Aberdare Community School

Mathematics Department

WJEC GCSE

Higher – Calculator

Algebra

Trapezium rule and gradient of a curve

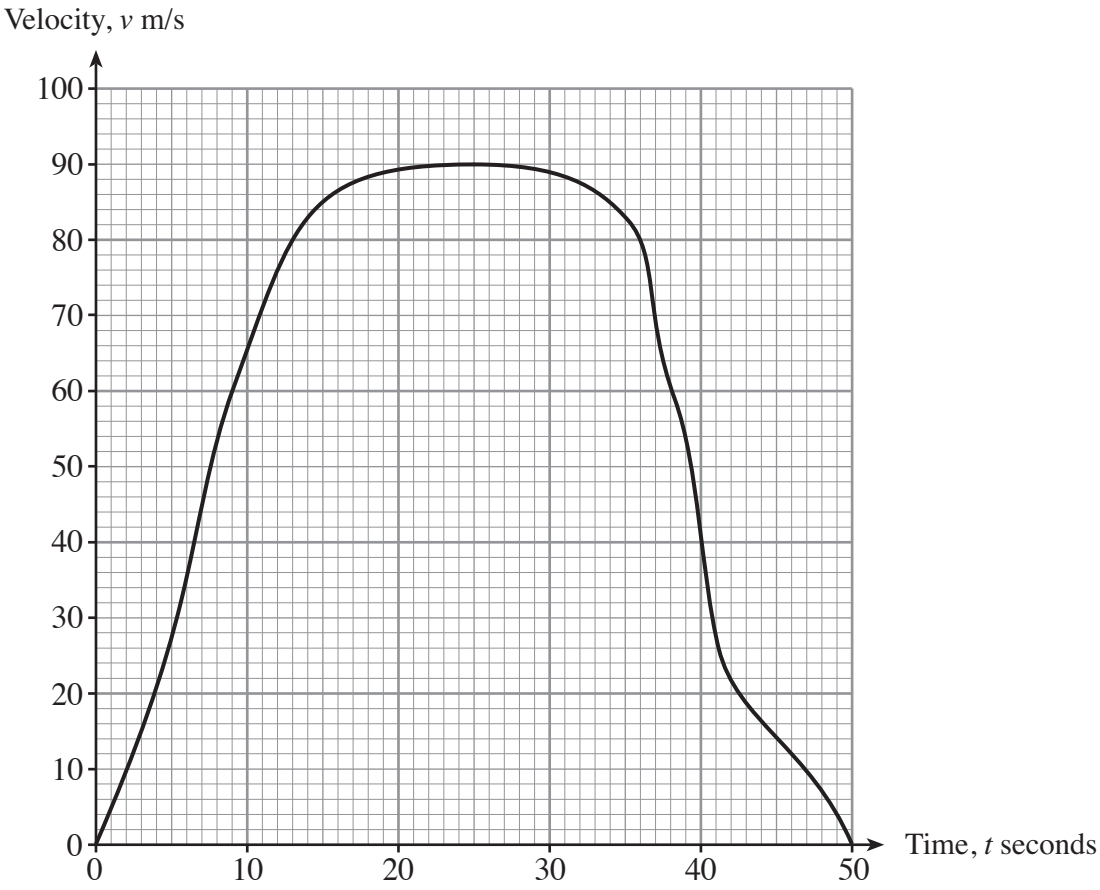
Name: .....

Set: .....

Date: .....

Teacher: .....

24. A scientific experiment was carried out. The velocity of an object was recorded over a period of 50 seconds, starting at $t = 0$ seconds. The results of the experiment were plotted on a graph, as shown below.



Use the graph to estimate the acceleration at $t = 15$ seconds.

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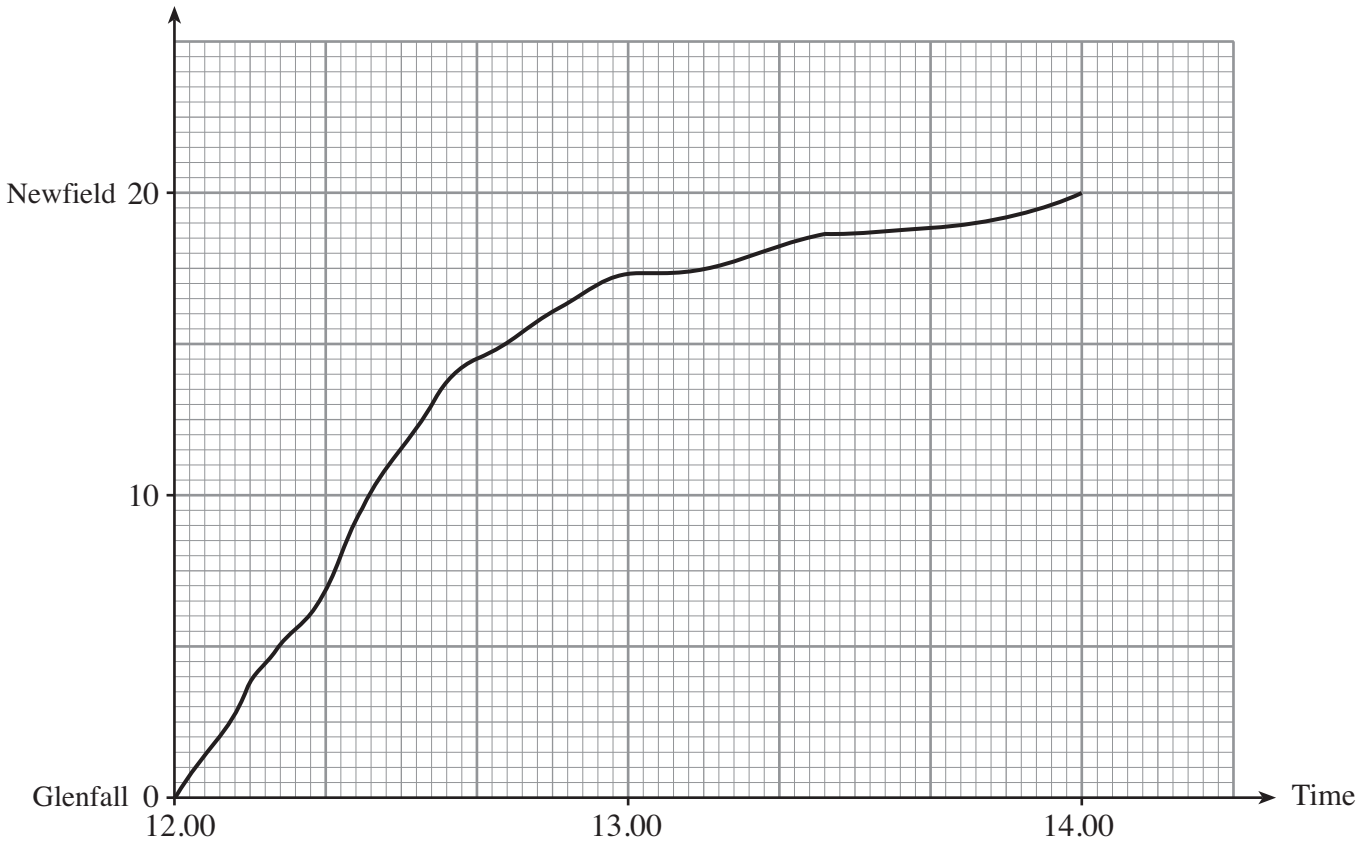
[3]

Examiner only

17. A cyclist travels a 20 km route starting at 12.00 from Glenfall and reaching Newfield at 14.00. The following diagram is a distance-time graph for the journey.



Use the graph to estimate the speed in km/h of the cyclist at 12.30.

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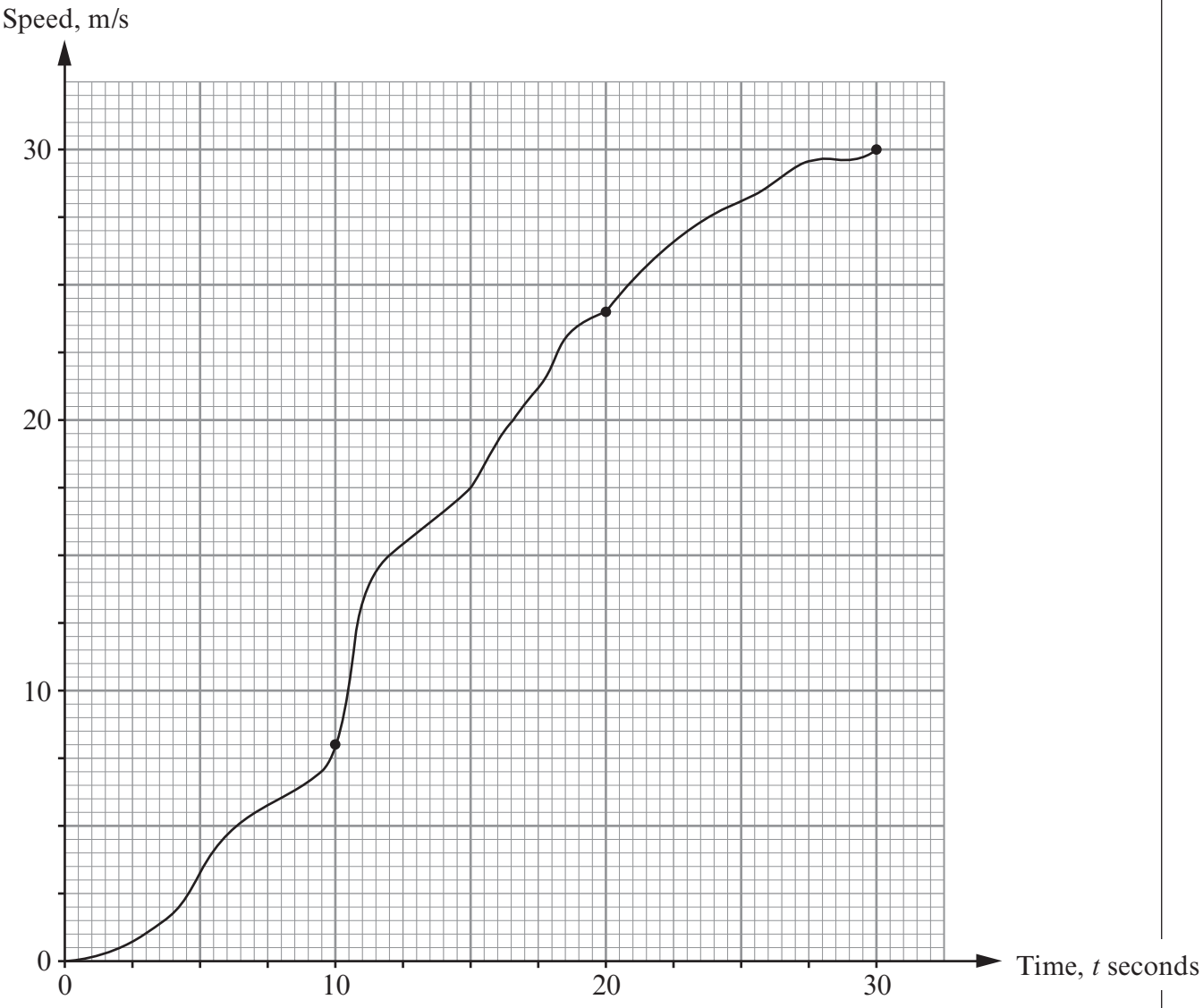
[4]

Turn over.

Examiner only

12. The graph below shows the speed of a train, in m/s, over a period of 30 seconds starting at time $t = 0$ seconds.



(a) Estimate the acceleration of the train at time $t = 12$ seconds.

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[3]

(b) The table below gives the speed of the train between $t = 0$ to $t = 30$.

Time t (seconds)	0	10	20	30
Speed (m/s)	0	8	24	30

Use the trapezium rule, with values taken from the table, to estimate the area enclosed by the curve shown on the opposite page, the t–axis and the line $t = 30$.

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[3]

(c) Estimate the total distance travelled during the 30 seconds.

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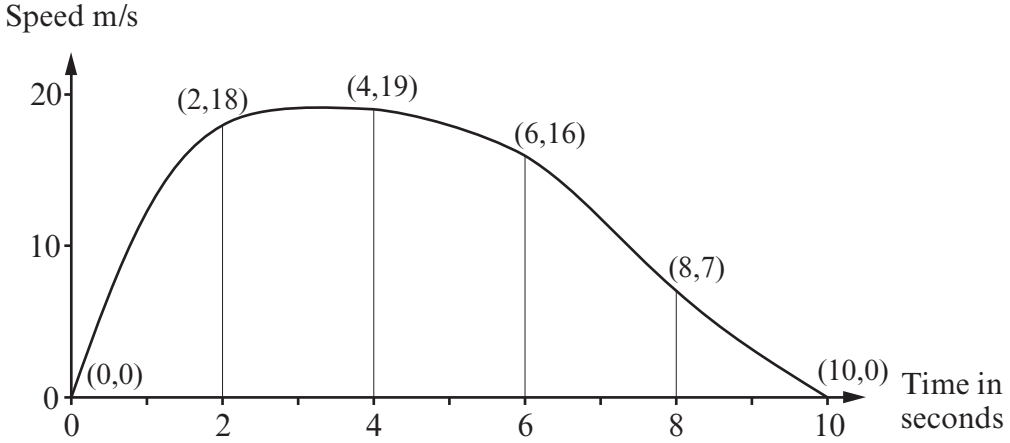
[1]

Examiner only

10. Dani is researching speed, distance and time.
She carries out an experiment using a computer to generate a graph to show the speed of a particle over a 10 second time interval.
The computer display is shown below.



By calculating the area, enclosed between the curve and the time axis, Dani can estimate the distance the particle travelled.
Find an estimate for the distance travelled by the particle.
You must state the unit of your answer.

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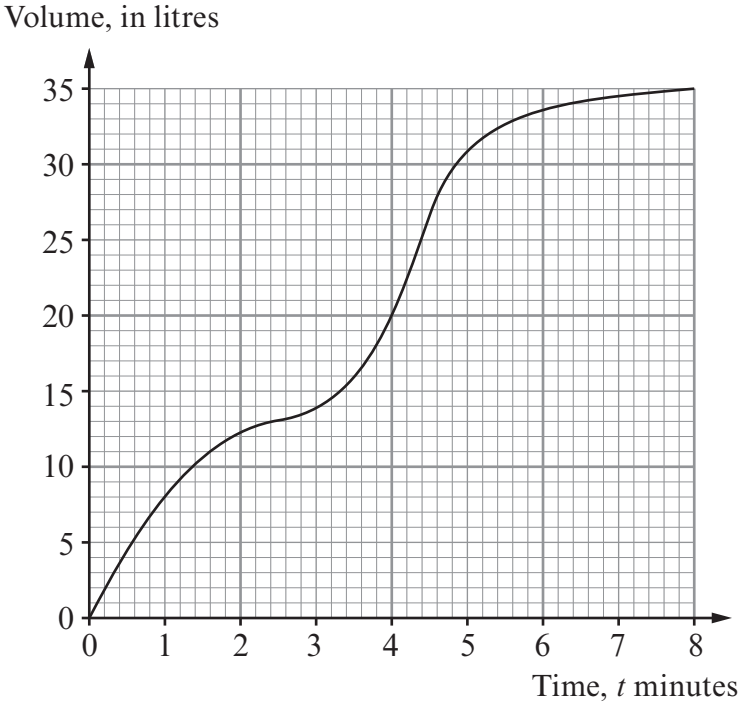
[5]

Examiner only

14. A tank has been filled with water.
The graph below shows the volume of water in the tank over a time period of 8 minutes.



(a) Calculate the gradient of the graph at time $t = 3$.
You must state the units of your answer.

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[4]

(b) Explain what the gradient of the graph is measuring.

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[1]

Examiner only

15. A sketch of $y = 9 - x^2$ is shown below for values of x from 0 to 3.

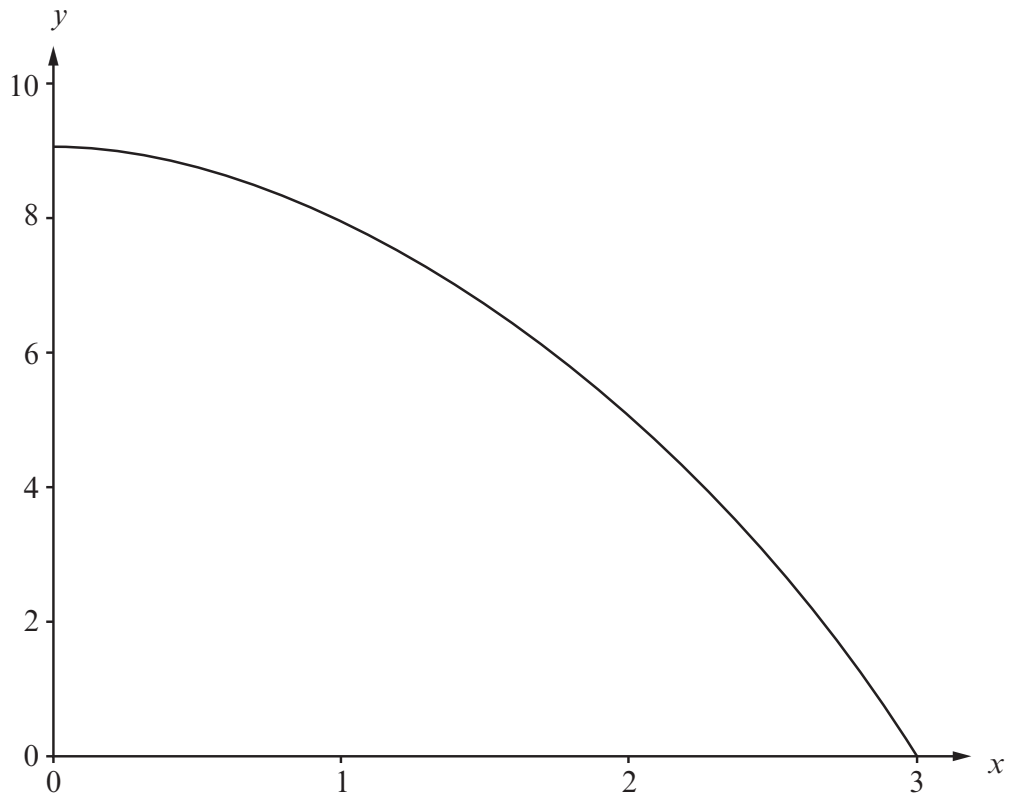

Diagram not drawn to scale

Use the trapezium rule, with the ordinates $x = 0$, $x = 1$, $x = 2$ and $x = 3$, to estimate the area of the region enclosed by the curve, the x-axis and the y-axis.

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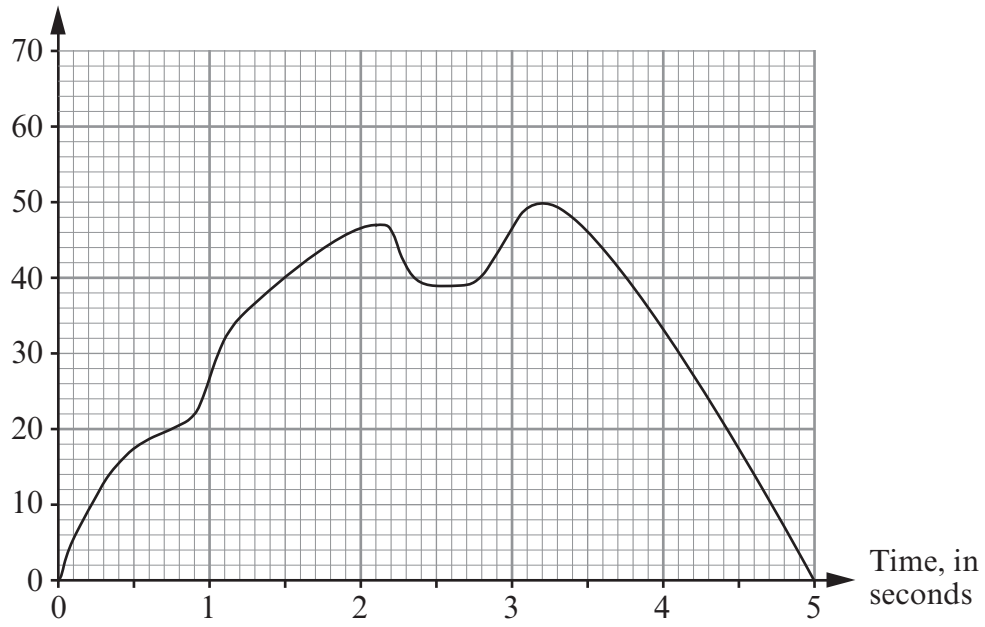
[4]

Examiner only

14. An engineer carried out an experiment.
He recorded the velocity of a particle during the first 5 seconds of the experiment.



(a) Calculate the acceleration of the particle at 3 seconds.
You must state the units of your answer.

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[4]

Examiner only

(b) (i) Calculate an estimate for the area enclosed by the x-axis and the curve shown in the graph.

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[4]

(ii) Write down an estimate for the distance travelled by the particle in the 5-second period.

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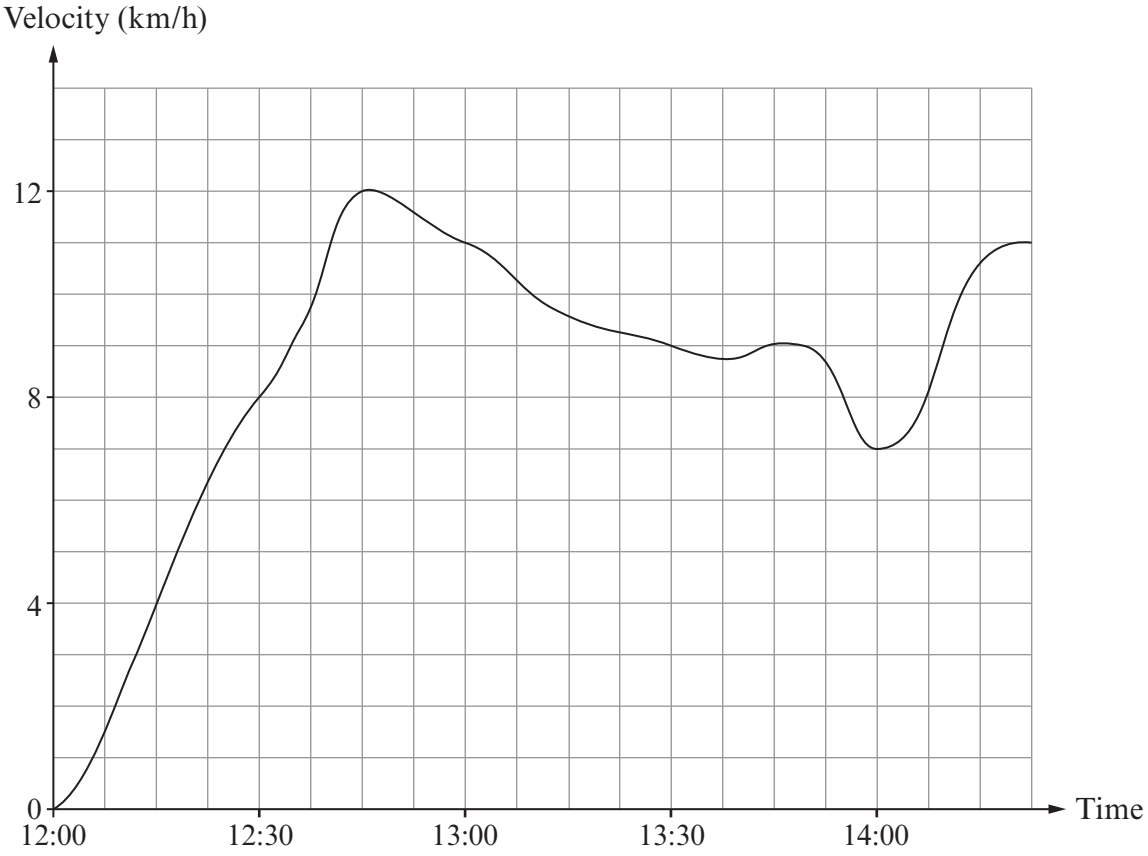
[1]

TURN OVER

Examiner only

11. Sue rode her bike along a cycle path.
She started her ride at 12:00.
The graph shows information about her cycle ride.



By considering every $\frac{1}{2}$ hour of Sue's cycle ride, use the trapezium rule to calculate an estimate for the total distance travelled in the first 2 hours.
Give the units of your answer.

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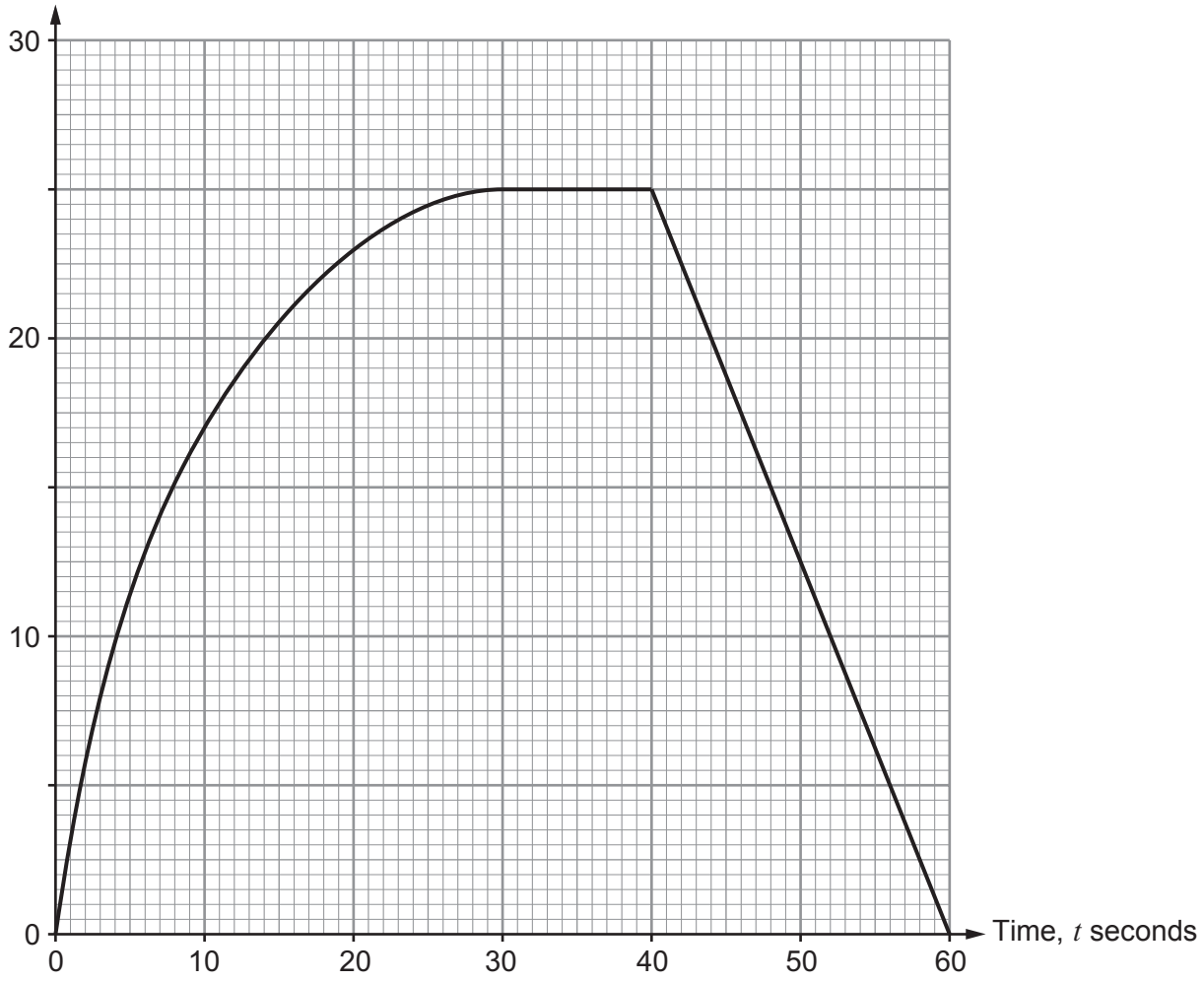
[5]

Examiner only

16. A car travels between two sets of traffic lights, starting at time $t = 0$.
The graph shows the velocity of the car in metres per second.



(a) Calculate an estimate for the acceleration of the car when $t = 20$. [3]

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Examiner only

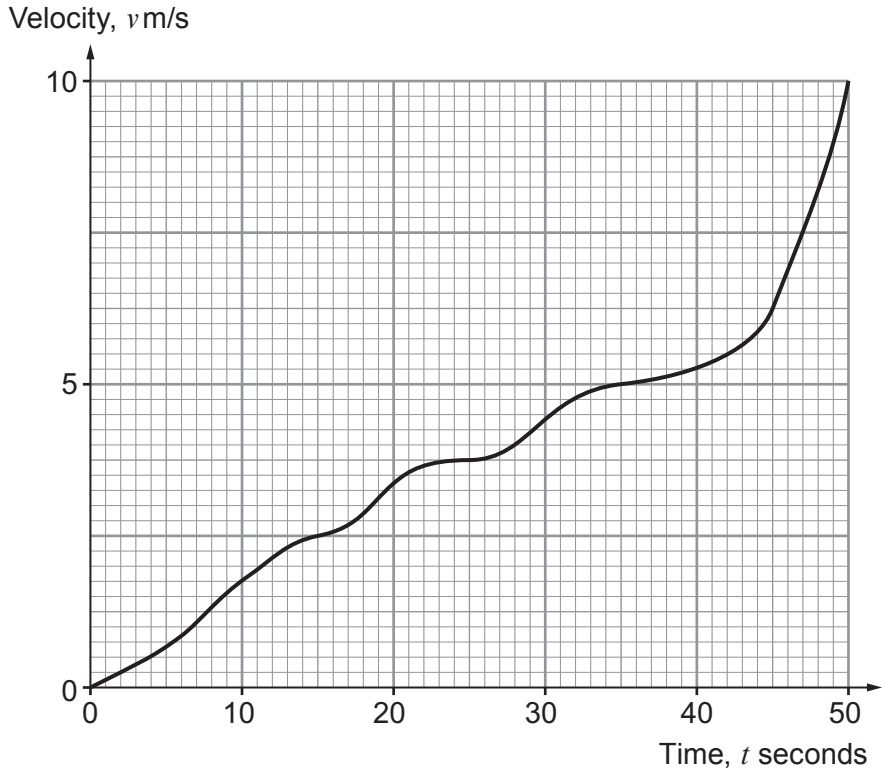
(b) Calculate an estimate of the area bounded by the curve, the time axis and the line $t = 30$. Use the trapezium rule with ordinates $t = 0$, $t = 10$, $t = 20$ and $t = 30$. [3]

(c) Calculate an estimate of the average speed of the car for the entire 60 second journey. [3]

END OF PAPER

Examiner only

13. A velocity-time graph, representing a 50 second journey of a car accelerating from 0 m/s, is shown below.



(a) Calculate the velocity of the car in km/h at time t = 50 seconds. [3]

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Velocity: ..... km/h

(b) Calculate an estimate for the acceleration at time t = 30 seconds.
You must give the units for your answer. [4]

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Acceleration: .....

Examiner only

(c) Calculate an estimate for the distance travelled by the car in the first 30 seconds. [3]

Distance travelled .....

(d) Over the same period, the velocity of another car is given by the equation $v = 0{\cdot}004t^2$. Other than at t = 0 seconds and t = 50 seconds, find the value of t for which the velocities of the two cars are the same.
Give your answer correct to the nearest second. [4]

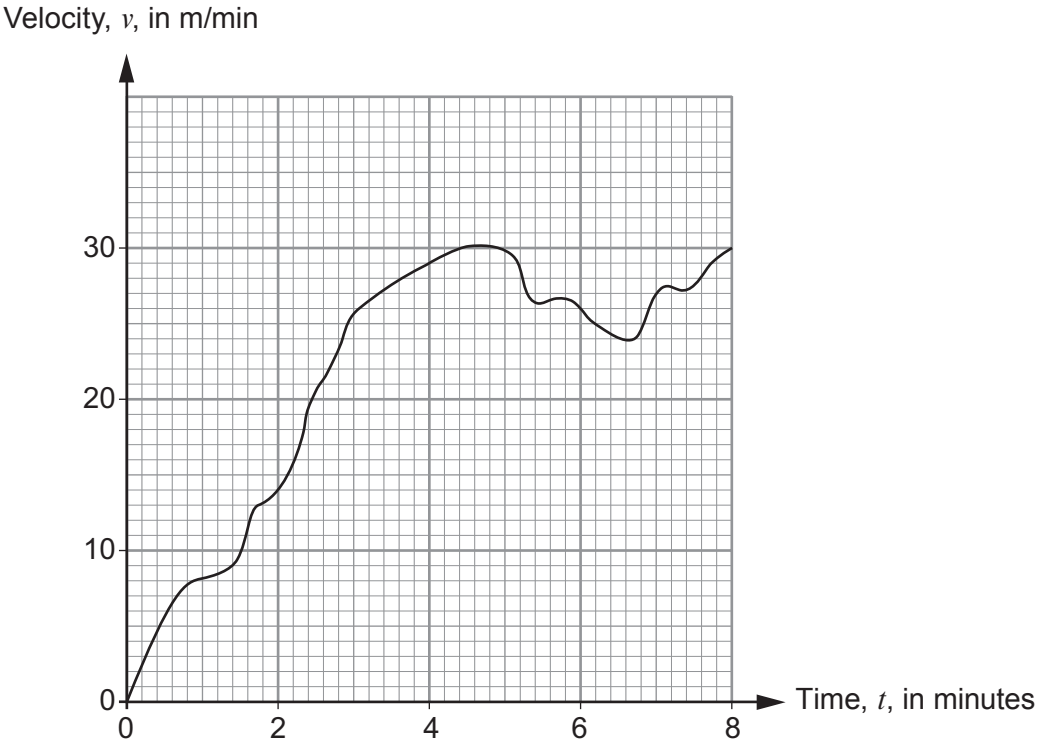
Time *t:* ..... seconds

END OF PAPER

Examiner only

15. Polly carried out an experiment.
She used equipment to record the velocity of an object, v, in m/min for the first 8 minutes of the experiment.

The velocity-time graph is shown below.



(a) Write down the gradient of the curve when $t = 4{\cdot}6$. [1]

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(b) Find an estimate for the acceleration of the object at $t = 3{\cdot}5$. [3]

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Examiner only

(c) (i) Use the trapezium rule, with the ordinates $t = 0$, $t = 2$, $t = 4$, $t = 6$ and $t = 8$, to estimate the area of the region bounded by the curve, the positive time axis and the line $t = 8$. [4]

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(ii) Calculate an estimate for the distance the object travelled in the first 8 minutes of Polly's experiment, giving your answer in kilometres. [1]

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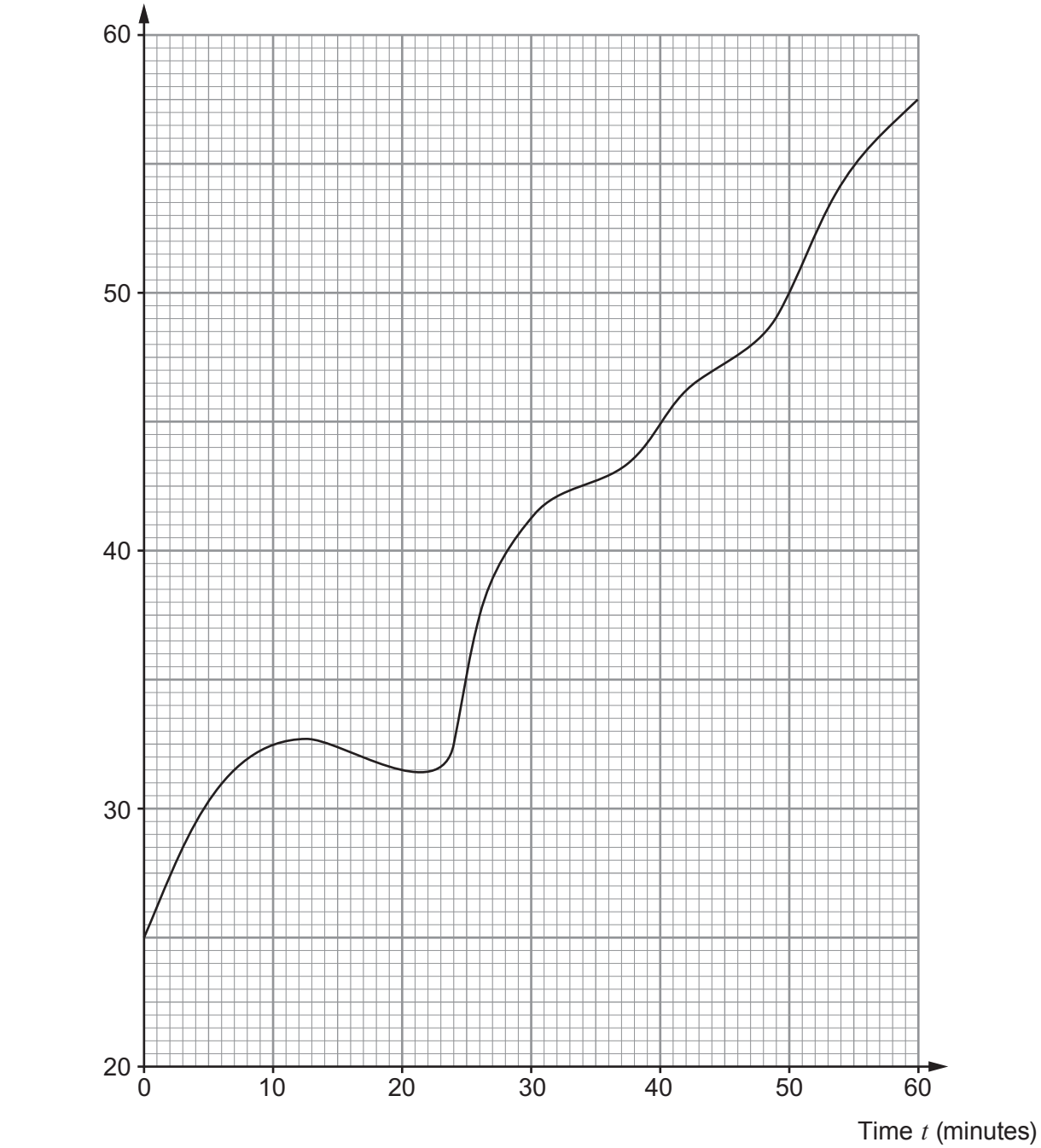
END OF PAPER

Examiner only

14. The graph shows the height of the liquid in a tank during a one-hour period.



(a) During which **5-minute period** was the height of the liquid increasing at the greatest rate? [1]

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Examiner only

(b) Calculate an estimate for the rate of increase in the height of the liquid in the tank at time $t = 35$. State the units of your answer. [4]

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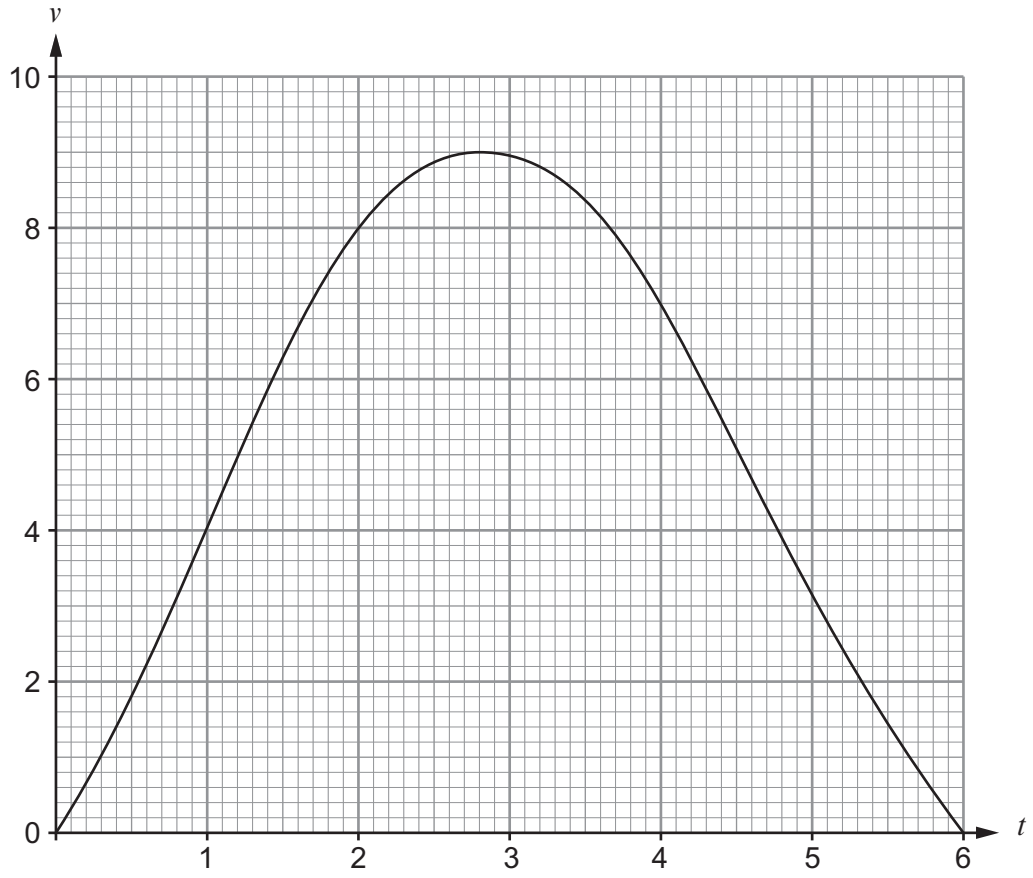
Examiner only

15. The graph below shows the velocity, v, in m/s, of a particle at time t seconds after the start of the experiment.

(a) Find an approximation for the distance travelled by the particle during the 6 seconds of the experiment using the ordinates $t = 0$, $t = 2$, $t = 4$, $t = 6$. [4]



Examiner only

(b) Is your approximation an over estimate or under estimate of the actual distance travelled?
Tick (✓) a box.
Give a reason for your answer. [1]

Over estimate ☐ Under estimate ☐

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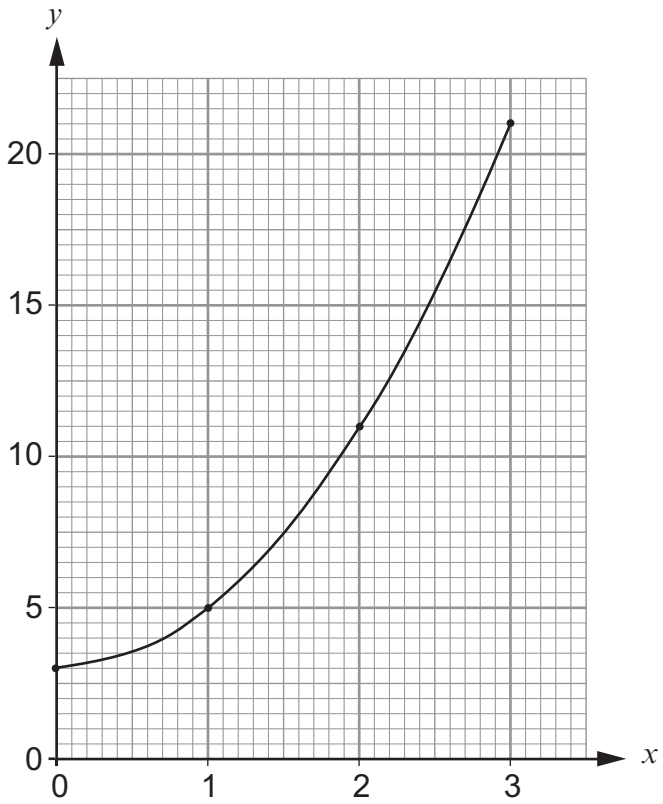
END OF PAPER

Examiner only

21. The graph of $y = 2x^2 + 3$, for values of x between $x = 0$ and $x = 3$, is shown below.



(a) Estimate the gradient of the curve when $x = 1$. [3]

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Examiner only

(b) Use the trapezium rule with ordinates $x = 0$, $x = 1$, $x = 2$ and $x = 3$ to estimate the area bounded by the curve $y = 2x^2 + 3$, the x-axis and the lines $x = 0$ and $x = 3$. [3]

END OF PAPER