Gradient as a rate of change

Grade 6 | Higher | 14 questions, 45 marks

GCSE Maths topic practice

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Name: _____ **Date:** _____ **Score:** _____ **/ 45**

1 A graph shows the total cost of hiring a ladder plotted against the number of days of hire.

The graph is a straight line with gradient 6.

Interpret what the gradient tells you about the cost of hiring the ladder.

Cost is measured in pounds and hire time in days.

(1 mark)

Answer _____

2 Water is poured into a tank at a steady rate.

The graph of depth of water, in cm, against time is a straight line that crosses the vertical axis at 20.

Interpret the value 20.

(1 mark)

Answer _____

3 A conversion graph for gallons and litres is a straight line through the points (0, 0) and (10, 45). The horizontal axis shows gallons and the vertical axis shows litres.

a. Work out the gradient of the line.

b. What does the gradient represent?

(3 marks)

Answer _____

4 Two companies hire out a bouncy castle. The straight-line graphs show the total cost, in pounds, against the number of days.

Company A: the line passes through (0, 20) and (5, 70).

Company B: the line passes through (0, 50) and (5, 80).

a. Work out the gradient of each line.

b. Which company charges more for each extra day? How can you tell from the graph?

c. What does the point where each line crosses the vertical axis represent?

(4 marks)

Answer _____

5 A taxi fare, F pounds, for a journey of m miles is shown by a straight-line graph through the points (0, 3.50) and (5, 15.50).

a. Work out the gradient of the line and say what it represents.

b. Write down the equation of the line in the form $F = am + b$.

c. Work out the fare for a 12-mile journey.

(4 marks)

Answer _____

6 A cyclist rides from home to a lake and back. On the distance-time graph the cyclist travels in a straight line from (0 hours, 0 km) to (1.5 hours, 24 km). The graph is then horizontal until 2 hours. It then goes in a straight line to (4 hours, 0 km).

a. Work out the cyclist's speed on the way to the lake.

b. What does the horizontal part of the graph show?

c. Work out the cyclist's speed on the way home, and explain why the gradient of that part of the graph is negative.

(4 marks)

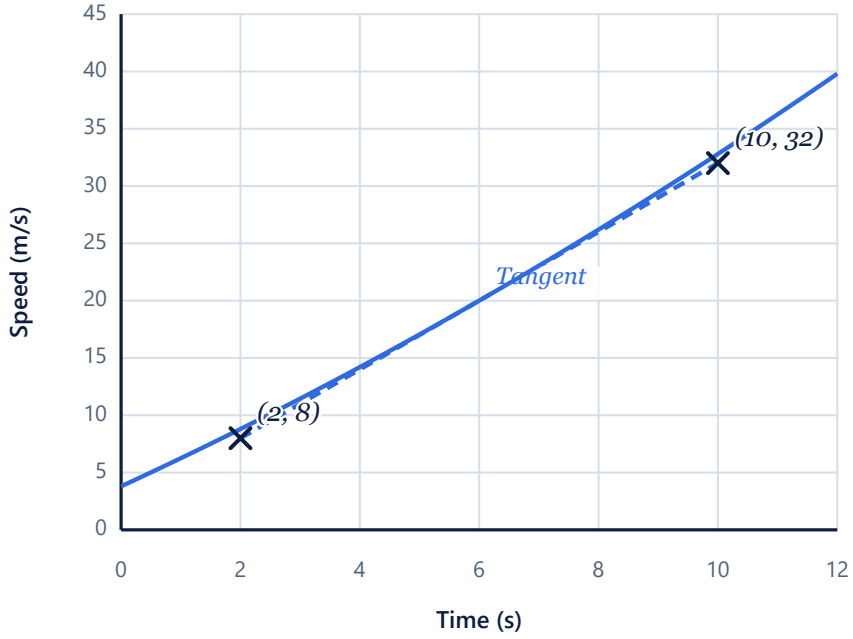
Answer _____

7 The speed-time graph for a car is a smooth curve for $0 \le t \le 12$, where t is the time in seconds and the speed is in m/s.

A tangent drawn by eye to the curve at $t = 6$ passes through the points (2, 8) and (10, 32).

a. Use the tangent to estimate the acceleration of the car at $t = 6$.

b. Explain why your answer is only an estimate.



(4 marks)

Answer _____

8 A cup of tea cools down. Its temperature, T °C, is measured every 2 minutes.

Time, t (minutes)	**0**	**2**	**4**	**6**	**8**	**10**
Temperature, T (°C)	90	72	60	52	46	42

a. Use the values at $t = 2$ and $t = 6$ to estimate the rate at which the tea is cooling at $t = 4$. Give the units.

b. Use the values at $t = 6$ and $t = 10$ to estimate the rate of cooling at $t = 8$.

c. Explain why the tea cools more slowly at $t = 8$ than at $t = 4$.

(4 marks)

Answer _____

9 The distance-time graph for a cyclist is a smooth curve. A tangent drawn to the curve at t = 20 seconds passes through the points (10, 30) and (30, 110), where the distances are in metres.

a. Use the tangent to estimate the speed of the cyclist at t = 20 in m/s.

b. Convert your answer to km/h.

(4 marks)

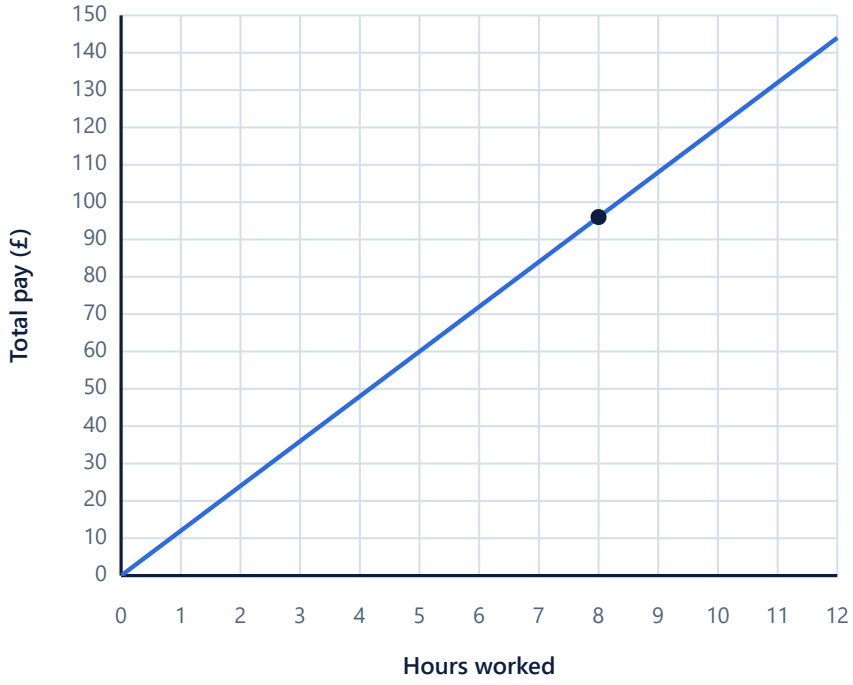
Answer

10 A graph shows Kelly's total pay plotted against the number of hours she works.

The graph is a straight line through (0, 0) and through the point (8, 96), where pay is in pounds.

a. Work out Kelly's hourly rate of pay.

b. Work out Kelly's total pay for working 11 hours.



(3 marks)

Answer

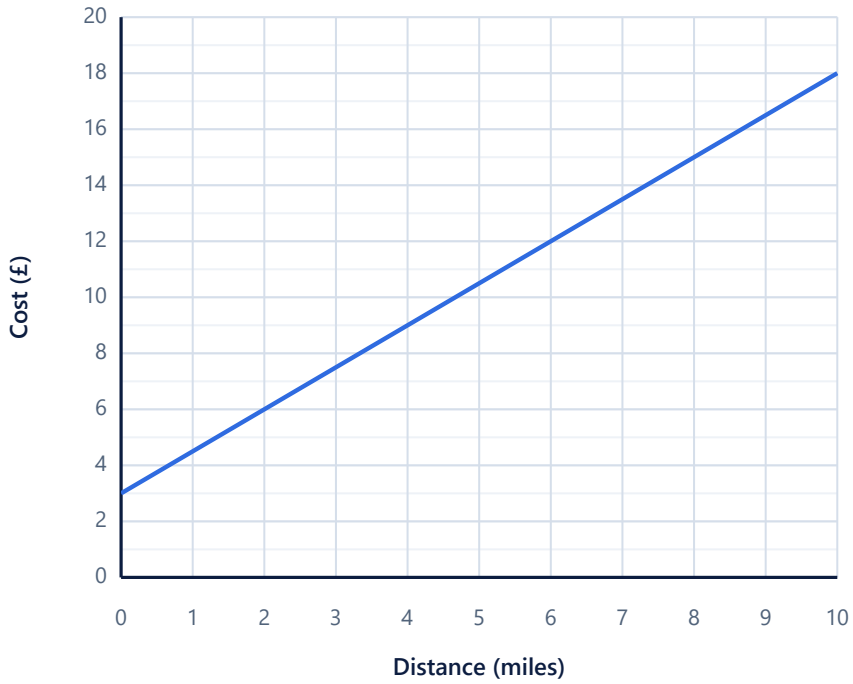
11 A taxi company shows its fares on a graph of cost against distance.

The graph is a straight line through (0, 3) and (10, 18), where cost is in pounds and distance is in miles.

a. Write down the fixed charge for any journey.

b. Work out the cost per mile.

c. Work out the fare for a journey of 6 miles.



(3 marks)

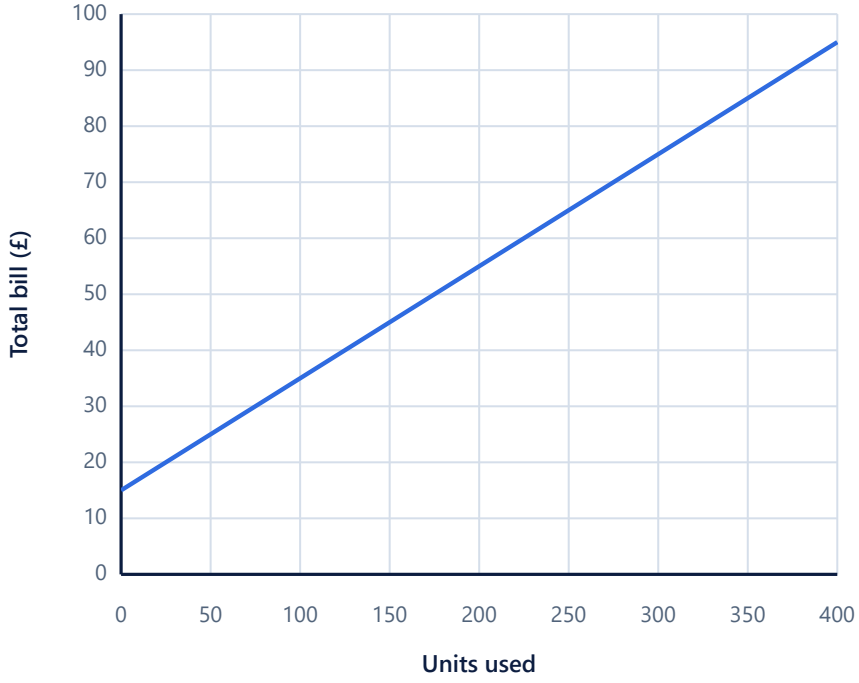
Answer _____

12 An electricity company's monthly bill is shown on a graph of total bill against units used.

The graph is a straight line through (0, 15) and (400, 95), where the bill is in pounds.

a. Work out the gradient of the line.

b. Interpret what the gradient tells you.



(3 marks)

Answer _____

13 Water is draining from a tank at a constant rate.

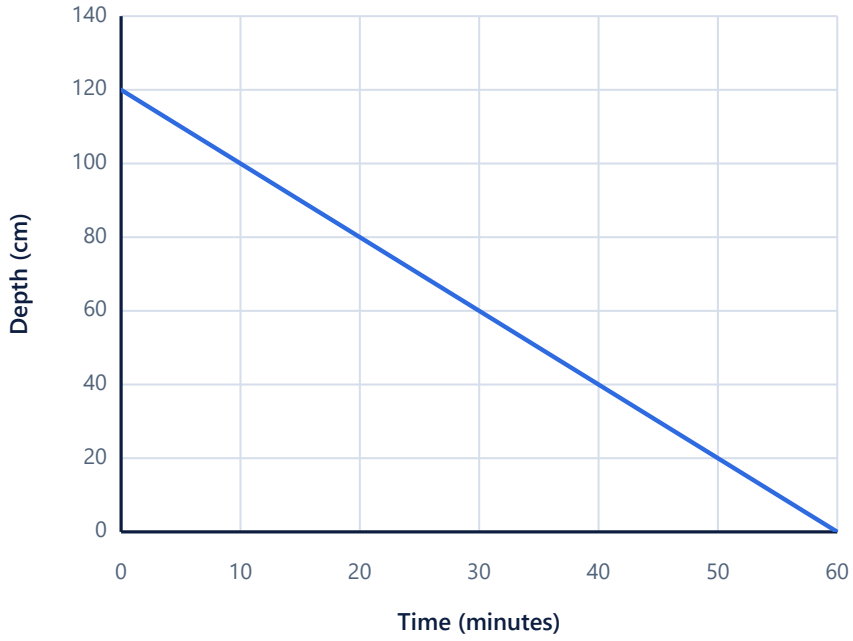
The depth of the water is 120 cm when the tank starts to drain.

After 40 minutes the depth of the water is 40 cm.

The graph of depth against time is a straight line.

a. Work out the gradient of the line.

b. Interpret what your gradient means in this situation.



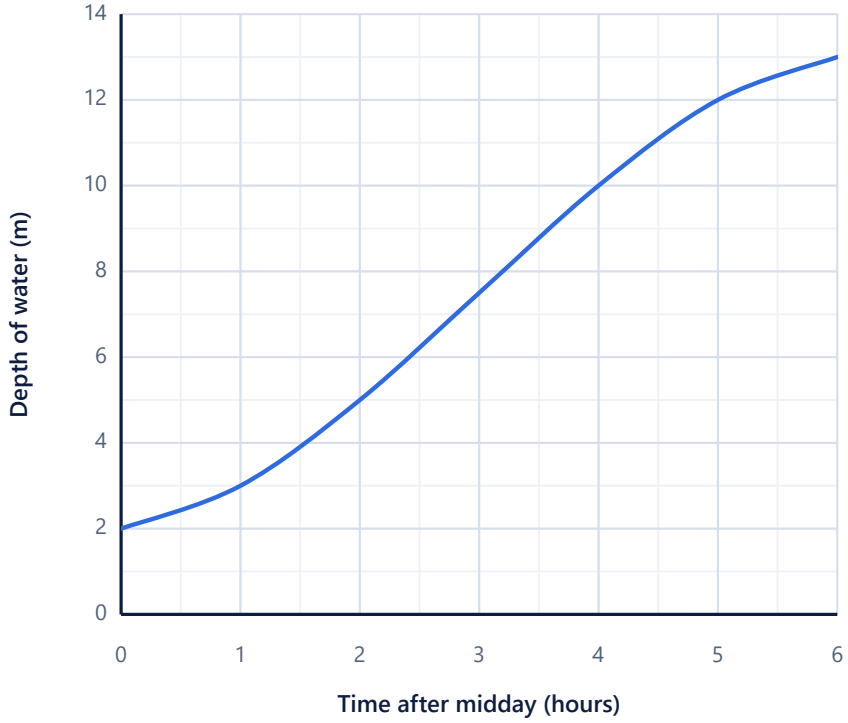
(3 marks)

Answer _____

14 The graph shows the depth of water in a harbour, in metres, during the 6 hours after midday.

By drawing a suitable tangent to the curve, estimate the rate at which the depth is increasing 3 hours after midday.

Give your answer in metres per hour.



(4 marks)

Answer _____

End of questions | Total 45 marks