Answers

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1. $x = 2$ and $y = -3$

2. $x = 17$ and $y = 11$

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3. $x = -2$ and $y = -3$

4. $g = -14$ and $h = 11.5$

5. $x = 2.20$ and $y = -1.52$ (2 dp)

6. $x = 1.65$ and $y = 0.55$

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7. $x = -1$ and $y = 1$

8. $x = 2.75$ and $y = 3\ .125$

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9. $x = 4.6$ and $y = 8.56$

10. $x = 2.26$ and $y = 0.687$ (3 sf)

11. $x = 163$ and $y = 435$

12. $x = 7.5$ and $y = 13.5$

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13. $x = 1.76$ and $y = 5.71$ (2 dp)

14. $x = 0.86$ and $y = 1.79$ (2 dp)

15. $(2k, 0)$

16. $(4, 2k + 4)$

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17. $x = 5$ and $y = -3$

18. $x = -0.5$ and $y = 0.25$

19. $x = 2$ and $y = -11$

20. $x = 0.2$ and $y = -0.15$

21. $x = -6$ and $y = 0$

22. $x = 0.414$ and $y = 1.977$ (3 dp)

23. $x = 0$ and $y = 5$

24. $x = -2$ and $y = -2$

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25. $x = -3$, $y = 4$ and $z = 2.5$

26. $x = 4$, $y = -3$ and $z = -2.5$

27. $x = 4$, $y = -1$ and $z = 7$

28. $x = 2$, $y = 0$ and $z = -3$

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29. $x = 3$, $y = -2$ and $z = -1$

30. $f = 11$, $g = -4$ and $h = 3.5$

31. $a = 4.2$, $b = 1.6$ and $c = 0.8$

32. $p = 8$, $q = 3$ and $r = 1$

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33. $x = 2$, $y = 1$ and $z = -3$

34. $x = \frac{1}{2}$, $y = \frac{-1}{3}$ and $z = \frac{5}{6}$

35. $x = 2$, $y = 3$ and $z = -2$

36. $x = 2$, $y = -0.5$ and $z = 6$

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37. $x = 1$, $y = 3$ and $z = -2$

38. $x = 3.5$, $y = 4$ and $z = -2$

39. $x = 1.5$, $y = -2.5$ and $z = 0$

40. $x = 1$, $y = -2$ and $z = -3$

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41. $x = 2$, $y = -5$ and $z = 4$

42. $x = 12$, $y = -8$ and $z = 20$

43. $x = 6.23$, $y = -1.81$ and $z = -2.57$ (3 sf)

44. $x = 1.06$, $y = 1.46$ and $z = 0.962$ (3 sf)

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45. Attempting to eliminate any variable gives a contradictory statement such as
$0 = 22$
So equations are inconsistent.

46. Attempting to eliminate any variable gives a contradictory statement such as
$0 = -3$
So equations are inconsistent.

47. Attempting to eliminate any variable gives a contradictory statement such as
$0 = 20$
So equations are inconsistent.

48. Attempting to eliminate any variable gives a contradictory statement such as
$0 = -3$
So equations are inconsistent.

49. Unique solution
$x = 2$, $y = 3$ and $z = 4$.

50. Contradictory statement results so equations are inconsistent.

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51. A true statement results so no unique solution.

52. A true statement results so no unique solution.

53. A true statement results so no unique solution.

54. A true statement results so no unique solution.

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55. Unique solution
$x = 4$, $y = -2$ and $z = 1$.

56. A true statement results so no unique solution.

57. $a = -7$. Results in a contradictory statement results so equations are then inconsistent.

58. $c = 8$. Results in a statement that is always true so this would mean no unique solution.

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59. Multiple answers possible including $x + y + z = 3$. The point $(2, 5, -4)$ must solve the equation and it must not solve with the point $(3, -3, 1)$ [which solves the first two but for a unique answer should not solve the generated answer].

60. $8y - 9z = 10 - 2k$

and $8y - 9z = 6$

gives $10 - 2k = 6$

$k = 2$

When $k = 2$ an answer is possible (consistent) but as this reduces the simultaneous equations to a result that is always true, the answer is not unique.

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61. $8F + 5S + 2T = 80$
$6F + 8S + 3T = 80$
$4F + 10S + 6T = 80$
$F = 7$, $S = 4$ and $T = 2$.

Change means Jerome wins.

62. $28C + 171N + 231D = 9177$
$31C + 196N + 212D = 9332$
$25C + 145N + 286D = 9735$
Connection = 120¢ / d
Night rate = 7¢ / u
Day rate = 20¢ / u

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63. $120L + 7.2S = 5000$

$0.013L + 0.0046S = 1.7$

Liver = 23.5 g (3 sf)

Spinach = 303 g (3 sf)

64. $11A + 16.5B + 4C = 403.65$

$6A + 21B + 7C = 416.25$

$4A + 27B + 12C = 517.50$

Jobs A = \$15.30/h, B = \$11.10/h, C = \$13.05 /h

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65. Apples = \$3.15

Spinach = \$7.04

Potatoes = \$1.27

The fourth visit should cost \$19.20 so no increase.

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66. Runs at 17.1 km/h

Cycles at 40.8 km/h (3 sf)

Paddles at 23.4 km/h (3 sf)

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67. $4.4A + 0.9B + 3.9C = 15.4$

$12.3A + 6B + 15.6C = 58.2$

$178A + 360B + 260C = 1696$

2 cans of A, 3 cans of B and 1 can of C.

68. $3A + S + B = 1500$

$A + 2S + B = 900$

$S + 2B = 400$

A = 400, S = 200, B = 100

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69. $1.2N + 2.2A + 2.5W = 275.4$

$N + A + W = 135$

$2(N + W) = A$

NZ = 27, Aust = 90, World = 18

70. Pigs = 0.035 kg, Beef = 0.16 kg and Sheep = 0.015 kg per day

30 pigs + 100 sheep = 2.55 kg / day

Pages 40 - 41 Practice Internal Assessment Task 1 – Systems of Equations 3.15

Achieved	Achievement with Merit	Achievement with Excellence
The student has applied systems of simultaneous equations to recommend how fast Pamela swims in metres per minute. The student has selected and used methods demonstrating knowledge of concepts and terms and communicating using appropriate representations.	The student has applied systems of simultaneous equations, using relational thinking, to recommend the distance covered if the time was amended on day one and the effect of altering the time. The student has formed and used a model, demonstrating knowledge of concepts and terms. The student has related their findings to the context, or communicated their thinking using appropriate mathematical statements.	The student has applied systems of simultaneous equations, using extended abstract thinking, to investigate what happens when the time on day one is changed. The student has developed a chain of logical reasoning to solve the problem. The student has used correct mathematical statements or communicated mathematical insight.
Example of possible student response: *The student has formed a system of simultaneous equations with three equations.* $24R + 9B + 10S = 10\,680$ $18R + 15B + 12S = 12\,750$ $12R + 20B + 14S = 14\,270$ *The student has found a solution to their system of simultaneous equations.* $R = 220, B = 550$ and $S = 45$ *The student has interpreted their solution in terms of how fast Pamela swims.* *Pamela swims at 45 m / minute.*	Example of possible student response *In addition to correctly solving the system of equations in Part A, the student has calculated the total distance travelled on day one.* $\text{Distance day one} = 10\,680 + 550$ $= 11\,230$ m *The student then attempts to solve the amended system of equations getting a statement that is always true showing no unique solution.* $24R + 10B + 10S = 11\,230$ $18R + 15B + 12S = 12\,750$ $12R + 20B + 14S = 14\,270$ $0 = 0$ etc.	Example of possible student response: *In addition to correctly showing there is no unique solution the student correctly shows that* $R = 220, B = 550$ and $S = 45$ *is still a solution.* *The student explains how to, and finds at least one other solution such as* $R = 217.5, B = 541$ and $S = 60$ *as predicted by* $S = k, B = 577 - 0.6k$ and $R = 227.5 - 0.16667k$

Pages 42 - 43 Practice Internal Assessment Task 2 – Systems of Equations 3.15

Achieved	Achievement with Merit	Achievement with Excellence
The student has applied systems of simultaneous equations to twice solve the equations when the unknown digit is 5 or one of 3, 7 or 9. The student has selected and used methods demonstrating knowledge of concepts and terms and communicating using appropriate representations.	The student has applied systems of simultaneous equations, using relational thinking, to investigate the nature of the solutions. The student has demonstrated knowledge of concepts and terms. The student has related their findings to the context, or communicated their thinking using appropriate mathematical statements.	The student has applied systems of simultaneous equations, using extended abstract thinking, to explore the non-unique solutions to the system of equations. The student has developed a chain of logical reasoning to solve the problem. The student has used correct mathematical statements or communicated mathematical insight.
Example of possible student response: *The student has formed a system of simultaneous equations with three equations.* $9x + 4y + z = 40$ $3x + y + z = 12$ $5x + y + 4z = 25$ *And* $9x + 4y + z = 40$ $3x + y + z = 12$ $Kx + y + 4z = 25$ *where K = 3, 7 or 9.* *The student has found a solution to their system of simultaneous equations.* *x = 0, y = 9 and z = 4* *The student has attempted to interpret their solutions, but does NOT say the answer is NOT unique.*	Example of possible student response *The student has interpreted their solutions to Part A by pointing out as x = 0 it does not matter what the multiplier of x is.* *The student eliminates z to get a system of equations with two unknowns and attempts to find a value for F that makes these lines parallel.* *For example* $6x + 3y = 27$ *and* $(12 - F)x + 3y = 27$	Example of possible student response: *The student has solved a two by two system of equations and solved for a value of F* $6x + 3y = 27$ *and* $(12 - F)x + 3y = 27$ $F = 6$ *The student has confirmed that x = 0, y = 9 and z = 4 is still a solution.* *The student has explained that the system now has no unique answer and has given at least one correct additional answer* *as predicted by* *z = k, y = 2k + 1 and x = 4 – k such as* *x = 2, y = 5 and z = 2 or* *x = 4, y = 1 and z = 0* *Student has explained that there is no value of F that gives no solution as the constant term for the two parallel lines is not dependent upon F (or something similar).*