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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

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.

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

[Turn over]



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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.

$(-2, 14)$

$(-1, 8)$

$(1, -1)$

$(2, -6)$

- 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.

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

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

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

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



- 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]

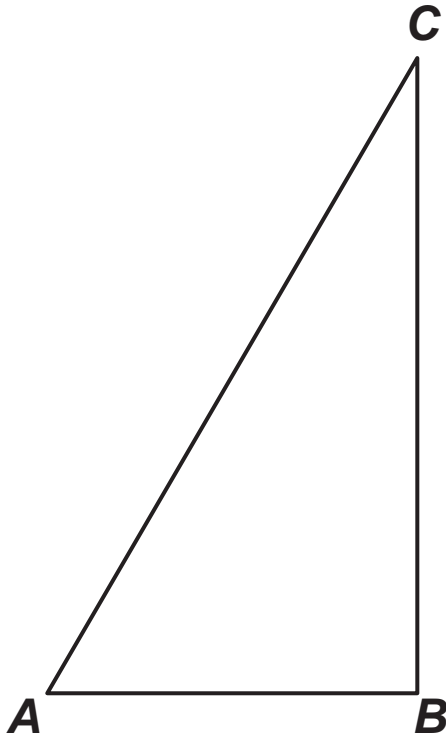


[Turn over]



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]



[Turn over]



- 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.

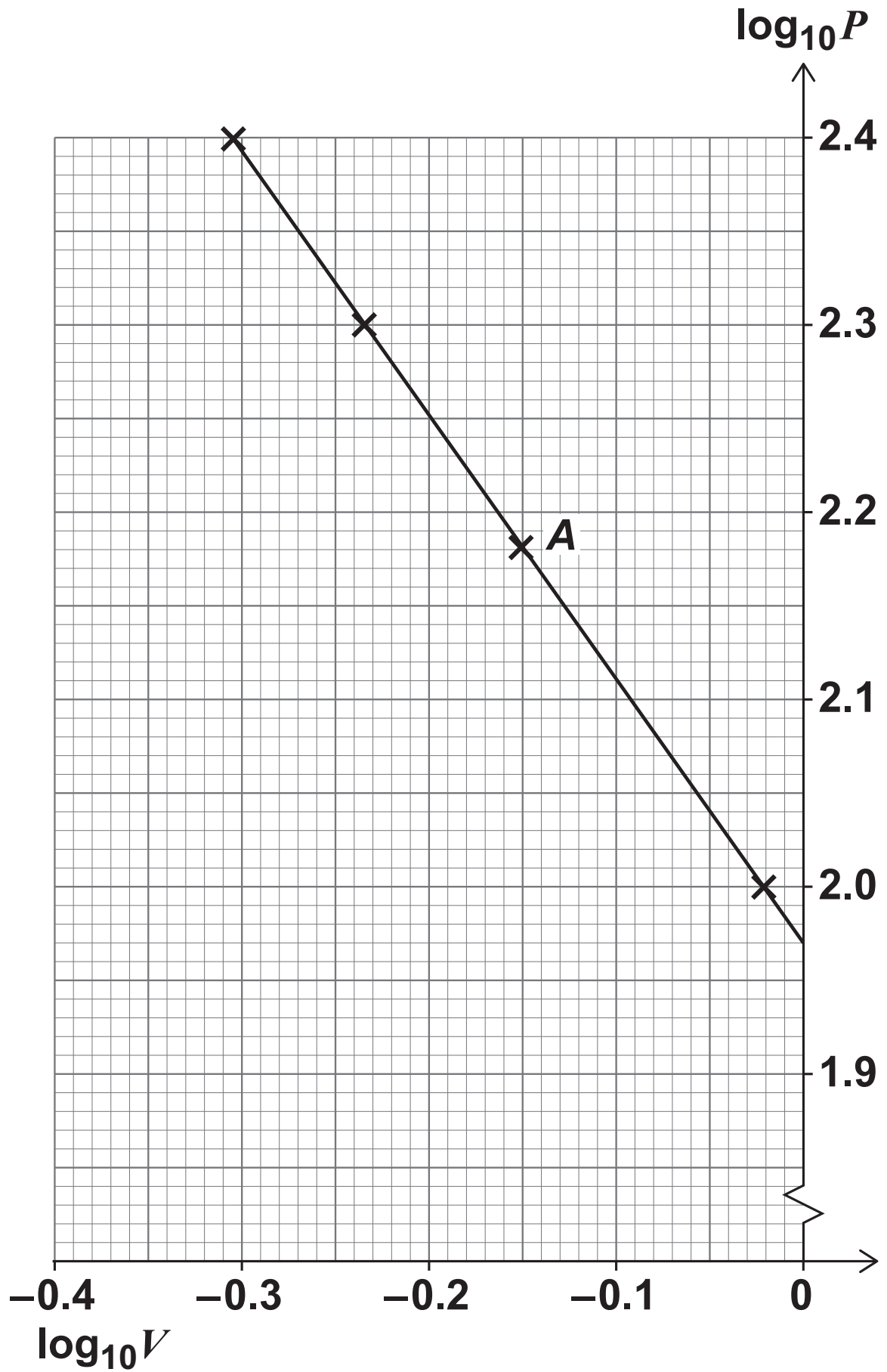
Maxine believes that the pressure and volume are connected by the equation

$$P = cV^d$$

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 17.





[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]

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

[Turn over]



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



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[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 22.
[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]



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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 m s^{-1} 28 m s^{-1} -780 m s^{-1} 780 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.

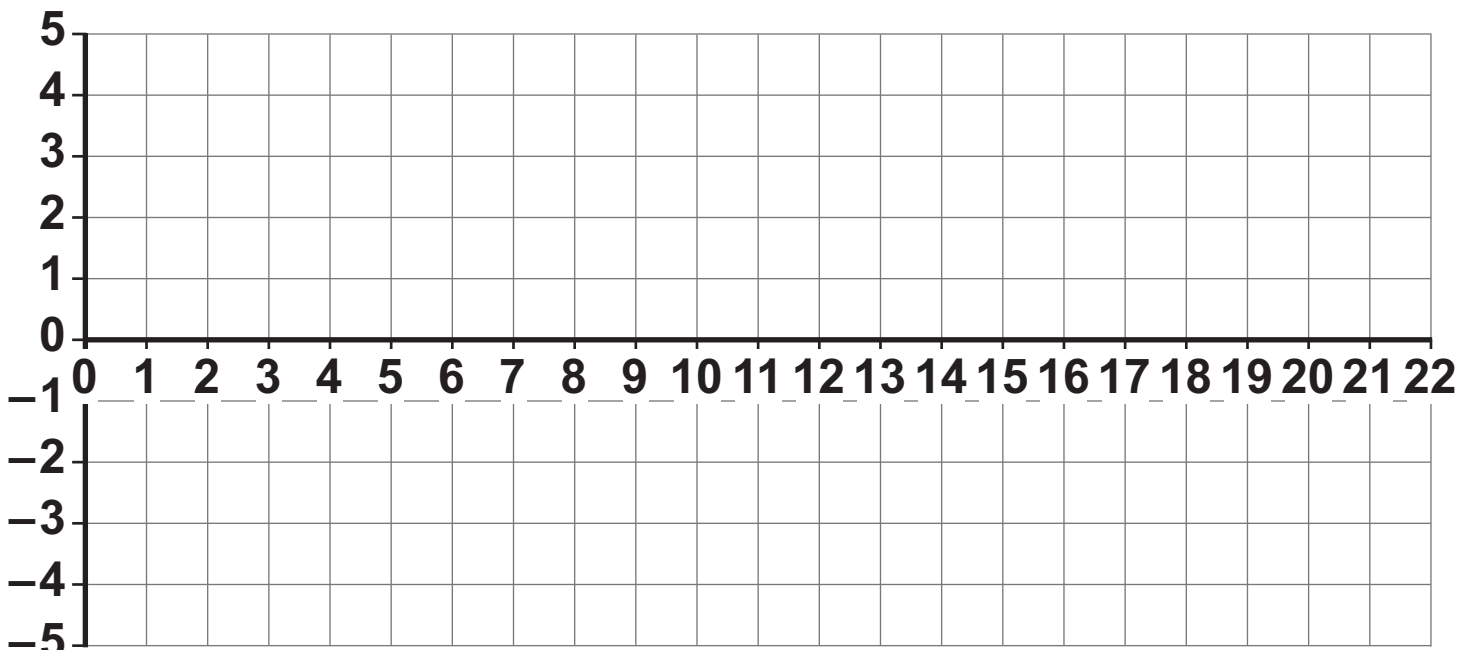
For the first 4 seconds the vehicle moves with a constant acceleration of 0.75 m s^{-2}

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.

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

Velocity
(m s^{-1})



Time (seconds)



- 13 (b) Find the distance of the car from P after 20 seconds. [3 marks]

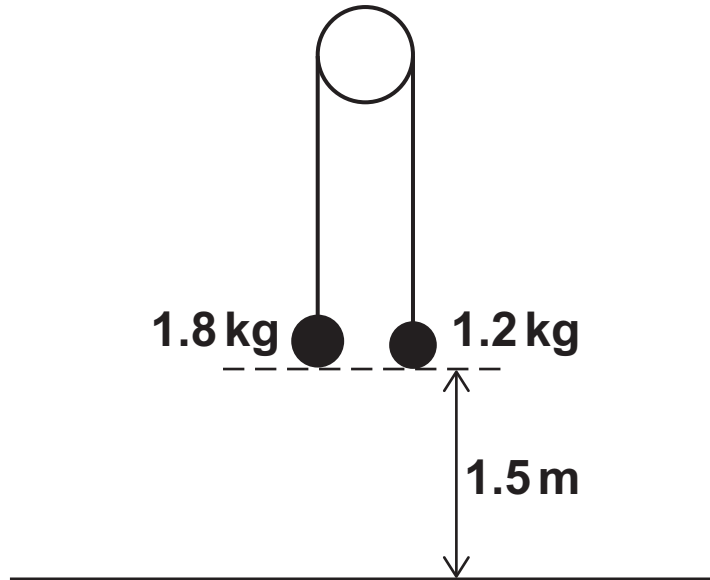
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14

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]



[Turn over]



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

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]

[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]

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]

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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