Test answers - Real-life graphs

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

Answer to Question 1 (4 marks)

a. Speed = distance ÷ time for the first section: $80 \div 2 =$**40 km/h**. On the graph this is the gradient of the first line. (1 mark)
b. The van stops for **30 minutes**. On a distance–time graph a stop is a horizontal line, because time passes but the distance stays the same. (1 mark)
c. Divide the 90 km by the 1.5 hours: $90 \div 1.5 =$**60 km/h**. (1 mark)
d. Add the two moving distances; the stop adds nothing: $80 + 90 =$**170 km**. (1 mark)

The last section is steeper than the first because the van is travelling faster. The whole journey takes 4 hours, so the average speed including the stop is $170 \div 4 = 42.5$ km/h.

Answer to Question 2 (4 marks)

a. Multiply by 1.8, then add 32: $1.8 \times 35 + 32 = 63 + 32 =$**95 °F**. (1 mark)
b. Set $68 = 1.8C + 32$. Subtract 32 from both sides: $36 = 1.8C$. Divide by 1.8: $C =$**20 °C**. (1 mark)
c. 1.8 is the **gradient** of the straight-line graph: F rises by 1.8 degrees for every 1 degree rise in C. (1 mark)
d. Substitute $C = -40$: $1.8 \times (-40) + 32 = -72 + 32 = -40$. The Fahrenheit value is also -40, so -40 °C and -40 °F are the same temperature. (1 mark)

On a graph this is where the conversion line crosses the line $F = C$. The 32 is the intercept: water freezes at 0 °C, which is 32 °F.

Answer to Question 3 (4 marks)

a. 3 GB is within the 4 GB allowance, so only the fixed monthly charge is paid: **£12**. (1 mark)
b. 7 GB is $7 - 4 = 3$ GB above the allowance: $12 + 3 \times 3 = 12 + 9 =$**£21**. (1 mark)
c. 10 GB is $10 - 4 = 6$ GB above the allowance: $12 + 3 \times 6 = 12 + 18 =$**£30**. (1 mark)
d. Subtract the fixed charge, $27 - 12 = 15$, and divide by £3 to find the extra data: $15 \div 3 = 5$ GB. Add the 4 GB allowance: **9 GB**. (1 mark)

The graph of this plan is horizontal from 0 to 4 GB, then becomes a straight line with gradient 3. Forgetting the allowance in (b) would give $12 + 21 = £33$, a common error.

Answer to Question 4 (4 marks)

a. Multiply by the multiplier 1.04 once: $500 \times 1.04 =$**£520**. (1 mark)
b. Three years means multiplying by 1.04 three times: $1.04^3 = 1.124864$, and $500 \times 1.124864 = 562.432$, which is **£562.43** to the nearest penny. (1 mark)
c. Keep going: after 4 years $500 \times 1.04^4 = £584.93$, still below £600; after 5 years $500 \times 1.04^5 = £608.33$ (1 mark for both values). The value first exceeds £600 after **5 years** (1 mark).

This is exponential growth: the value rises by a larger amount each year (£20, then £20.80, then £21.63...), so the graph curves upwards rather than being a straight line.

Answer to Question 5 (4 marks)

a. Substitute $n = 4$: $t = 36 \div 4 =$**9 hours**. (1 mark)
b. Substitute $n = 9$: $t = 36 \div 9 =$**4 hours**. (1 mark)
c. Rearrange the formula to $n = \frac{36}{t}$, then substitute $t = 3$: $n = 36 \div 3 =$**12 volunteers**. (1 mark)
d. The graph is a **reciprocal curve**: it decreases steeply at first and then levels off, getting closer and closer to the n-axis but never reaching zero. (1 mark)

The product $nt = 36$ is constant, which means time is inversely proportional to the number of volunteers. Doubling the volunteers halves the time. The curve never touches the axes, since no number of volunteers can clear the field in zero hours.