Test answers - Direct and inverse proportion

Year: Year 9 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. Direct proportion means $y = kx$, so the ratio $\frac{y}{x}$ is constant. $k = 35 \div 7 =$**5**. (1 mark)
b. Put $k = 5$ into $y = kx$: $y = 5x$. (1 mark)
c. Substitute $x = 12$: $y = 5 \times 12 =$**60**. (1 mark)
d. Solve $5x = 95$ by dividing both sides by 5: $x =$**19**. Check: $5 \times 19 = 95$. (1 mark)

The graph of $y = 5x$ is a straight line through the origin with gradient 5, which is the picture of direct proportion. A quick sense check: x went from 7 to 12, a little less than double, so y should be a little less than double 35, and 60 fits. Doubling x always doubles y.

Answer to Question 2 (4 marks)

a. Inverse proportion means $y = \frac{k}{x}$, so the product xy is constant: $k = 15 \times 4 =$**60**. (1 mark)
b. Substitute $x = 20$ into $y = \frac{60}{x}$: $y = 60 \div 20 =$**3**. (1 mark)
c. Solve $12 = \frac{60}{x}$: multiply both sides by x to get $12x = 60$, so $x =$**5**. (1 mark)
d. If x is multiplied by 3, the denominator becomes three times as big, so **y is divided by 3**; it becomes one third of its value. (1 mark)

Check (b) and (c): $20 \times 3 = 60$ and $5 \times 12 = 60$, so both pairs give the same product. As x increases, y decreases, but never reaches zero.

Answer to Question 3 (4 marks)

a. Divide the total cost by the number of pencils: $£2.28 \div 6 =$**£0.38**, which is 38p each. (1 mark)
b. Multiply the price of one pencil by 15: $15 \times 0.38 =$**£5.70**. (1 mark)
c. Divide the money available by the price of one pencil: $9.50 \div 0.38 = 25$ (1 mark). The club can buy **25 pencils** (1 mark).

Here the division is exact, so no rounding is needed and there is no money left over. Check: $25 \times 0.38 = 9.50$. If the division had not been exact, the answer would have to be rounded down, since the club cannot buy part of a pencil. Working in pence (950 ÷

38) avoids decimal errors.

Answer to Question 4 (4 marks)

a. The total amount of work is the number of decorators times the number of days: $5 \times 6 =$**30** decorator-days. (1 mark)
b. Share the 30 decorator-days between 3 decorators: $30 \div 3 =$**10 days**. Fewer workers take longer, as expected for inverse proportion. (1 mark)
c. Finishing in 4 days needs $30 \div 4 = 7.5$ decorators (1 mark). Decorators come in whole numbers, and 7 decorators would need $30 \div 7 \approx 4.3$ days, which is too long. So **8 decorators** are needed (1 mark).

This is a case where the answer must be rounded up, not to the nearest whole number. With 8 decorators the job takes 3.75 days, inside the 4-day limit.

Answer to Question 5 (4 marks)

a. Multiply each pair: $2 \times 20 = 40$, $4 \times 10 = 40$, $5 \times 8 = 40$ and $10 \times 4 = 40$ (1 mark for the products). The product xy is the same for every pair, which is exactly the condition for inverse proportion (1 mark for the conclusion).
b. Use the constant product 40 as k in $y = \frac{k}{x}$: $y = \frac{40}{x}$. (1 mark)
c. Substitute $x = 16$: $y = 40 \div 16 =$**2.5**. (1 mark)

Testing the ratio $\frac{y}{x}$ instead would give 10, 2.5, 1.6 and 0.4, which are all different, so the values are not in direct proportion. Check (c): $16 \times 2.5 = 40$.