

## Answers

## Page 4

1.  $4x^2 + 20x$
2.  $8x^2 - 12x$
3.  $2x^3 + 3x^2$
4.  $30a^2 - 18a$
5.  $6k^3 + 4k^2 + 2k$
6.  $12x^4 + 24x^3 - 28x^2$
7.  $x^2 + 8x + 15$
8.  $3x^2 + 2x - 1$
9.  $6a^2 + 5a + 1$
10.  $-30x^2 + 25x + 30$
11.  $15x^2 - 6x - 12$
12.  $12x^2 - 9x + 3$
13.  $x^2 - 2x - 12$
14.  $16x^2 - 4x + 10$
15.  $21x^2 - 14x$
16.  $x^3 - 21x^2 + 147x - 343$
17.  $12x^3 + 24x^2 - 3x - 6$
18.  $3x^3 + x^2 - 8x + 4$
19.  $a^3 + a^2 - 14a - 24$
20.  $6x^3 + 13x^2 - 40x - 75$
21.  $x^3 + x^2 - 8x - 12$
22.  $6y^3 - 19y^2 + y + 6$
23.  $x^3 - 11x^2 + 31x - 29$
24.  $64x^3 + 48x^2 + 12x + 1$
25.  $3k^3 - 16k^2 + 32k - 17$
26.  $-8y^3 + 12y^2 - 9y - 11$
27.  $-12x^2 - 16$

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28.  $8q^3 - 12q^2 + 6q - 1$
29.  $-11m^2 + 5m$
30.  $6p^3 - 7p^2 - 6p + 3$
31.  $12x^2 - 28x + 8$
32.  $m^3 - 7m - 6$
33.  $24k^3 - 58k^2 + 23k + 15$
34. a)  $2x + 40$   
b)  $\pi x^2 + 40\pi x + 400\pi$   
c)  $40\pi x + 400\pi$   
d)  $x = 5.92$   
Diameter of stage is  
11.8 m (1 dp).

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35.  $3x(7 - 2x)$
36.  $5x(1 - 3x)$
37.  $x^3yz(z + y + x)$
38.  $3b(4a^2 + a - 3b)$
39.  $2\pi r(r + h)$
40.  $7km(4k - 7m)$
41.  $4k^2(1 - 3k)$
42.  $12xy(3x - 2y)$
43.  $(k - 3)(4 + y)$
44.  $(x + 2)(x + 7)$
45.  $(x - 7)(x - 1)$
46.  $(x - a)(4 - 2y)$   
 $= 2(x - a)(2 - y)$
47.  $(x + 2)(12x + a)$
48.  $(e + 1)(3ac - 6b)$   
 $= 3(e + 1)(ac - 2b)$
49.  $(4x - 1)(2x + 3z)$

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50.  $(x + 6)(x + 1)$
51.  $(x + 3)(x + 4)$
52.  $x(x + 9)$
53.  $(x - 8)(x + 3)$
54.  $(a + 6)(a - 4)$
55.  $(z + 5)(z - 5)$
56.  $(x + 5)(x + 1)$
57.  $(x + 8)(x - 3)$
58.  $(x - 4)(x - 8)$
59.  $(h + 6)(h + 6) = (h + 6)^2$
60.  $(p + 1)(p - 1)$
61.  $(x + 9)(x - 9)$
62.  $(m - 1)(m - 6)$
63.  $(x - 9)(x + 5)$
64.  $(x + 26)(x - 2)$

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65.  $(m + 7)(m - 2)$
66.  $(k - 9)(k - 6)$
67.  $(r + 7)(r - 4)$
68.  $(a - 9)(a + 2)$
69.  $(p - 6)^2$
70.  $(n + 1)(n + 12)$
71.  $(s - 17)(s + 4)$
72.  $(x + 14)(x - 8)$
73.  $(k + 12)(k - 9)$
74.  $(x + 10)(x - 10)$
75.  $(4k - 7)(4k + 7)$
76.  $(y - 8x)(y + 8x)$

## Page 9 cont...

77.  $(5 - 6a)(5 + 6a)$
78.  $(1 - pq)(1 + pq)$
79.  $(b - \frac{1}{b})(b + \frac{1}{b})$
80.  $(x - 10)^2$
81.  $(x + 8)^2$
82.  $(x + 11)^2$
83.  $(x + 13)^2$
84.  $(x - 7)^2$
85.  $(x - 15)^2$

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86.  $2(x - 4)(x + 1)$
87.  $3(x - 3)(x - 1)$
88.  $3(x + 10)(x - 1)$
89.  $(4b + 5)(b + 2)$
90.  $(x - 3)(3x + 2)$
91.  $(2n - 5)(3n - 4)$
92.  $3(x - 8)(x + 5)$
93.  $4(x + 7)(x - 2)$
94.  $2(n + 1)(n + 12)$

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95.  $3(p + 7)(p - 7)$
96.  $5(q - 7)(q - 3)$
97.  $0.5(n - 8)(n + 6)$
98.  $(3x + 1)(x + 1)$
99.  $(4x + 1)(x - 1)$
100.  $(5x + 1)(x - 2)$
101.  $(7x + 3)(x + 2)$
102.  $(3x - 1)(3x + 4)$
103.  $(2x + 3)(3x - 2)$
104. a) Length =  $60 - 2w$   
Width =  $40 - w$   
b)  $2w^2 - 140w + 2400 = 1408$   
 $w^2 - 70w + 496 = 0$   
c)  $w = 8$  m (reject 62)  
Length 44 m, Width 32 m

## Page 14

105.  $\frac{1}{81}$
106. 2
107.  $\frac{1}{125}$

## Page 14 cont...

108.  $\frac{-1}{4}$   
 109. 8  
 110. -8  
 111.  $27x^9$   
 112.  $\frac{2}{x^3}$   
 113.  $x^2$   
 114. y  
 115.  $\frac{1}{m^2}$   
 116.  $\frac{k^2}{q^3}$   
 117.  $9a^4b^6$   
 118.  $\frac{64}{25k^2}$   
 119.  $\frac{q^{3/2}}{p^2}$   
 120.  $\frac{9p^4}{4m^2n^2}$   
 121.  $\frac{1}{2g^2}$   
 122.  $\frac{y^9}{x^6}$   
 123.  $\frac{16p^{13}}{q^{11}}$   
 124.  $x^8$   
 125.  $\frac{1}{x^{4b}}$   
 126.  $\frac{3b}{a}$   
 127.  $\frac{x^{4a}}{y^a}$   
 128.  $\frac{1}{q^{2x}}$   
 129.  $\frac{2n^{1/4}}{m^{1/2}}$   
 130.  $2x^4$   
 131.  $\frac{p^{5/4}}{q^{1/2}}$

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132.  $4x^3$   
 133.  $x^3$   
 134.  $\frac{1}{4x}$   
 135.  $\frac{x^2}{9}$   
 136.  $\frac{1}{p^{10}}$   
 137.  $\frac{1}{x^4}$

## Page 15 cont...

138.  $\frac{6n}{m^2}$   
 139.  $4x^{9/2}$   
 140.  $x^{2/3}$   
 141. a)  $A = \frac{10p^5}{9}$   
 b)  $V = \frac{80p^4}{27}$   
 c)  $p = 1.5$  cm  
 d) Width = 4.13 cm  
 Depth = 2.04 cm  
 Height of bottle 5.33 cm

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142.  $u = v - at$   
 143.  $I = \frac{V}{R}$   
 144.  $c = y - mx$   
 145.  $x = \frac{y - c}{m}$   
 146.  $r = \sqrt{\frac{A}{2\pi}}$   
 147.  $r = \sqrt[3]{\frac{3V}{4\pi}}$   
 148.  $a = \frac{2s - 2ut}{t^2}$   
 149.  $R = \sqrt{\frac{A + \pi r^2}{\pi}}$   
 150.  $h = \frac{2A}{a + b}$   
 151.  $b = \frac{2A}{h} - a$   
 152.  $M = \frac{4P - 4t}{3}$   
 153.  $R = \frac{100I}{PT}$

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154.  $b = \pm\sqrt{a^2 - c^2}$   
 155.  $T = \frac{100I}{PR}$   
 156.  $h = \frac{E}{mg}$   
 157.  $F = \frac{9C}{5} + 32$   
 158.  $x = k\left(\frac{a}{b} + c\right)$   
 159.  $y = \frac{20 - 10x}{3}$

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160.  $a = \frac{2b + bv}{3v - 1}$   
 161.  $a = \frac{5d + 12 - bs}{s}$   
 162.  $x = \frac{cy + a}{y - 5}$   
 163.  $b = \frac{ar}{a - r}$

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164.  $r = \sqrt{\frac{A}{\pi}}$  no  $\pm$  as r is +ve  
 165.  $r = \sqrt[3]{\frac{3V}{\pi}}$   
 166.  $x = \left(\frac{c - a}{b}\right)^2$   
 167.  $s = \frac{v^2 - u^2}{2a}$   
 168.  $r = \sqrt{\frac{3S}{4\pi}}$  no  $\pm$  as r is +ve  
 169.  $x = \frac{(y - 4a)^2}{25}$   
 170.  $y = \frac{x}{k^2}$   
 171.  $b = \frac{12}{15a - 2x^2}$   
 172. Half sphere =  $\frac{2}{3}\pi r^3$   
 Total Vol. =  $\frac{2}{3}\pi r^3 + \pi r^2 h$   
 Make h the subject  
 $\pi r^2 h = V - \frac{2}{3}\pi r^3$   
 $h = \frac{V - \frac{2}{3}\pi r^3}{\pi r^2}$   
 $h = \frac{V}{\pi r^2} - \frac{2}{3}r$

## Page 23

173.  $25 = 5^A$   
 $A = 2$   
 174.  $512 = 8^B$   
 $B = 3$   
 175.  $64 = 2^C$   
 $C = 6$   
 176.  $0.5 = 2^D$   
 $D = -1$   
 177.  $G = 3^3$   
 $G = 27$

## Page 23 cont...

178.  $H = 10^3$   
 $H = 1000$
179.  $M^5 = 32$   
 $M = 2$
180.  $N^1 = 10$   
 $N = 10$
181.  $P^0 = 1$   
 $P = \text{any real number except } 0$
182.  $Q^5 = 243$   
 $Q = 3$
183.  $4y + 4 = 32$   
 $y = 7$
184.  $2x - 1 = 9$   
 $x = 5$
185.  $\frac{1}{x} = 2$   
 $x = \frac{1}{2}$
186.  $x^2 = 64$   
 $x = 8, -8$
187.  $4x - 4 = x^2$   
 $(x - 2)^2 = 0$   
 $x = 2$
188.  $7z - 10 = z^2$   
 $z = 2, 5$

## Page 25

189.  $\log 20$
190.  $\log 5$
191.  $\log 625$
192.  $\log 3$
193.  $\log 1 (= 0)$
194.  $\log \frac{a^2}{b^2}$
195.  $2\log a + \log b + \log c$
196.  $\log a - \log b - \log c$
197.  $2\log a - \log b$
198.  $\frac{1}{2}(\log a + \log b + \log c)$
199.  $\log(4x - 3) - \log x^2 = \log 1$   
 $\log\left(\frac{4x-3}{x^2}\right) = 0$   
 $\left(\frac{4x-3}{x^2}\right) = 1$   
 $x^2 - 4x + 3 = 0$   
 $x = 3 \text{ and } 1$

## Page 25 cont...

200.  $\log(x^2 + x + 3) = \log(9x - 9)$   
 $x^2 + x + 3 = 9x - 9$   
 $x^2 - 8x + 12 = 0$   
 $(x - 2)(x - 6) = 0$   
 $x = 2 \text{ and } 6$
201.  $(5x - 6) = x^2$   
 $x^2 - 5x + 6 = 0$   
 $(x - 2)(x - 3) = 0$   
 $x = 2 \text{ and } 3$
202.  $(7z - 12) = z^2$   
 $z^2 - 7z + 12 = 0$   
 $(z - 3)(z - 4) = 0$   
 $z = 3 \text{ and } 4$

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203.  $\log(x + 1)^2 = \log 4$   
 $\log\left(\frac{x^2 + 2x + 1}{4}\right) = 0$   
 $\left(\frac{x^2 + 2x + 1}{4}\right) = 1$   
 $x^2 + 2x - 3 = 0$   
 $x = -3 \text{ and } 1$   
But  $x = -3$  leaves  $\log(x + 1)$  undefined so  
 $x = 1$
204.  $\log(x^2 + 3x) = \log 10$   
 $\log\left(\frac{x^2 + 3x}{10}\right) = 0$   
 $\left(\frac{x^2 + 3x}{10}\right) = 1$   
 $x^2 + 3x - 10 = 0$   
 $x = -5 \text{ and } 2$   
But  $x = -5$  leaves  $\log x$  undefined so  
 $x = 2$
205.  $\log_x(2x + 8) = 2$   
 $2x + 8 = x^2$   
 $x^2 - 2x - 8 = 0$   
 $x = -2 \text{ and } 4$   
But log base cannot be negative so  
 $x = 4$
206.  $3k + 13 = (k + 1)^2$   
 $k^2 - k - 12 = 0$   
 $k = -3 \text{ and } 4$   
But log base cannot be negative so  
 $k = 4$

## Page 27

207.  $x = 7$
208.  $x = 3.457$  (3 dp)

## Page 27 cont...

209.  $x = -0.810$  (3 dp)
210.  $x = 4.637$  (3 dp)
211.  $x = 20.219$  (3 dp)
212.  $x = 2.278$  (3 dp)
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213. a) \$13 956 (0 dp)  
b)  $3000 = 28000(0.87^n)$   
 $n = \frac{\log 0.10714}{\log 0.87}$   
 $n = 16$  years (0 dp)
214. a) \$3 200 000 (3 sf)  
b)  $2\,000\,000 = 825\,000(1.145^n)$

- $n = \frac{\log 2.4242}{\log 1.145}$   
 $n = 6.54$   
 $n = 7$  years (0 dp)
215.  $1\,000\,000 = 125\,000(1.045^n)$   
 $n = \frac{\log 8}{\log 1.045}$   
 $n = 47.24$   
Year would be 2048.
216. In thousands  
 $1200(1.084^n) = 825(1.145^n)$   
 $n = \frac{\log 1.4545}{\log 1.145 - \log 1.084}$   
 $n = 6.8435$   
Year would be 2023.

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217.  $\frac{U}{2} = U\left(1 - \frac{r}{100}\right)^T$   
 $\frac{1}{2} = \left(1 - \frac{r}{100}\right)^T$   
 $\log 0.5 = T \log\left(1 - \frac{r}{100}\right)$   
 $T = \frac{\log 0.5}{\log\left(1 - \frac{r}{100}\right)}$   
 $T = 17$  years (0 dp),  $r = 4\%$
218.  $\log U_1(1 + r_1/100)^t = \log U_2(1 + r_2/100)^t$   
 $\log U_1 + t \log(1 + r_1/100) = \log U_2 + t \log(1 + r_2/100)$   
 $t = \frac{\log U_2 - \log U_1}{\log(1 + \frac{r_1}{100}) - \log(1 + \frac{r_2}{100})}$   
 $t = \frac{\log\left(\frac{U_2}{U_1}\right)}{\log\left(\frac{100 + r_1}{100 + r_2}\right)}$

## Page 30

219.  $3b^2$

220.  $\frac{5}{m^2}$

221.  $\frac{5x}{4y^3z^3}$

222.  $\frac{9(x+2)}{4az}$

223.  $\frac{5n^3p}{9m^5q^3}$

224.  $\frac{(x+2)}{(x-5)^2}$

225.  $\frac{x^2+7}{y^2+7}$  no factors

226.  $\frac{(x-3)}{4}$

227.  $\frac{m}{5(n+1)}$

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228.  $\frac{(x+4)}{(x-4)}$

229.  $\frac{(x-5)}{(x-3)}$

230.  $\frac{x}{(x+3)}$

231.  $\frac{(x-3)}{(x-4)}$

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

233.  $\frac{2x+1}{x+2}$

234.  $x$

235.  $\frac{x-5}{x}$

236.  $\frac{3}{x+7}$

237.  $\frac{(6-x)}{(x+2)}$

238.  $\frac{a(a+5)}{(a+3)}$

239.  $\frac{5k+3}{k+3}$

240.  $\frac{x-2}{3x-1}$

241.  $\frac{z(z+2)}{z-3}$

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242.  $\frac{ab}{c^2}$

243.  $\frac{2x}{3}$

## Page 33 cont...

244.  $\frac{1}{c}$

245.  $\frac{x^3}{y^6}$

246.  $\frac{d^3}{e^4g^2}$

247.  $6x^6y^2$

248.  $\frac{4x^6y}{9}$

249.  $1$

250.  $\frac{x^2y^2z^2}{8}$

251.  $\frac{c^2}{b^2}$

252.  $\frac{1}{(x+3)(x+2)}$

253.  $\frac{y^5}{2x}$

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

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255.  $\frac{x(a+b)}{ab}$

256.  $\frac{4b+15a}{10ab}$

257.  $\frac{6b-5ax}{3x}$

258.  $\frac{2yz-5xz+6xy}{xyz}$

259.  $\frac{3xy-4y+5x^2}{x^2y^2}$

260.  $\frac{6bc+8ac-9ab}{12abc}$

261.  $\frac{2b+5a}{ab}$

262.  $\frac{4y-3x}{xy}$

263.  $\frac{a-5}{(a-2)(a-3)}$

264.  $\frac{24b^2-10ab-21a}{6a^2b^2}$

265.  $\frac{5x-7}{(x-3)(x+1)}$

266.  $\frac{11x-8}{30x}$

267.  $\frac{3x+7}{(x+3)(x+5)}$

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268.  $\frac{x^2-5x}{4(x-2)(x-3)}$

269.  $\frac{15x^3+64x^2+4x}{10(x+1)(x+4)}$

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270.  $x = -10$

271.  $x = 8$

272.  $x = -6$

273.  $x = 2$

274.  $q = -6$

275.  $x = -3$

276.  $x = 2$

277.  $3\frac{5}{7}$  (3.714)

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278.  $x = 5\frac{1}{3}$  (5.333)

279.  $x = -17$

280.  $q = \frac{-1}{10}$  (-0.1)

281.  $k = 4$

282. Any real number

283. No real answer

284.  $x = 4$

285.  $y = \frac{1}{11}$  (0.0909)

286.  $x = 0$

287. No real answer

288.  $x = 2\frac{2}{17}$  (2.118)

289.  $z = -2$

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290.  $x = 4$

291.  $x = -5$

292.  $x$  is any real number

293.  $x = -7$

294.  $x = -38$

295.  $x = -3$

296.  $x = 1\frac{7}{8}$  (1.875)

297.  $x = 10$

298. No real solution

299.  $x = 2\frac{1}{2}$  (2.5)

300.  $x = 2\frac{7}{9}$  (2.778)

301.  $x = \frac{1}{2}$  (0.5)

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302. a) Long side  $x$  and short side  $x - 12$   
 b) Long side  $x + 30$  and short side  $x + 18$   
 c)  $2(2x + 2(x - 12)) = 2(x + 18) + 2(x + 30)$   
 or equivalent  
 d)  $x = 36$   
 Length 36 m  
 Width 24 m
303. a) There are 20 who support the idea (19 + 1) and  $24 + x$  who were at the meeting.  
 b)  $\frac{1}{x}$   
 c)  $\frac{20}{24 + x} - \frac{1}{x} = \frac{1}{2}$   
 $38x - 48 = x(24 + x)$   
 $x = 6, 8$

d) Two answers and both possible.

$$\frac{20}{32} - \frac{1}{8} = \frac{1}{2} \text{ and}$$

$$\frac{20}{30} - \frac{1}{6} = \frac{1}{2}$$

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304. a)  $1500x + 800(2x + 3) + 4800x$   
 b)  $1.5x + 0.8(2x + 3) + 4.8x = 20$   
 $x = 2.228$   
 Order: 2 m<sup>3</sup> cement,  
 (4 + 3) = 7 m<sup>3</sup> sand and  
 6 m<sup>3</sup> crushed stone.
305. a) Energy =  $11t + 2t \times 5$   
 b) Energy =  $21t + (60 - 3t) \times 8$   
 c)  $21t + 8(60 - 3t) = 440$   
 Jogging 13 minutes,  
 walking 27 minutes and  
 Cycling 20 minutes.  
 Answers to 0 dp.
306. Time cafe =  $t$   
 $5(13.5t + 2t \times 10 + 20) = 600$   
 $t = 2.985$   
 Cafe = 3 hours (0 dp)

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307.  $x < -9$   
 308.  $x \geq -4$   
 309.  $r \leq 7\frac{1}{2}$  (7.5)  
 310.  $k < 10$   
 311.  $x < 7$   
 312.  $x < 4\frac{1}{4}$  (4.25)  
 313.  $k \geq 5$   
 314.  $m \geq -4\frac{1}{2}$  (-4.5)

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315.  $y \leq 2$   
 316.  $x < -\frac{12}{13}$  (-0.9231)  
 317.  $x \geq -11$   
 318.  $a > -20$   
 319.  $x > -5$   
 320.  $x > 4$   
 321.  $p \leq 2\frac{1}{3}$  (2.333)  
 322.  $q \leq -\frac{1}{13}$  (-0.0769)  
 323.  $y \leq -11$   
 324.  $x > -4$   
 325.  $y > 4$   
 326.  $w \leq \frac{16}{53}$  (0.3019)

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327.  $m < -3$   
 328.  $k < 0$   
 329. a)  $0.065(15000 - n) + 0.085n = 0.02n + 975$   
 b)  $0.02n + 975 \geq 1200$   
 c)  $n \geq 11\ 250$  (\$)  
 d) Term deposit \$3750  
 Unit trust int. = \$956.25  
 Term deposit int. = \$243.75

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330.  $x = -\frac{1}{2}, 5$   
 331.  $x = -5, 5$   
 332.  $x = \frac{3}{4}, -2\frac{1}{2}$   
 333.  $x = 0, 2$   
 334.  $x = 0, -9$   
 335.  $a = -5$   
 336.  $q = 11, -12$   
 337.  $a = -12, 3$   
 338.  $x = 9, -7$   
 339.  $x = -3, 11$   
 340.  $x = 1, 2$   
 341.  $x = -2, 2$   
 342.  $x = -3, 8$   
 343.  $b = -5, 3$   
 344.  $c = -7, 7$   
 345.  $x = -1, 10$   
 346.  $x = -2, 6$   
 347.  $k = -15, 9$   
 348.  $p = -11, -4$   
 349.  $q = -12, 6$

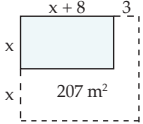
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350.  $x = -11, 2$   
 351.  $x = 3$   
 352.  $x = -\frac{1}{2}, 5$   
 353.  $x = -1, \frac{1}{6}$   
 354.  $x = -1\frac{1}{2}, \frac{1}{4}$   
 355.  $x = 3\frac{1}{2}, -1\frac{1}{2}$   
 356.  $x = -5, 5$   
 357.  $k = -1\frac{1}{2}, \frac{1}{3}$   
 358.  $x = \pm\sqrt{3}$ , ( $\pm 1.732$ ) only  
 359.  $x = \frac{1}{25}$  (0.04) only  
 360.  $x = 1\frac{1}{2}$  only as  $x = 1$  involves  $\div$  by 0.  
 361.  $b = \pm 1, \pm\sqrt{\frac{5}{4}}$  ( $\pm 1.118$ )  
 362.  $z = 3$  only  
 363.  $p = \sqrt[3]{3}, -\sqrt[3]{\frac{6}{5}}$  or  
 $p = 1.4422, -1.0627$  (4 dp)

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364. a)  $(x + 18)(x + 12) = 432$   
 b)  $x^2 + 30x - 216 = 0$   
 c)  $(x - 6)(x + 36) = 0$   
 d)  $x = 6$  m only  
 $x = -36$  is rejected
365. a)  $(20 - x)(15 - x) = 249.75$   
 $x^2 - 35x + 50.25 = 0$   
 $4x^2 - 140x + 201 = 0$   
 b)  $(2x - 3)(2x - 67) = 0$   
 $x = 1.5, 33.5$   
 Ignore 33.5  
 Length = 18.5 m  
 Width = 13.5 m

## Page 48

366. a)   
 b)  $2x(x + 11) = x(x + 8) + 207$   
 $x^2 + 14x - 207 = 0$   
 c)  $(x + 23)(x - 9) = 0$   
 $x = 9, -23$   
 Ignore -23  
 Width = 9 m  
 Length = 17 m

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367.  $n(n+2) = 7[n + n + 2] - 1$   
 $n^2 - 12n - 13 = 0$   
 $(n - 13)(n + 1) = 0$   
 $n = 13, n = -1$   
 Ignore  $n = -1$   
 Numbers 13 and 15.
368.  $(x + 3)^2 + x^2 = (2x - 3)^2$   
 $2x^2 - 18x = 0$   
 $2x(x - 9) = 0$   
 $x = 9, 0$   
 Ignore  $x = 0$   
 Answer:  
 Lengths 9 cm, 12 cm, 15 cm

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369.  $x = 4.562, 0.438$  (3 dp)  
 370.  $x = -0.228, -8.772$  (3 dp)  
 371.  $x = -1, -1.5$   
 372.  $x = 1.212, -3.712$  (3 dp)  
 373.  $x = -0.697, -4.303$  (3 dp)  
 374.  $x = 0.425, -1.175$  (3 dp)

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375.  $x = 0.309, -0.809$  (3 dp)  
 376.  $x = -0.775, -3.225$  (3 dp)  
 377.  $x = -1.5$   
 378.  $x = -0.469, -8.531$  (3 dp)  
 379.  $m = 1.644, -0.553$  (3 dp)  
 380.  $y = 2.610, -1.277$  (3 dp)  
 381.  $x = 1.844, -1.844$  (3 dp)  
 382.  $x = 4, -1.5$   
 383.  $p = -0.057, 2.182$  (3 dp)  
 384.  $x = -2.5, 2.333$  (3 dp)  
 385.  $a = 7, -0.5$   
 386.  $q = 2.443, -4.776$  (3 dp)  
 387.  $x = -2, 2$   
 388.  $x = -0.215, 1.549$  (3 dp)

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389. a)  $0.70 + 0.10x$   
 b)  $30\ 000 - 2\ 000x$   
 c)  $y = -200x^2 + 1\ 600x + 21\ 000$   
 d)  $24\ 200 = -200x^2 + 1\ 600x + 21\ 000$   
 e) Solve for  $x$  to find  
 increase = 40¢ so Price = \$1.10
390. a)  $x + 12$  and  $x + 14$   
 b)  $(x + 14)^2 = (x + 12)^2 + x^2$   
 c)  $x^2 - 4x - 52 = 0$   
 d)  $(x - 2)^2 - 56 = 0$   
 $x = -5.5, 9.5$  (2 sf)  
 Length of sides to 2 sf.  
 are 9.5, 21.5 and 23.5 m.

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391.  $\Delta = 0$  one rational root  
 392.  $\Delta = 16$  two rational roots  
 393.  $\Delta = -8$  no real roots  
 394.  $\Delta = 0$  one rational root  
 395.  $\Delta = 49$  two rational roots  
 396.  $\Delta = 37$  two irrational roots  
 397.  $\Delta = 0$  one rational root  
 398.  $\Delta = 0.96$  two irrational roots  
 399.  $\Delta = 169$  two rational roots  
 400.  $\Delta = 8$  two irrational roots  
 401.  $b^2 - 64 = 0$   
 $b = 8$  or  $-8$
402.  $36 - 32a < 0$   
 $a > 1\frac{1}{8}$  (1.125)
403.  $25 - 36p \geq 0$   
 $36p \geq -25$   
 $p \leq \frac{25}{36}$  (0.6944)
404.  $q^2 - 32 < 0$   
 $-\sqrt{32} < q < \sqrt{32}$   
 $-5.657 < q < 5.657$
405.  $4 - 24k > 0$   
 $k < \frac{1}{6}$  (0.1667)
406.  $36 - 12b < 0$   
 $b > 3$

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407.  $16 - 4p(p + 3) = 0$   
 $4p^2 + 12p - 16 = 0$   
 $4(p + 4)(p - 1) = 0$   
 $p = -4, 1$
408.  $\Delta = (2q + 1)^2 - 4q(q + 1)$   
 $\Delta = 1$  two rational roots
409.  $16k^2 - 4(2k + 3)(4) = 0$   
 $16k^2 - 32k - 48 = 0$   
 $16(k - 3)(k + 1) = 0$   
 $k = 3, -1$
410.  $(k + 1)^2 - 4(1)(-k - 1) = 0$   
 $k^2 + 6k + 5 = 0$   
 $(k + 5)(k + 1) = 0$   
 $k = -5, -1$
411.  $a, b$  and  $c$  are consecutive arithmetic terms  
 so  $b - a = Z$  and  $c - b = Z$   
 therefore  $c - a = 2Z$  and  
 $a - b$  and  $b - c = -Z$ .  
 Discriminant  
 $(2Z)^2 - 4(-Z)(-Z) = 0$  so  
 quadratic has equal roots.

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412.  $t^2 - 10t + 11 + k$   
 Discriminant  $< 0$   
 $100 - 44 - 4k < 0$   
 $k > 14$
413.  $(p + 3)^2 - 4(p)(p) \geq 0$   
 $-3p^2 + 6p + 9 \geq 0$   
 $-3(p - 3)(p + 1) \geq 0$   
 $-1 \leq p \leq 3$
414.  $p(-k) = k^2 + 3k + 5$   
 $p(3k) = 9k^2 - 9k + 5$   
 Equating  
 $k^2 + 3k + 5 = 9k^2 - 9k + 5$   
 $8k^2 - 12k = 0$   
 $4k(2k - 3) = 0$   
 Ignoring  $k = 0$  so  $k = 1.5$

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415. Discriminant must be negative for no roots and below axes so  $2q$  must be negative.  
 $0 > 4(q + 4)^2 - 4.2q.(q + 1)$   
 $0 > 4q^2 + 32q + 64 - 8q^2 - 8q$   
 $0 > -4q^2 + 24q + 64$   
 $0 < 4q^2 - 24q - 64$   
 $0 < q^2 - 6q - 16$   
 $0 < (q - 8)(q + 2)$   
 This is true if  $q > 8$  OR  $q < -2$ .  
 As  $2q$  must be negative then answer  $q < -2$ .
416. Take logs base 10 of both sides.  
 $\log(y^{(4x+1)}) = \log(100y^x)$   
 $(4x + 1)\log y = \log 100 + \log y^x$   
 $(4x + 1)\log y = \log 100 + x \log y$   
 $4x \log y - x \log y = 2 - \log y$   
 $x(4 \log y - \log y) = 2 - \log y$   
 $x = \frac{2 - \log y}{3 \log y}$   
 $x = \frac{2 - \log y}{\log y^3}$   
 and  $y > 0$ , but  $y \neq 1$ .  
 When  $y > 0$   $\log y$  exists, but if  $y = 1$ ,  $\log 1 = 0$  and we cannot divide by zero.
417. Substitute for  $y$  in the parabola  
 $y = 2x^2 - 8x + 4$   
 $4x + k = 2x^2 - 8x + 4$   
 $0 = 2x^2 - 12x + 4 - k$   
 $a = 2, b = -12, c = 4 - k$   
 $144 - 32 + 8k = 0, k = -14$   
 $0 = 2x^2 - 12x + 18$   
 $0 = 2(x - 3)^2$   
 Intersection is  $(3, -2)$ .

## Page 58

418. a)  $5000 = 50(1.095)^T$

$100 = (1.095)^T$

$T = \frac{\log 100}{\log 1.095}$

$T = 50.7 \text{ years}$

$T = 51 \text{ years round up}$

i.e. in 2031.

b)  $500(1.095)^N = 25 \times 68(1.030)^N$

$N = 20 \text{ years rounding up}$

## Page 59

419. a)  $k = 43.527(8)$

$(d + 0.5)^{1.2} = 8.7055$

$d = 5.6 \text{ km}$

b)  $48 = 120 \times 1.0151^{(13-t)}$

$t = 74.1 \text{ or } 74 \text{ weeks}$

c)  $t_1 + t_2 = 27.10$

$t_1 = 0.45c$

$t_2 = 5 + 0.015c^2$

$0.45c + 5 + 0.015c^2 = 27.10$

$0.015c^2 + 0.45c - 22.10 = 0$

$c = -56.21, 26.2$

Answer 26 characters

## Pages 60 – 65

## Practice External Assessment Task

## Question One

a)  $2x^3 - 5x^2 - 13x + 30$

A

b)  $\log\left(\frac{A^3B}{\sqrt{C}}\right)$

A

c) i)  $x = \frac{1}{3}, 1$

A

ii) Discriminant

$0 = k^2 - 4 \times 3 \times 4$

$k = \pm 4\sqrt{3} (\pm 6.928)$

E

d)  $x + 3x + (6x - 12) = 128$

Mary is 72 years

M

A part eqn. or M eqn. &amp; soln.

e) i) Factorise numerator and denominator

$(x-4)(x+1) = 3(x-4)$

$x = 4$

M

A some simplification or M complete simplification and solution.

ii) Both  $x = 2$  and  $x = -2$ 

make the original

equation undefined.

E

## Question Two

a)  $A = 42.89$

$k = 1.118$

$t = 13.7 \text{ years}$

Sept 2021 or Jan 2022

Depends upon whether t rounded or not as to the month it reaches 200.

b) i)  $x = 1.672$  (4 sf)

ii)  $x = 5, -2$

Excludes  $x = -2$ 

as all log expressions must be positive.

c)  $2n - 14 > 9n$

$-7n > 14$

$n < -2$

d)  $p(x+2)^2 + q(x+2) + r$

$= p(x^2 + 4x + 4) + qx + 2q + r$

$= px^2 + (4p+q)x + 4p + 2q + r$

Equating to  $2x^2 - 7x - 4$ 

$p = 2, q = -15, r = 18$

## Question Three

a) i)  $(18 - 2x)(15 - x) = 162.5$

$2x^2 - 48x + 107.5 = 0$

$4x^2 - 96x + 215 = 0$

A

ii)  $(2x - 43)(2x - 5)$

$x = 2.5, 21.5$

Ignore 21.5

Length = 13 m

Width = 12.5 m

M

b)  $4x = (x+1)^2$

$x^2 - 2x + 1 = 0$

$x = 1$

M

c)  $x^2 + (x-k)^2 = 8$

$2x^2 + 2kx + k^2 - 8 = 0$

Discriminant  $> 0$ 

$4k^2 - 4 \times 2(k^2 - 8) > 0$

$-4k^2 + 64 > 0$

$-4 \leq k \leq 4$

E

A correct simplified quadratic or M discriminant  $> 0$ .

d)  $T_1 = a$

$T_n = a + (n-1)d$

$S_n = n \times \left(\frac{\text{first} + \text{last}}{2}\right)$

$S_n = n \left(\frac{a + (a + (n-1)d)}{2}\right)$

$S_n = \frac{n}{2}(a + a + (n-1)d)$

$S_n = \frac{n}{2}(2a + (n-1)d)$

E

## Question Three cont...

A e) 25 litres a month at a cost of \$26 A

M

E Sufficiency

For Question 1 students require two of A for Achievement or two of M for Merit or one or two of E for Excellence.

A

For Question 2 students require two of A for Achievement or two of M for Merit or one or two of E for Excellence.

M

For Question 3 students require two of A for Achievement or two of M for Merit or one or two of E for Excellence.

A

Overall students require

Two or more Achievement questions or better for overall Achievement.

M

Two or more Merit questions plus one Achievement question or better for overall Merit.

Two or more Excellence questions plus one Achievement question or better for overall Excellence.

A

A

In the external examinations NZQA uses a different approach to marking based on understanding (u), relational thinking (r) and abstract thinking (t). They then allocate marks to these concepts and add them up to decide upon the overall grade. This approach is not as easy for students to self mark as the NuLake approach, but the results should be broadly similar.