PRACTICE PAPER
SET1

Please write clearly, in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

AS MATHEMATICS

Paper 2

Practice paper – Set 1 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 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.

Section A

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

1 Simplify $\dfrac{\left(a^4 b\right)^{\frac{5}{2}}}{(a^3 b^{\frac{1}{2}})^{-3}}$

Circle your answer.

[1 mark]

$a^{19}b$ $\quad$ ab^4 $\quad$ ab $\quad$ $a^{19}b^4$

2 Find the solution of the inequality

$$\left(3-x\right)(x+4)<0$$

Circle your answer.

[1 mark]

$-4<x<3$ $\quad$ $x<-4$ or $x>3$ $\quad$ $-3<x<4$ $\quad$ $x<-3$ or $x>4$

3 (a) Find the first three terms, in ascending powers of x, of the expansion of $\left(3-\frac{x}{2}\right)^8$

[3 marks]

3 (b) Use your expansion to estimate the value of 2.995^8.

[2 marks]

4 (a) (i) Express as a single logarithm

$$\log_a 36 - \frac{1}{2}\log_a 81 + 2\log_a 4 - 3\log_a 2$$

[3 marks]

4 (a) (ii) Hence find the value of a, given

$$\log_a 36 - \frac{1}{2}\log_a 81 + 2\log_a 4 - 3\log_a 2 = \frac{3}{2}$$

[1 mark]

4 (b) Solve the equation $9e^{2x} = 16$, expressing your answer in the form $\ln p$ where p is a rational number.

[2 marks]

Turn over for the next question

5 The points A and B have coordinates (1, –2) and (5, 6) respectively.

Given that the point with coordinates $(p, p + 8)$ lies on the perpendicular bisector of AB, find the value of p.

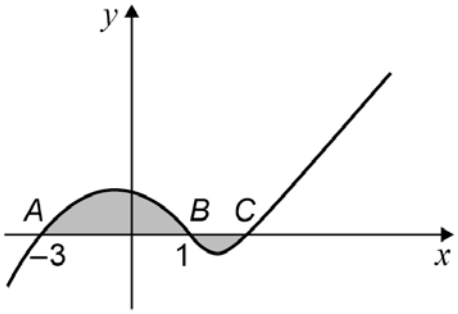
[4 marks]

6 Differentiate $f(x) = 3x^4$ from first principles.

Fully justify your answer.

[5 marks]

7 The curve with equation $y = x^3 - 7x + 6$ is sketched below.



The curve intersects the x-axis at the points A (–3, 0), B (1, 0) and C.

7 (a) Find the coordinates of C.

[1 mark]

7 (b) Find $\int \left(x^3 - 7x + 6 \right) \mathrm{d}x$

[2 marks]

7 (c) Find the total area of the shaded regions enclosed by the curve and the x-axis.

[4 marks]

8 Two models are proposed for the value of a car.

8 (a) The first model suggests that the value of the car, V pounds, is given by $V = 18000 - 6000\sqrt{t}$, where t is the time in years after the car was first purchased.

8 (a) (i) State the value of the car when it was first purchased**.**

[1 mark]

8 (a) (ii) Find V and $\frac{\mathrm{d}V}{\mathrm{d}t}$ when $t = 4$

[3 marks]

8 (a) (iii) Interpret your answers to **(a)(ii)** in the context of the model.

[2 marks]

Question 8 continues on the next page

8 (b) The second model that is proposed suggests that the value of the car, V pounds, is given by $V = ab^{-t}$, where t is the time in years after the car was first purchased.

When $t = 0$, both models give the same value for V.

When $t = 4$, both models give the same value for V.

Find the value of a and the value of b.

[3 marks]

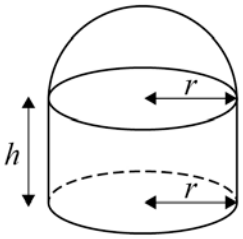
8 (c) Explain, with a reason, which model is likely to be the better model over time.

[2 marks]

Turn over for the next question

9 A company plans to manufacture a flour shaker with a capacity of 200 cubic centimetres.

The company models the flour shaker as a cylinder with base radius r centimetres and height h centimetres, attached to a hemisphere at one end, as shown in the diagram below.



It can be assumed that the flour shaker will be made from a material of negligible thickness.

For a **sphere** radius r, surface area $= 4\pi r^2$ and volume $= \frac{4}{3}\pi r^3$

9 (a) Show that the total surface area A of the flour shaker is $A = \frac{5\pi r^2}{3} + \frac{400}{r}$

[4 marks]

9 (b) In order to minimise the cost of production, the company wishes to minimise the surface area.

Find the dimensions of the flour shaker when it has the minimum surface area.

Fully justify your answer.

[7 marks]

Question 9 continues on the next page

9 (c) State one limitation of the model and suggest an improvement.

[2 marks]

END OF SECTION A

Section B

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

10 In which of the following sampling methods does every member of the population have an equal chance of being selected?

Circle your answer.

[1 mark]

Cluster sampling | Quota sampling | Convenience sampling | Simple random sampling

11 Estimate the standard deviation of the times given in this frequency table.

Time (minutes)	Frequency
$5 \leq t < 10$	4
$10 \leq t < 20$	2
$20 \leq t < 25$	6
$25 \leq t < 40$	1

Circle your answer.

[1 mark]

7.3 | 7.8 | 8.5 | 9.2

12 (a) The events A and B are such that P(A) = 0.4 and P(B) = 0.5

A and B are mutually exclusive.

Find P($A \cup B$).

[1 mark]

12 (b) The events C and D are such that P(C) = 0.8 and P(D) = 0.3.

C and D are independent.

12 (b) (i) Find P($C \cup D$)

[3 marks]

12 (b) (ii) Find P($C' \cap D'$)

[1 mark]

13 Anna investigated the CO emissions for Fords first registered in London in 2016 using data from the Large Data Set.

She calculated the mean of the CO emissions for **all** of these cars driven by male and by female drivers.

	Male	Female
$\overline{x}$	0.401	0.385
Number of drivers	33	37

13 (a) Find the mean CO emissions for the male and female driver data combined.

[2 marks]

13 (b) Virat also investigated CO emissions for Fords first registered in London in 2016. He correctly calculated the mean CO emissions for all of these cars to be 0.38

Using your knowledge of the Large Data Set, explain why there is a difference between the mean you calculated in (a) and Virat's result.

[1 mark]

13 (c) Anna claims that the mean **carbon dioxide** emissions for Fords first registered in London in 2016 is 0.485 g/km.

Using your knowledge of the Large Data Set, explain why this value must be incorrect.

[1 mark]

14 The discrete random variable Y has probability distribution given by:

Y	0	1	2	3	4
P($Y = y$)	a	b	c	0.1	0.15

where a, b and c are constants.

P($Y = 1$) = P($Y \geq 3$)

P($Y = 0$) = P($Y = 2$) – 0.1

Find the values of a, b and c.

[4 marks]

15 It is given that $X \sim B(5, p)$ and $P(X = 3) = P(X = 4)$

15 (a) Find the value of p, given that $0 < p < 1$

[3 marks]

15 (b) Explain how you have used $0 < p < 1$ in your answer to part **(a)**.

[1 mark]

16 A garden centre claims that 90% of a particular type of seed will produce yellow flowers.

Xavier randomly selects 40 of these seeds and 32 produce yellow flowers.

Xavier wants to use a binomial distribution to model the number of yellow flowers produced.

16 (a) State, in context, two assumptions necessary for the binomial distribution to be applicable in this case.

[2 marks]

16 (b) Xavier claims that the garden centre is overstating the proportion of these seeds that will produce yellow flowers.

Carry out a hypothesis test at the 5% significance level to investigate Xavier's claim.

[6 marks]

END OF QUESTIONS

There are no questions printed on this page

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