Test answers - Compound units and direct/inverse proportion

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

Answer to Question 1 (4 marks)

a. 3 h 30 min $= 3.5$ h (1). $168 \div 3.5 =$ **48 mph** (1) Change the time into hours, then divide the distance by the time. The lorry's average speed is 48 mph.
b. 1 h 40 min $= 1\frac{2}{3}$ h (1). $42 \times 1\frac{2}{3} =$ **70 km** (1) 40 minutes is $\frac{40}{60} = \frac{2}{3}$ of an hour. Distance $=$ speed $\times$ time, so the bus travels 70 km.

A common error in (a) is to divide by 3.3 instead of 3.5, which gives about 50.9 mph.

Answer to Question 2 (4 marks)

a. $200 \times 15 \times 10 =$ **30 000 cm³** (1) The beam is a cuboid, so multiply the three dimensions. Its volume is 30 000 cm³.
b. Mass $= 0.65 \times 30\,000$ (1) $= 19\,500$ g (1) $=$ **19.5 kg** (1) Use mass $=$ density $\times$ volume, then divide by 1000 to change grams into kilograms. The beam has a mass of 19.5 kg.

Check with sensible values: a beam this size weighing about 20 kg is realistic, since the wood is lighter than water.

Answer to Question 3 (4 marks)

a. $0.6 \times 0.4 =$ **0.24 m²** (1) Change centimetres into metres before multiplying: 60 cm $= 0.6$ m and 40 cm $= 0.4$ m.
b. $480 \div 0.24 =$ **2000 N/m²** (1 for dividing, 1 for the answer) Pressure $=$ force $\div$ area. The pressure on the floor is 2000 N/m².
c. This side has area 0.18 m², which is smaller, so the pressure is **bigger** (same force on a smaller area) (1) The new pressure is $480 \div 0.18 \approx 2667$ N/m².

Answer to Question 4 (4 marks)

a. 1 ticket $= 94.50 \div 7 = 13.50$ (1). 11 tickets $=$ **£148.50** (1) Use the unitary method: find the cost of one ticket, then multiply by 11. So 11 tickets cost £148.50.
b. $5 \times 12 = 60$ machine-hours (1). $60 \div 8 =$ **7.5 hours** (1) This is inverse proportion: more machines take less time. Divide the total of 60 machine-hours by 8. Eight machines take 7.5 hours.

In (b), check: 8 machines for 7.5 hours is again 60 machine-hours.

Answer to Question 5 (4 marks)

a. $y = kx^2$, so $45 = 9k$ and $k = 5$ (1). $y = 5x^2$ (1) Write $y = kx^2$ and substitute $x = 3$, $y = 45$. Since $3^2 = 9$, $k = 45 \div 9 = 5$.
b. $5 \times 36 = \mathbf{180}$ (1) Substitute $x = 6$: $6^2 = 36$ and $5 \times 36 = 180$. So $y = 180$.
c. $125 = 5x^2$, $x^2 = 25$, $x = \mathbf{5}$ (1) Divide by 5, then take the positive square root. So $x = 5$.

Check (c) with the formula: $5 \times 5^2 = 125$. In (b), doubling x multiplies y by $2^2 = 4$, and $45 \times 4 = 180$, which confirms the answer without the formula.