Test answers - Simultaneous equations

Year: Year 10 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. Multiply to match coefficients: $9x + 6y = 36$ and $10x - 6y = 2$ (1). Add: $19x = 38$ (1). $x = 2$ (1). $y = 3$ (1). Multiply the first equation by 3 and the second by 2, so the y terms are $+6y$ and $-6y$ and cancel when added. Substitute $x = 2$ into $3x + 2y = 12$: $6 + 2y = 12$, so $y = 3$. Check: $10 - 9 = 1$.

Check both equations with $x = 2$, $y = 3$: $6 + 6 = 12$ and $10 - 9 = 1$. A common error is to subtract $9x + 6y = 36$ and $10x - 6y = 2$, which leaves $12y$ and does not eliminate anything.

Answer to Question 2 (4 marks)

a. $2a + 3c = 34$ and $3a + c = 30$ (1). Multiply the second by 3: $9a + 3c = 90$ (1). Subtract: $7a = 56$, $a = 8$ (1). Then $c = 30 - 24 = 6$: **adult £8, child £6** (1). Multiplying by 3 makes the c terms match, so subtracting removes c. Check: $16 + 18 = 34$ and $24 + 6 = 30$. One adult ticket costs £8 and one child ticket costs £6.

Letters must be defined: a is the price of an adult ticket in pounds and c the price of a child ticket. Substitution also works, with $c = 30 - 3a$.

Answer to Question 3 (4 marks)

a. $2x + 3x - 4 = 11$ (1), $5x = 15$ (1), $x = 3$, $y = 5$ (1). $3 \times 3 - 4 = 5$ ✓ but $3 + 5 = 8 \neq 7$ (1). Substitute $y = 3x - 4$ into the second equation and solve for x. The point $(3, 5)$ fits $y = 3x - 4$ but not $x + y = 7$, so it is not on that line.

Check the solution in both original equations: $y = 3 \times 3 - 4 = 5$ and $2 \times 3 + 5 = 11$. Elimination is also possible by writing the first equation as $3x - y = 4$ and adding it to $2x + y = 11$, which gives $5x = 15$ again. The point $(3, 5)$ is where the two lines meet.

Answer to Question 4 (4 marks)

a. $x + 2x + 1 = 10$ (1), $x = 3$, $y = 7$: $(3, 7)$ (1) Substitute $y = 2x + 1$ into $x + y = 10$. The lines cross at $(3, 7)$.

b. $2 + 1.5m = 5 + m$ (1), $0.5m = 3$, $m = 6$ **miles** (1) Set the two costs equal and solve. Check: $2 + 9 = 11$ and $5 + 6 = 11$. The charges are the same for 6 miles.

In (a), check the point in both equations: $2 \times 3 + 1 = 7$ and $3 + 7 = 10$. In (b), let m be

the number of miles; for journeys longer than 6 miles the second firm is cheaper because it charges less per mile.

Answer to Question 5 (4 marks)

a. $x^2 + (x+2)^2 = 34$ (1), $2x^2 + 4x - 30 = 0$ so $x^2 + 2x - 15 = 0$ (1), $(x+5)(x-3) = 0$, $x = -5$ or 3 (1). Solutions $(3, 5)$ and $(-5, -3)$ (1). Substitute $y = x + 2$ into the circle equation and expand $(x+2)^2 = x^2 + 4x + 4$. Divide by 2 and factorise, then find y from $y = x + 2$. Check: $9 + 25 = 34$ and $25 + 9 = 34$.

Both pairs must be given, matched correctly. A common error is to pair $x = 3$ with $y = -3$; always use the linear equation to find y. Geometrically, the line meets the circle of radius $\sqrt{34}$ at two points.