



Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

**AS
MATHEMATICS**

Paper 1

7356/1

Wednesday 16 May 2018 Morning

Time allowed: 1 hour 30 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]



For this paper you must have:

- **an AQA Formulae for A-level Mathematics booklet.**
- **a graphical or scientific calculator that meets the requirements of the specification.**

INSTRUCTIONS

- **Use black ink or black ball-point pen. Pencil should only be used for drawing.**
- **Answer ALL questions.**
- **You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do NOT use the space provided for a different question.**
- **Show all necessary working; otherwise marks for method may be lost.**
- **Do all rough work in this book. Cross through any work that you do not want to be marked.**



INFORMATION

- **The marks for questions are shown in brackets.**
- **The maximum mark for this paper is 80.**

ADVICE

- **Unless stated otherwise, you may quote formulae, without proof, from the booklet.**
- **You do not necessarily need to use all the space provided.**

**DO NOT TURN OVER UNTIL TOLD
TO DO SO**



SECTION A

Answer ALL questions in the spaces provided.

- 1 Three of the following points lie on the same straight line.**

Which point does NOT lie on this line? [1 mark]

Tick ONE box.

(−2, 14)

(−1, 8)

(1, −1)

(2, −6)



5

2

A circle has equation

$$(x - 2)^2 + (y + 3)^2 = 13$$

Find the gradient of the tangent to this circle at the origin. [1 mark]

Circle your answer.

$$-\frac{3}{2}$$

$$-\frac{2}{3}$$

$$\frac{2}{3}$$

$$\frac{3}{2}$$

[Turn over]



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- 3 State the interval for which $\sin x$ is a decreasing function for $0^\circ \leq x \leq 360^\circ$ [2 marks]

[Turn over]



- 4 (a) Find the first three terms in the expansion of $(1 - 3x)^4$ in ascending powers of x . [3 marks]**

**4(b) Using your expansion,
approximate $(0.994)^4$ to six
decimal places. [2 marks]**

[Turn over]



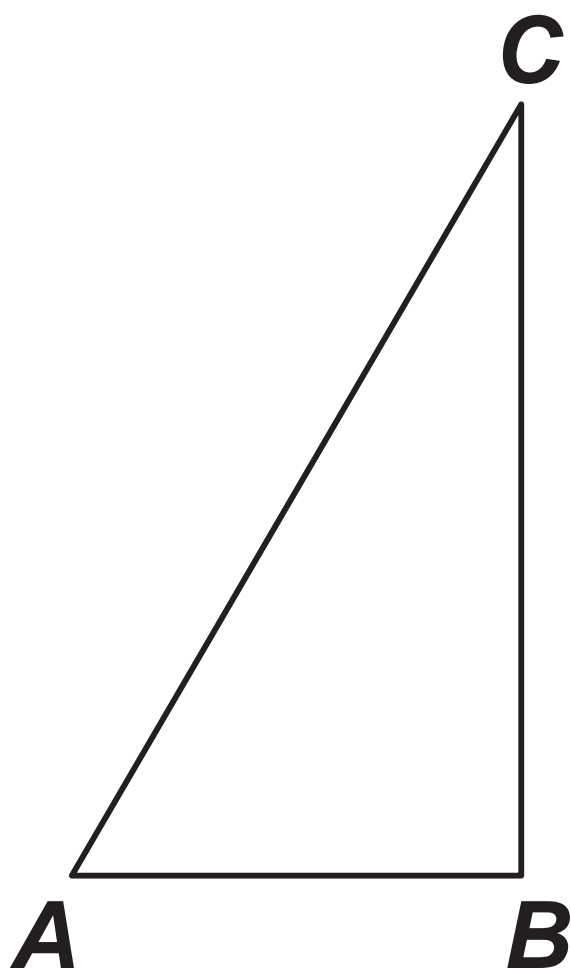
5 Point C has coordinates $(c, 2)$ and point D has coordinates $(6, d)$.

The line $y + 4x = 11$ is the perpendicular bisector of CD .

Find c and d . [5 marks]



- 6 **ABC is a right-angled triangle. It is not drawn accurately.**



D is the point on hypotenuse AC such that $AD = AB$.

The area of $\triangle ABD$ is equal to half that of $\triangle ABC$.

- 6 (a) **Show that $\tan A = 2 \sin A$
[4 marks]**

6(b)(i) Show that the equation given in part (a) has two solutions for $0^\circ \leq A \leq 90^\circ$ [2 marks]

**6 (b)(ii) State the solution which is appropriate in this context.
[1 mark]**

[Turn over]

7

Prove that n is a prime number greater than 5 $\Rightarrow n^4$ has final digit 1 [5 marks]

[Turn over]



8 Maxine measures the pressure, P kilopascals, and the volume, V litres, in a fixed quantity of gas.

Maxine believes that the pressure and volume are connected by the equation

$$P = cV^d$$

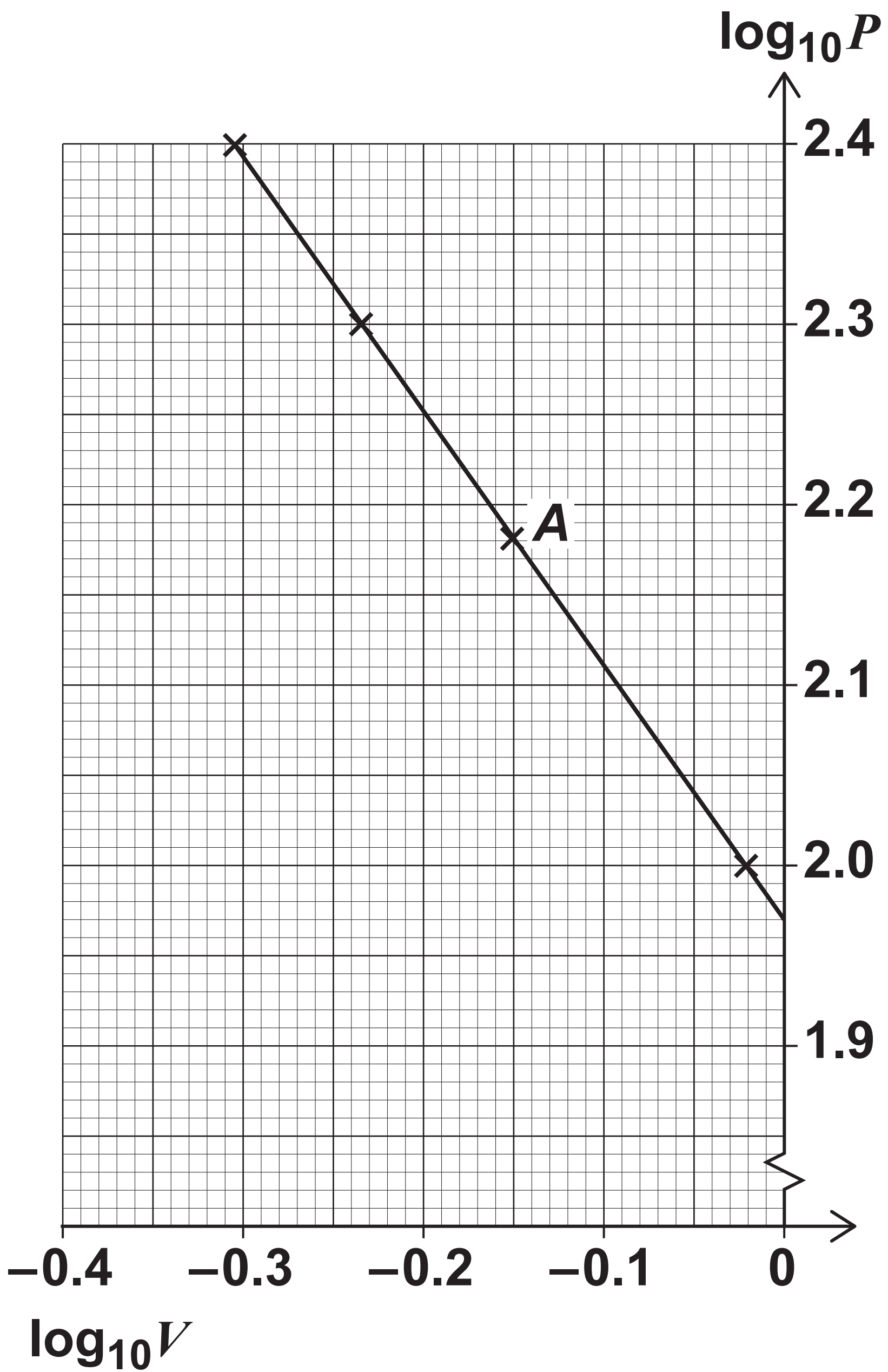
where c and d are constants.

Using four experimental results, Maxine plots $\log_{10}P$ against $\log_{10}V$, as shown in the graph on page 20.

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[Turn over]





8 (a) Find the value of P and the value of V for the data point labelled A on the graph. [2 marks]

[Turn over]

8 (b) Calculate the value of each of the constants c and d . [4 marks]

**8 (c) Estimate the pressure of the gas when the volume is 2 litres.
[2 marks]**

[Turn over]

- 9 Craig is investigating the gradient of chords of the curve with equation $f(x) = x - x^2$

Each chord joins the point $(3, -6)$ to the point $(3 + h, f(3 + h))$

The table shows some of Craig's results.

x	$f(x)$	h	$x + h$	$f(x + h)$	Gradient
3	-6	1	4	-12	-6
3	-6	0.1	3.1	-6.51	-5.1
3	-6	0.01			
3	-6	0.001			
3	-6	0.0001			

- 9 (a) Show how the value -5.1 has been calculated. [1 mark]



9 (b) Complete the third row of the table on page 24. [2 marks]

9 (c) State the limit suggested by Craig's investigation for the gradient of these chords as h tends to 0 [1 mark]

[Turn over]



9(d) Using differentiation from first principles, verify that your result in part (c) is correct. [4 marks]



[Turn over]

10 A curve has equation
 $y = 2x^2 - 8x\sqrt{x} + 8x + 1$ for
 $x \geq 0$

10 (a) Prove that the curve has a
maximum point at $(1, 3)$

**Fully justify your answer.
[9 marks]**



[Turn over]





10(b) Find the coordinates of the other stationary point of the curve and state its nature. [2 marks]

[Turn over]



SECTION B

Answer ALL questions in the spaces provided.

11 In this question use $g = 9.8 \text{ m s}^{-2}$

A ball, initially at rest, is dropped from a height of 40 m above the ground.

Calculate the speed of the ball when it reaches the ground.

[1 mark]

Circle your answer.

$$-28 \text{ m s}^{-1}$$

$$28 \text{ m s}^{-1}$$

$$-780 \text{ m s}^{-1}$$

$$780 \text{ m s}^{-1}$$



12 An object of mass 5 kg is moving in a straight line.

As a result of experiencing a forward force of F newtons and a resistant force of R newtons it accelerates at 0.6 m s^{-2}

Which one of the following equations is correct? [1 mark]

Circle your answer.

$$F - R = 0$$

$$F - R = 5$$

$$F - R = 3$$

$$F - R = 0.6$$

[Turn over]





13

A vehicle, which begins at rest at point P , is travelling in a straight line.

For the first 4 seconds the vehicle moves with a constant acceleration of 0.75 m s^{-2}

For the next 5 seconds the vehicle moves with a constant acceleration of -1.2 m s^{-2}

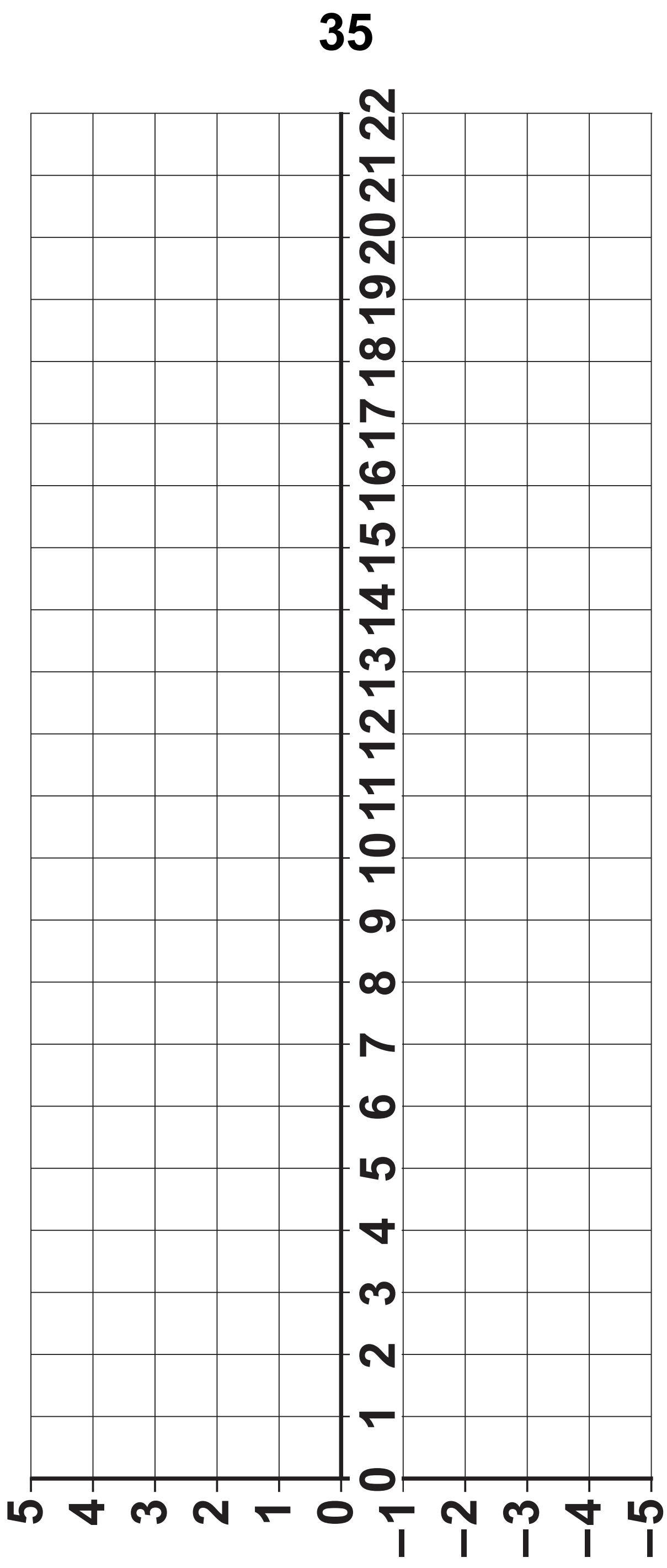
The vehicle then immediately stops accelerating, and travels a further 33 m at constant speed.

34

13 (a) Draw a velocity–time graph for this journey on the grid on page 35. [3 marks]



**Velocity
(m s⁻¹)**



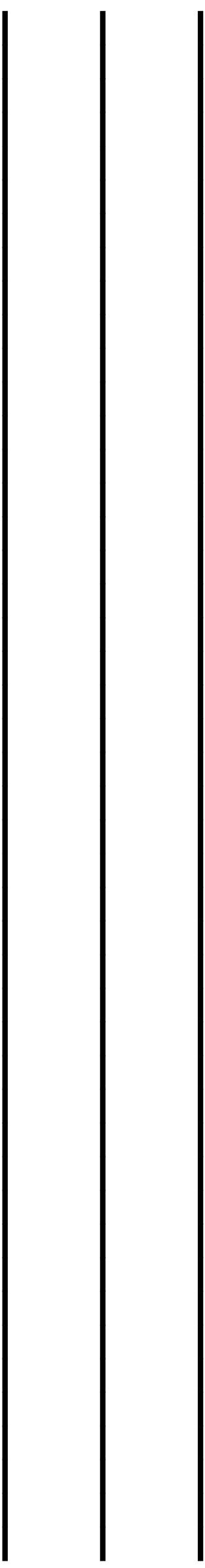
Time (seconds)

[Turn over]



13(b)

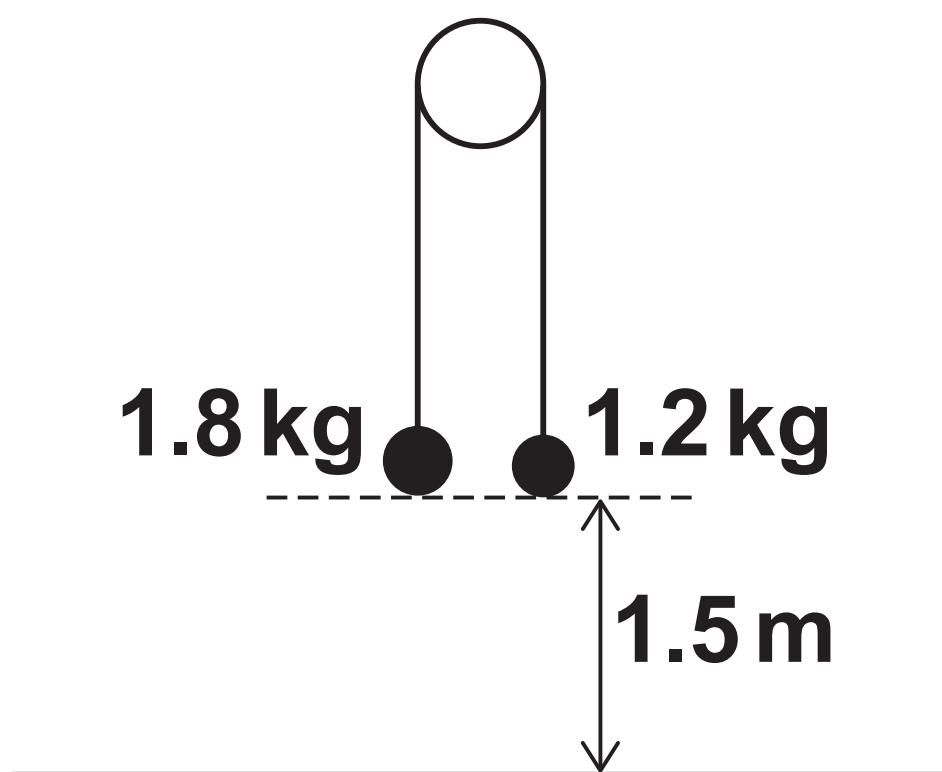
**Find the distance of the car from P after 20 seconds.
[3 marks]**



[Turn over]

14 In this question use $g = 9.81 \text{ m s}^{-2}$

Two particles, of mass 1.8 kg and 1.2 kg, are connected by a light, inextensible string over a smooth peg.



14 (a) Initially the particles are held at rest 1.5 m above horizontal ground and the string between them is taut.

The particles are released from rest.

Find the time taken for the 1.8 kg particle to reach the ground.
[5 marks]



Handwriting practice lines consisting of 15 horizontal black lines spaced evenly down the page.



**14(b) State one assumption you have made in answering part (a).
[1 mark]**

[Turn over]

- 15** A cyclist, Laura, is travelling in a straight line on a horizontal road at a constant speed of 25 km h^{-1}
- A second cyclist, Jason, is riding closely and directly behind Laura. He is also moving with a constant speed of 25 km h^{-1}
- 15 (a)** The driving force applied by Jason is likely to be less than the driving force applied by Laura.

Explain why. [1 mark]

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[Turn over]



15(b) Jason has a problem and stops, but Laura continues at the same constant speed.

Laura sees an accident 40 m ahead, so she stops pedalling and applies the brakes.

She experiences a total resistance force of 40 N

Laura and her cycle have a combined mass of 64 kg

15 (b) (i) Determine whether Laura stops before reaching the accident.

**Fully justify your answer.
[4 marks]**

[Turn over]



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15 (b)(ii) State one assumption you have made that could affect your answer to part (b)(i). [1 mark]

[Turn over]

16 A remote-controlled toy car is moving over a horizontal surface. It moves in a straight line through a point A .

The toy is initially at the point with displacement 3 metres from A . Its velocity, $v \text{ m s}^{-1}$, at time t seconds is defined by

$$v = 0.06(2 + t - t^2)$$

16 (a) Find an expression for the displacement, r metres, of the toy from A at time t seconds.
[4 marks]

[Turn over]

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16(b) In this question use $g = 9.8 \text{ m s}^{-2}$

At time $t = 2$ seconds, the toy launches a ball which travels directly upwards with initial speed 3.43 m s^{-1}

Find the time taken for the ball to reach its highest point. [3 marks]

END OF QUESTIONS



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For Examiner's Use	
Question	Mark
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