

Please write clearly in block capitals.

Centre number

--	--	--	--	--

Candidate number

--	--	--	--

Surname

Forename(s)

Candidate signature

I declare this is my own work.

AS MATHEMATICS

Paper 1

Wednesday 13 May 2020

Morning

Time allowed: 1 hour 30 minutes

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 need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
TOTAL	



Section AAnswer **all** questions in the spaces provided.

- 1** At the point $(1, 0)$ on the curve $y = \ln x$, which statement below is correct?

Tick (✓) **one** box.**[1 mark]**

The gradient is negative and decreasing

☐

The gradient is negative and increasing

☐

The gradient is positive and decreasing

☐

The gradient is positive and increasing

☐

- 2** Given that $f(x) = 10$ when $x = 4$, which statement below must be correct?

Tick (✓) **one** box.**[1 mark]** $f(2x) = 5$ when $x = 4$ ☐ $f(2x) = 10$ when $x = 2$ ☐ $f(2x) = 10$ when $x = 8$ ☐ $f(2x) = 20$ when $x = 4$ ☐

3 Jia has to solve the equation

$$2 - 2 \sin^2 \theta = \cos \theta$$

where $-180^\circ \leq \theta \leq 180^\circ$

Jia's working is as follows:

$$2 - 2(1 - \cos^2 \theta) = \cos \theta$$

$$2 - 2 + 2 \cos^2 \theta = \cos \theta$$

$$2 \cos^2 \theta = \cos \theta$$

$$2 \cos \theta = 1$$

$$\cos \theta = 0.5$$

$$\theta = 60^\circ$$

Jia's teacher tells her that her solution is incomplete.

3 (a) Explain the **two** errors that Jia has made.

[2 marks]

3 (b) Write down all the values of θ that satisfy the equation

$$2 - 2 \sin^2 \theta = \cos \theta$$

where $-180^\circ \leq \theta \leq 180^\circ$

[2 marks]

Turn over ►



Find the difference between these two terms.

[illegible]

Differentiate from first principles

[4 marks]

[illegible]

6 (a) It is given that

$$f(x) = x^3 - x^2 + x - 6$$

Use the factor theorem to show that $(x - 2)$ is a factor of $f(x)$.

[2 marks]

6 (b) Find the quadratic factor of $f(x)$.

[1 mark]

6 (c) Hence, show that there is only one real solution to $f(x) = 0$

[3 marks]



6 (d) Find the exact value of x that solves

$$e^{3x} - e^{2x} + e^x - 6 = 0$$

[3 marks]

Turn over for the next question

Turn over ►



[6 marks]

[illegible]

[illegible]

Turn over ►



- 8 (a)** Find the equation of the tangent to the curve $y = e^{4x}$ at the point (a, e^{4a}) .

[3 marks]

- 8 (b)** Find the value of a for which this tangent passes through the origin.

[2 marks]



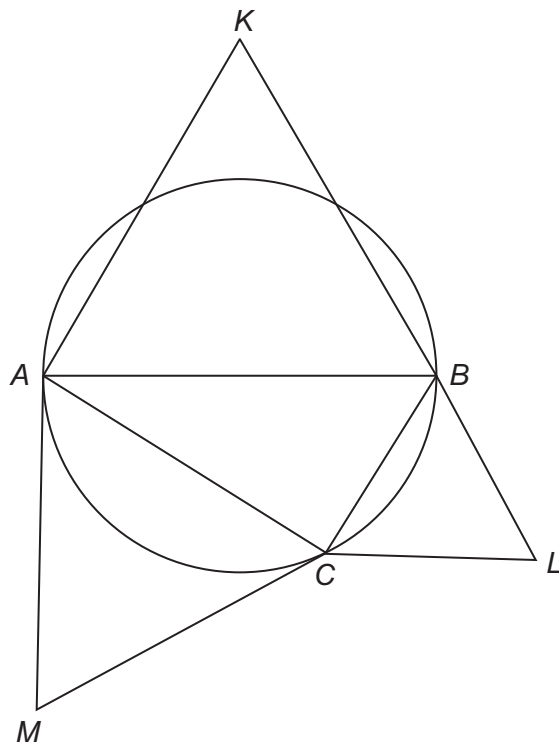
8 (c)

$$e^{4x} = mx$$

[3 marks]

[illegible]

The diagram below shows a circle and four triangles.



Triangles ABK , BCL and CAM are equilateral.

[5 marks]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

[illegible]

Turn over ►



- 10** Raj is investigating how the price, P pounds, of a brilliant-cut diamond ring is related to the weight, C carats, of the diamond.

He believes that they are connected by a formula

$$P = aC^n$$

where a and n are constants.

- 10 (a)** Express $\ln P$ in terms of $\ln C$.

[2 marks]

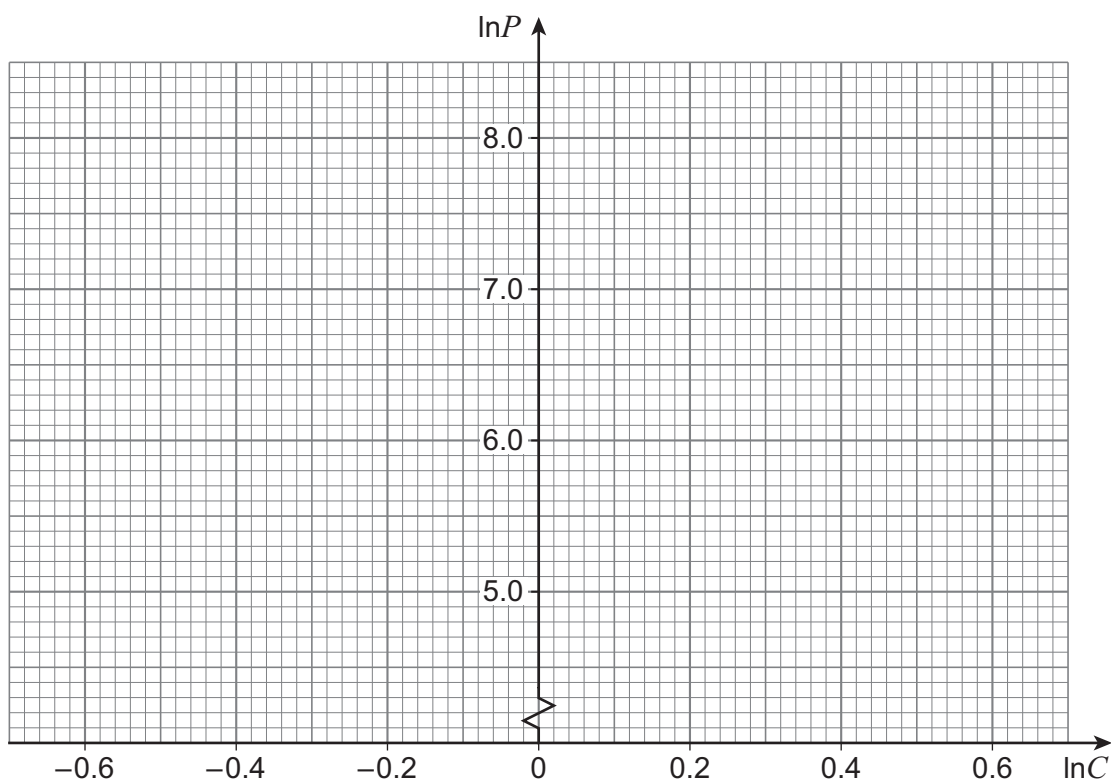
- 10 (b)** Raj researches the price of three brilliant-cut diamond rings on a website with the following results.

C	0.60	1.15	1.50
P	495	1200	1720



10 (b) (i) Plot $\ln P$ against $\ln C$ for the three rings on the grid below.

[2 marks]



10 (b) (ii) Explain which feature of the plot suggests that Raj's belief may be correct.

[1 mark]

Question 10 continues on the next page

Turn over ►



10 (b) (iii) Using the graph on page 15, estimate the value of a and the value of n .

[4 marks]

10 (c) Explain the significance of a in this context.

[1 mark]



10 (d) Raj wants to buy a ring with a brilliant-cut diamond of weight 2 carats.

Estimate the price of such a ring.

[2 marks]

Turn over for the next question

Turn over ►



Section B

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

- 11** A go-kart and driver, of combined mass 55 kg, move forward in a straight line with a constant acceleration of 0.2 m s^{-2}

The total driving force is 14 N

Find the total resistance force acting on the go-kart and driver.

Circle your answer.

[1 mark]

0 N

3 N

11 N

14 N

- 12** One of the following is an expression for the distance between the points represented by position vectors $5\mathbf{i} - 3\mathbf{j}$ and $18\mathbf{i} + 7\mathbf{j}$

Identify the correct expression.

Tick (✓) **one** box.

[1 mark]

$$\sqrt{13^2 + 4^2}$$

☐

$$\sqrt{13^2 + 10^2}$$

☐

$$\sqrt{23^2 + 4^2}$$

☐

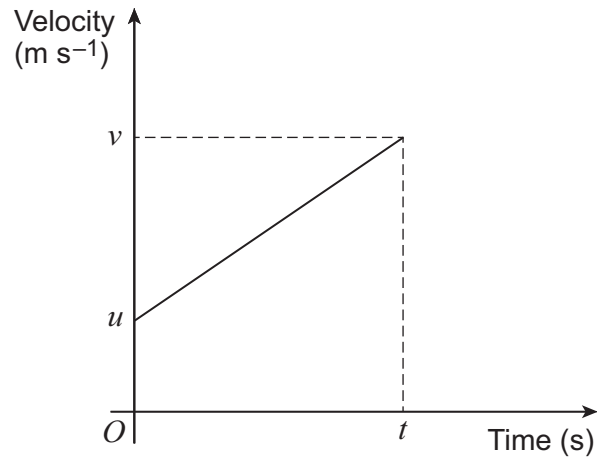
$$\sqrt{23^2 + 10^2}$$

☐


13

An object is moving in a straight line, with constant acceleration $a \text{ m s}^{-2}$, over a time period of t seconds.

It has an initial velocity u and final velocity v as shown in the graph below.



Use the graph to show that

$$v = u + at$$

[3 marks]

Turn over for the next question

Turn over ►



A particle of mass 0.1 kg is initially stationary.

As a result, the particle accelerates in a straight line, reaching a speed of 4 m s^{-1} after travelling a distance of 3.2 m

[5 marks]

[illegible]

Turn over for the next question

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Turn over ►



- 15** A particle, P , is moving in a straight line with acceleration $a \text{ m s}^{-2}$ at time t seconds, where

$$a = 4 - 3t^2$$

- 15 (a)** Initially P is stationary.

Find an expression for the velocity of P in terms of t .

[2 marks]



Find the time at which P passes through O , giving your answer to three significant figures.

[5 marks]

[illegible]

16

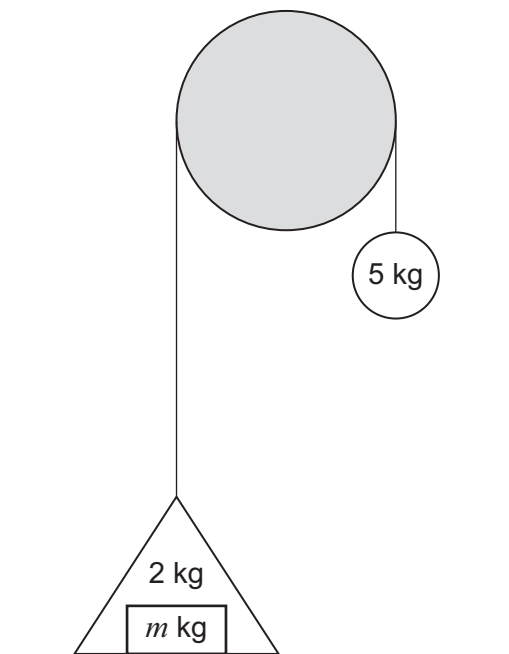
A simple lifting mechanism comprises a light inextensible wire which is passed over a smooth fixed pulley.

One end of the wire is attached to a rigid triangular container of mass 2 kg, which rests on horizontal ground.

A load of m kg is placed in the container.

The other end of the wire is attached to a particle of mass 5 kg, which hangs vertically downwards.

The mechanism is initially held at rest as shown in the diagram below.



The mechanism is released from rest, and the container begins to move upwards with acceleration $a \text{ m s}^{-2}$

The wire remains taut throughout the motion.



$$a = \left(\frac{3 - m}{m + 7} \right) g$$
[illegible]

[1 mark]

Turn over ►



[4 marks]

[illegible]

16 (d) Ignoring air resistance, describe **one** assumption you have made in your model.

[1 mark]

END OF QUESTIONS



There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



Do not write
outside the
box

[illegible]

Do not write
outside the
box

[illegible]

Do not write
outside the
box

[illegible]

There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Copyright information

For confidentiality purposes, all acknowledgements of third-party copyright material are published in a separate booklet. This booklet is published after each live examination series and is available for free download from www.aqa.org.uk.

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team.

Copyright © 2020 AQA and its licensors. All rights reserved.



3 2

Jun20/7356/1



2 0 6 A 7 3 5 6 / 1