.

69. a) Cycling

b) They have a fatality rate less than cycling.

c) 3.3 times

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70. a) Absolute risk = 0.36

b) RR = 6.6

c) RR = 0.15

d) RR = 4.1

e) RR = 0.24

f) An obese person is 6.6 times more likely to have diabetes than a person who is not obese. There appears to be causal link between obesity and diabetes.

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71. RR = 9

72. a) i) $\frac{306}{435}$ (0.70)

ii) 7034 per 10 000

b) $\frac{180}{225}$ (0.8)

c) $\frac{126}{210}$ (0.6)

d) $\frac{0.6}{0.8}$ (0.75)

e) The risk of having an asthma attack for those taking the trialled drug is 0.75 times the risk of those taking the placebo.

f) $\frac{0.8}{0.6}$ (1.33 (3 sf))

g) The risk of having an asthma attack for those on the placebo is 1.3 times the risk of those taking the trialled drug.

h) Placebo. It is better to compare the risk of the drug group (treatment) with the placebo group (non-treatment).

i) $\frac{0.6-0.8}{0.8} \times 100\% = -25\%$

j) There is a 25% decrease in the chance of a patient having an asthma attack if they are taking the trialled drug compared to the placebo.

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73. a)

	Passed	Failed	Total
CAI	120	25	145
Tutoring	138	12	150
Total	258	37	295

b) Absolute risk = 0.125

c) RR = 0.9

d) RR = 1.1

e) That you are 1.1 times more likely to pass the course by tutoring than CAI. Assuming the figures calculated are unbiased, i.e. more brighter students may decide to study the course by tutoring.

74. a)

	City 1 Nuclear	City 2 No nuclear	Total
Deformities	50	15	65
Non Deformities	99 950	119 985	219 935
Total	100 000	120 000	220 000

b) Absolute risk = 0.0003

c) RR = 4

d) RR = 0.25

e) That the relative risk in Russia of birth deformities is four times greater if you are situated in a town near a nuclear facility.

75. a)

	Acc.	No acc.	Total
Factory 1	24	96	120
Factory 2	30	120	150
Total	54	216	270

b) Absolute risk = 0.2

c) RR = 1. No difference between the two factories.

d) RR = 1.5, i.e. 1.5 times more likely to have an accident in factory two than factory one.