

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

A-level MATHEMATICS

Paper 2

Wednesday 13 June 2018

Morning

Time allowed: 2 hours

Materials

- You must have the AQA Formulae for A-level Mathematics booklet.
- You should have 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.
- Fill in the boxes at the top of this page.
- 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 100.

Advice

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

For Examiner's Use	
Question	Mark
1	
2	
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12	
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15	
16	
17	
TOTAL	



Section A

Answer **all** questions in the spaces provided.**1** Which of these statements is correct?Tick **one** box.**[1 mark]**

$x = 2 \Rightarrow x^2 = 4$

☐

$x^2 = 4 \Rightarrow x = 2$

☐

$x^2 = 4 \Leftrightarrow x = 2$

☐

$x^2 = 4 \Rightarrow x = -2$

☐**2** Find the coefficient of x^2 in the expansion of $(1 + 2x)^7$

Circle your answer.

[1 mark]

42

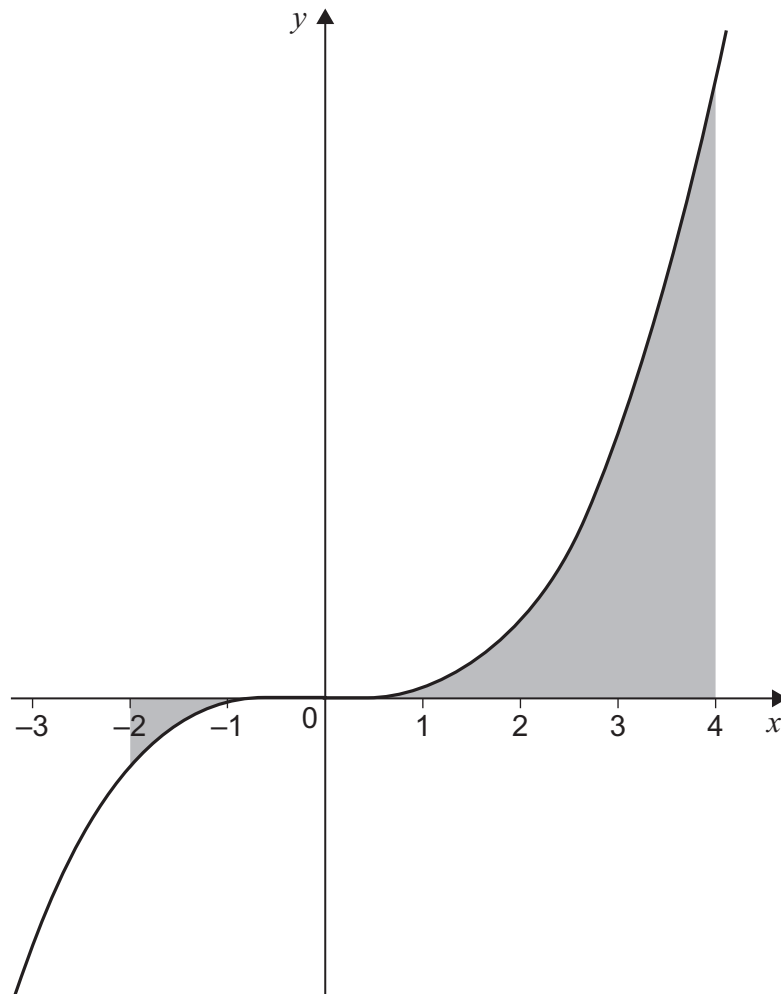
4

21

84



3

The graph of $y = x^3$ is shown.

Find the total shaded area.

Circle your answer.

[1 mark]

-68

60

68

128

Turn over ►

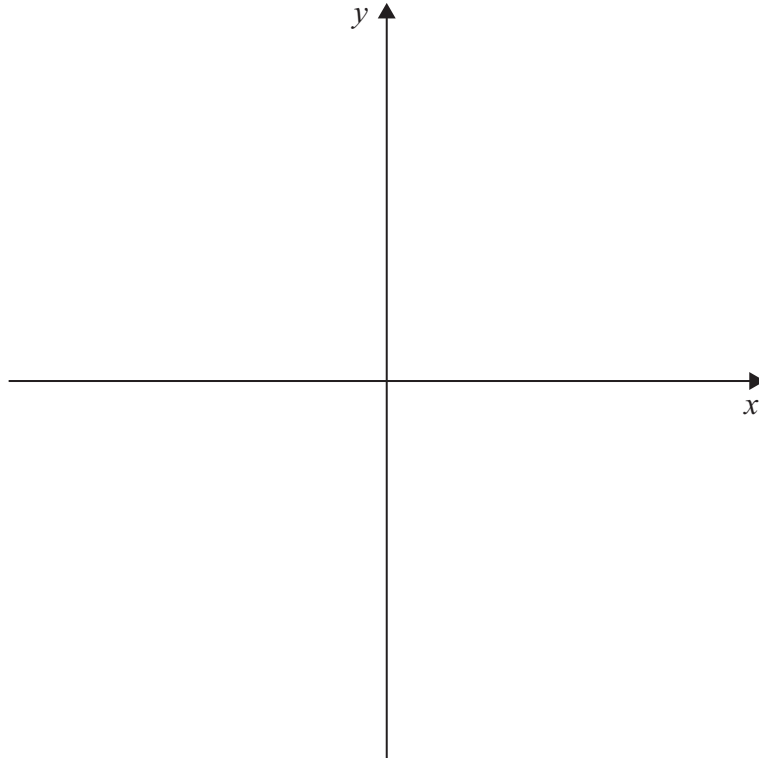


4 A curve, C , has equation $y = x^2 - 6x + k$, where k is a constant.

The equation $x^2 - 6x + k = 0$ has two distinct positive roots.

4 (a) Sketch C on the axes below.

[2 marks]



4 (b) Find the range of possible values for k .

Fully justify your answer.

[4 marks]

Turn over for the next question

Turn over ►



5

Prove that 23 is a prime number.

[2 marks]



Find the coordinates of the stationary point of the curve with equation

[7 marks]

[illegible]

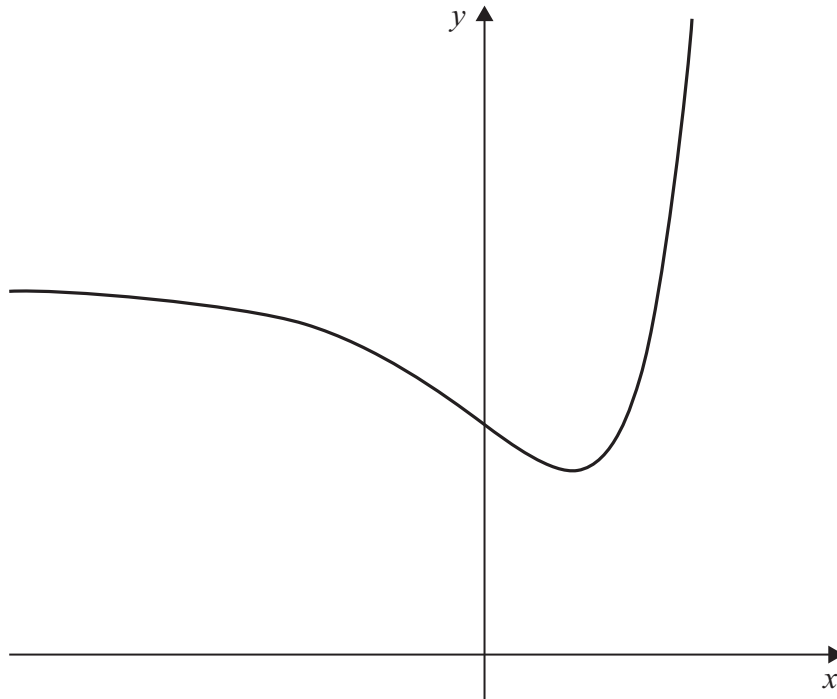
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Turn over ►



The graph of $y = f(x)$ is shown.



[8 marks]

[illegible]

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Fully justify your answer.

[illegible]

8 (b) (i) Show that the least value of $\frac{1}{\sqrt{3}\sin x - 3\cos x + 4}$ is $\frac{2 - \sqrt{3}}{2}$

[2 marks]

8 (b) (ii) Find the greatest value of $\frac{1}{\sqrt{3}\sin x - 3\cos x + 4}$

[1 mark]

Turn over for the next question

Turn over ►



9 A market trader notices that daily sales are dependent on two variables:

number of hours, t , after the stall opens

total sales, x , in pounds since the stall opened.

The trader models the rate of sales as directly proportional to $\frac{8-t}{x}$

After two hours the rate of sales is £72 per hour and total sales are £336

9 (a) Show that

$$x \frac{dx}{dt} = 4032(8 - t)$$

[3 marks]



9 (b) Hence, show that

$$x^2 = 4032t(16 - t)$$

[3 marks]

Question 9 continues on the next page

Turn over ►



Using the results in parts (a) and (b), calculate the earliest time that the trader closes the stall.

[illegible]

9 (c) (ii) Explain why the model used by the trader is not valid at 09.30.

[2 marks]

Turn over for Section B

Turn over ►



Section B

Answer **all** questions in the spaces provided.

10

A garden snail moves in a straight line from rest to 1.28 cm s^{-1} , with a constant acceleration in 1.8 seconds.

Find the acceleration of the snail.

Circle your answer.

[1 mark]

2.30 ms^{-2}

0.71 ms^{-2}

0.0071 ms^{-2}

0.023 ms^{-2}

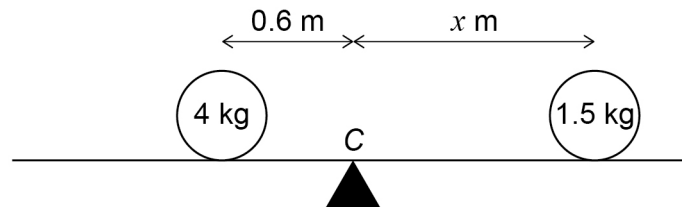
11

A uniform rod, AB , has length 4 metres.

The rod is resting on a support at its midpoint C .

A particle of mass 4 kg is placed 0.6 metres to the left of C .

Another particle of mass 1.5 kg is placed x metres to the right of C , as shown.



The rod is balanced in equilibrium at C .

Find x .

Circle your answer.

[1 mark]

1.8 m

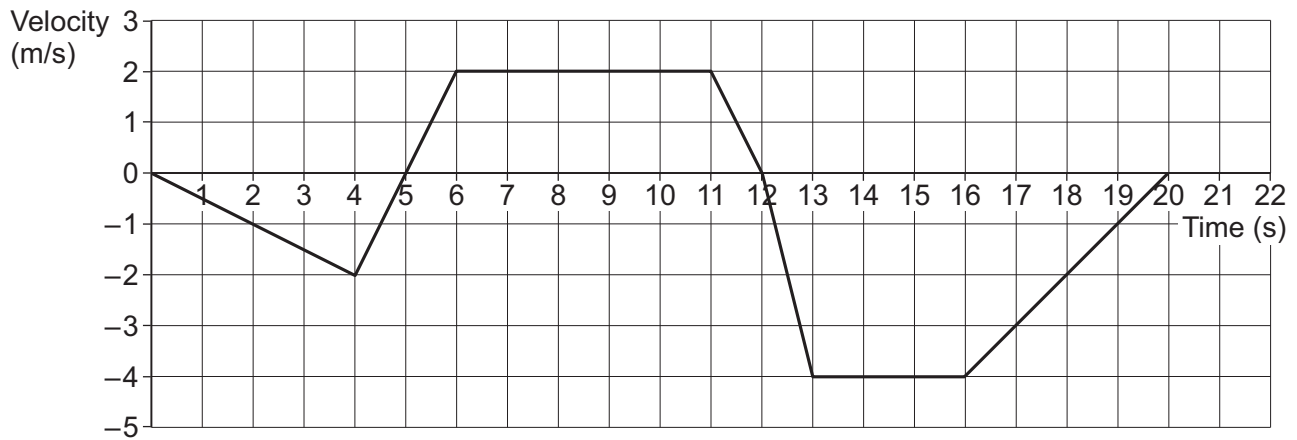
1.5 m

1.75 m

1.6 m



- 12** The graph below shows the velocity of an object moving in a straight line over a 20 second journey.



- 12 (a)** Find the maximum magnitude of the acceleration of the object.

[1 mark]

- 12 (b)** The object is at its starting position at times 0, t_1 and t_2 seconds.

Find t_1 and t_2

[4 marks]

Turn over ►



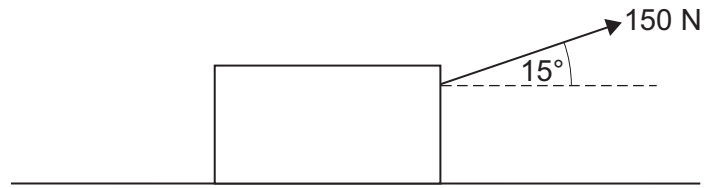
13 In this question use $g = 9.8 \text{ m s}^{-2}$

A boy attempts to move a wooden crate of mass 20 kg along horizontal ground. The coefficient of friction between the crate and the ground is 0.85

13 (a) The boy applies a horizontal force of 150 N. Show that the crate remains stationary. **[3 marks]**



Instead, the boy uses a handle to pull the crate forward. He exerts a force of 150 N, at an angle of 15° above the horizontal, as shown in the diagram.



Fully justify your answer.

[5 marks]

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[1 mark]

[5 marks]

[illegible]

A driver is road-testing two minibuses, A and B, for a taxi company.

A flag is dropped to indicate the start of the test.

Each minibus starts from rest.

The acceleration in m s^{-2} of each minibus is modelled as a function of time, t seconds, after the flag is dropped:

The acceleration of $A = 0.138 t^2$

The acceleration of B = $0.024 t^3$

Find the time taken for A to travel 100 metres.

Give your answer to four significant figures.

[4 marks]

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Question 15 continues on the next page

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Determine which minibus should be bought.

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[1 mark]



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

A particle is projected with an initial speed u , at an angle of 35° above the horizontal.

It lands at a point 10 metres vertically below its starting position.

The particle takes 1.5 seconds to reach the highest point of its trajectory.

16 (a) Find u .

[3 marks]

16 (b) Find the total time that the particle is in flight.

[3 marks]

Turn over ►



17

A buggy is pulling a roller-skater, in a straight line along a horizontal road, by means of a connecting rope as shown in the diagram.



The combined mass of the buggy and driver is 410 kg
A driving force of 300 N and a total resistance force of 140 N act on the buggy.

The mass of the roller-skater is 72 kg
A total resistance force of R newtons acts on the roller-skater.

The buggy and the roller-skater have an acceleration of 0.2 m s^{-2}

17 (a) (i) Find R .

[3 marks]



17 (a) (ii) Find the tension in the rope.

[3 marks]

17 (b) State a necessary assumption that you have made.

[1 mark]

Question 17 continues on the next page

Turn over ►



The driver notices a change in motion of the buggy, and brings it to rest at a distance of 20 m from A.

[5 marks]

[illegible]

17 (c) (ii) Explain the change in motion that the driver noticed.

[2 marks]

END OF QUESTIONS



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