HIGHER

3.6H Proportion: Higher Tier Practice

Total Marks

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 75 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A car uses fuel at a rate directly proportional to distance travelled. If the car uses 8.4 litres of fuel for 60 km, work out how many litres it uses for 225 km.

(Total for Question 1 is 2 marks)

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2 A recipe for a sauce uses ingredients in the ratio tomato:oil:vinegar = 6:1:0.5 by mass. Ava wants to make 1.2 kg of the sauce. Calculate the mass of oil she should use, giving your answer in grams.

(Total for Question 2 is 2 marks)

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3 Quantities A and B are inversely proportional. When A = 12, B = 5. Work out the value of B when A = 18.

(Total for Question 3 is 3 marks)

4 A map uses a scale of 1 cm to 7.5 km. A cyclist plans a route that is proportional to the straight-line distance. On the map the route would be 28 cm. Calculate the real distance and then the time taken if the cyclist rides at an average speed of 18 km/h. Give the time in hours and minutes, correct to the nearest minute.

(Total for Question 4 is 4 marks)

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5 A retailer sells two sizes of detergent. A 1.8 litre bottle costs 5.58 pounds and a 3.6 litre bottle costs 10.26 pounds. Which size is better value per litre? Show your working and justify your answer.

(Total for Question 5 is 4 marks)

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6 A metal rod is stretched so that its length increases in direct proportion to the temperature increase. At 20 degrees C the rod is 1.25 m long. At 80 degrees C the rod is 1.253 m long. Assuming linear proportional change, find an expression for the length L (in metres) as a function of temperature t in degrees C, of the form $L = m\,t + c$. Give m and c to 6 decimal places.

(Total for Question 6 is 5 marks)

7 An alloy is made by mixing metals X and Y in the ratio X:Y = 7:3 by mass. A manufacturer needs 560 kg of alloy. However, metal X costs 12.40 pounds per kg and metal Y costs 7.10 pounds per kg. Calculate the minimum total cost to make 560 kg of alloy. Show clear working.

(Total for Question 7 is 6 marks)

Mark scheme · 3.6H Proportion: Higher Tier Practice

Question 1

- **M1** use of direct proportion method, e.g. unit rate or ratio: 8.4/60 * 225 or equivalent
- **A1** 31.5 litres cao
- **Answer: 31.5 litres (cao). Working: unit rate = 8.4/60 = 0.14 L/km; 0.14 * 225 = 31.5 L. Check: 225/60 = 3.75; 3.75 * 8.4 = 31.5.**

Question 2

- **M1** find fraction for oil: total parts = 6 + 1 + 0.5 = 7.5, so oil = 1/7.5 of total or equivalent
- **A1** 160 g cao
- **Answer: 160 g. Working: total = 1.2 kg = 1200 g; oil = 1/7.5 * 1200 g = 160 g. Check: 1200/7.5 = 160.**

Question 3

- **M1** use product k = A * B = 12 * 5 = 60
- **M1** use B = k / A to find B = 60 / 18
- **A1** 10/3 or 3.333... cao
- **Answer: 10/3 (or 3.333...) cao. Working: k = 12 * 5 = 60 so B = 60/18 = 10/3.**

Question 4

- **M1** convert map length to real distance: distance = 28 * 7.5 km
- **A1** 210 km cao
- **M1** use time = distance / speed: 210 / 18 hours
- **A1** 11 hours 40 minutes cao
- **Answer: 210 km and 11 hours 40 minutes. Working: distance = 28 * 7.5 = 210 km. Time = 210 / 18 = 11.666... hours = 11 hours + 0.666...*60 = 11 hours 40 minutes. Check: 18 * 11.666... = 210.**

Question 5

- **M1** calculate unit prices: 5.58/1.8 and 10.26/3.6
- **M1** correct numerical comparison of the two unit prices
- **A1** state both unit prices correctly, e.g. 5.58/1.8 = 3.10 (to 2 dp) and 10.26/3.6 = 2.85 (to 2 dp) cao
- **A1** conclude 3.6 litre bottle is better value cao
- **Answer: 3.6 litre bottle is better value. Working: 5.58/1.8 = 3.10 pounds per litre; 10.26/3.6 = 2.85 pounds per litre. Since 2.85 < 3.10 the 3.6 L bottle is cheaper per litre. Check: 1.8 * 3.10 = 5.58 and 3.6 * 2.85 = 10.26.**

Question 6

- **M1** use two points to find gradient m = (1.253 - 1.25) / (80 - 20)
- **A1** m = 0.000050 cao to 6 dp
- **M1** substitute one point to find c using L = m t + c
- **A1** c = 1.249000 cao to 6 dp
- **A1** final correct expression L = 0.000050 t + 1.249000 cao
- **Answer: L = 0.000050 t + 1.249000. Working: m = (1.253 - 1.25)/(80 - 20) = 0.003/60 = 0.00005 = 0.000050 to 6 dp. Then c = 1.25 - 0.00005*20 = 1.25 - 0.001 = 1.249000. Check: at t = 80, L = 0.00005*80 + 1.249 = 0.004 + 1.249 = 1.253.**

Question 7

- **M1** find masses from ratio: total parts = 7 + 3 = 10, X = 7/10 * 560 kg, Y = 3/10 * 560 kg
- **M1** calculate mass of X: 7/10 * 560 = 392 kg
- **M1** calculate mass of Y: 3/10 * 560 = 168 kg
- **M1** calculate cost of X: 392 * 12.40 = 4860.80 pounds
- **A1** calculate cost of Y: 168 * 7.10 = 1192.80 pounds cao
- **A1** total cost = 4860.80 + 1192.80 = 6053.60 pounds cao
- **Answer: 6053.60 pounds. Working: total parts 10 so X = 7/10 * 560 = 392 kg, Y = 168 kg. Cost X = 392 * 12.40 = 4860.80 pounds. Cost Y = 168 * 7.10 = 1192.80 pounds. Total = 4860.80 + 1192.80 = 6053.60 pounds. Check: 392*12 = 4704; 392*0.4 = 156.8; sum 4860.8. 168*7 = 1176; 168*0.1 = 16.8; sum 1192.8. Total 6053.6.**