OXFORD

INTERNATIONAL AQA EXAMINATIONS

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

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INTERNATIONAL AS
MATHEMATICS

(9660/MA02) – Pure, Statistics and Mechanics Unit 1

Tuesday 29 May 2018 07.00 GMT Time allowed: 1 hour 30 minutes

Materials
- For this paper you must have the Oxford International AQA booklet of formulae and statistical tables.
- You may use a graphics calculator.

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 the questions in the spaces provided. Do not write outside the box around each page or on blank pages. If you require extra space, use a supplementary answer book.
- Do all rough work in this book. Cross through any work 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.
- Show all necessary working; otherwise marks may be lost.

For Examiner's Use	
Question	Mark
1	
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11	
12	
13	
TOTAL	

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Section A

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

1 (a) Simplify fully

$$\log_a 1 - 2\log_a a^b$$

[2 marks]

Answer _____

1 (b) Simplify fully

$$2\log_a x^4 + 3\log_a x^2$$

Give your answer in the form $n\log_a x$ where n is an integer.

[2 marks]

Answer _____

4

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Turn over for the next question

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2 The circle C has centre P and equation $x^2 - 22x + y^2 - 16y + 135 = 0$

2 (a) (i) Write the equation of C in the form

$$(x - a)^2 + (y - b)^2 = k$$

[2 marks]

Answer _____

2 (a) (ii) State the radius of C and the coordinates of its centre.

[2 marks]

Radius _____

Centre _____

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2 (b) A chord of C has length 6

Find the perpendicular distance from the centre P to this chord.

Give your answer in the form $\sqrt{a}$ where a is an integer.

[3 marks]

Answer _____

2 (c) A circle C' with centre at the origin has the same radius as the circle C.

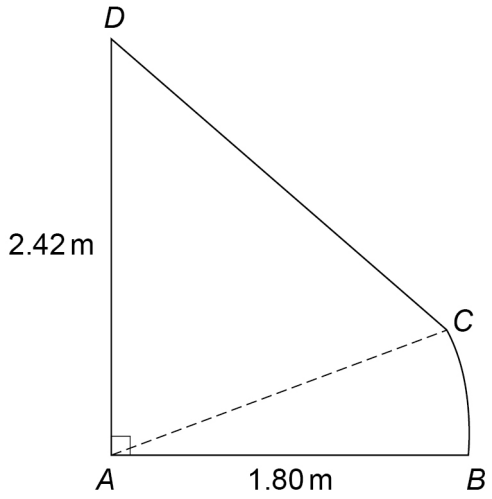
Describe fully the transformation that maps C onto C'.

[2 marks]

9

3 **Figure 1** shows the sail of a small boat.

Figure 1



The straight line *AD* is vertical and has length 2.42 metres.

The straight line *AB* is horizontal and has length 1.80 metres.

The curve *BC* is an arc of a circle with centre *A*.

AC and *CD* are straight lines.

3 (a) The area of the sector *ABC* is $0.648\ \text{m}^2$.

Show that the angle *BAC* is 0.4 radians.

[2 marks]

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3 (b) Find the perimeter of the sail.

Give your answer to two decimal places.

[7 marks]

Answer _____

9

4 Triangle *ABC* has *AC* = $10\ \text{cm}$, *BC* = $4\ \text{cm}$ and angle *BAC* = $18°$

4 (a) Find the possible values for the size of the angle *ABC*.

You may include a sketch to help you with your answer.

[4 marks]

Answer _____

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4 (b) Given that the angle *ABC* is acute, find the area of the triangle *ABC*.

[2 marks]

Answer _____

6

Turn over for the next question

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5 (a) Show that $\frac{16^{2x-\sqrt{x}}}{4^{3x-2\sqrt{x}+7}} \equiv 2^{2x-14}$ when $x \geq 0$

[3 marks]

5 (b) Hence solve the equation $\frac{16^{2x-\sqrt{x}}}{4^{3x-2\sqrt{x}+7}} = 6$

Give your answer in the form $a + b\log_2 c$, where a, b and c are rational numbers.

[2 marks]

$x =$ _____

5

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6 (a) Show that $\sin^4\theta - \cos^4\theta = 2\sin^2\theta - 1$

[3 marks]

6 (b) Hence solve the equation $\sin^4\theta - \cos^4\theta = -0.28$ in the interval $0° \leq \theta \leq 360°$

Give your answers to the nearest degree.

[4 marks]

Answer _____

7

Turn over for the next section

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Section B

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

7 Members of a sports centre have unlimited access to its facilities.

The probability of the event G, that a member uses the gym, is 0.3

The probability of the event S, that a member uses the swimming pool, is 0.8

The probability that a member uses the gym and the swimming pool is 0.25

7 (a) Find the probability that a randomly selected member:

7 (a) (i) uses either the gym or the swimming pool

[2 marks]

Answer _____

7 (a) (ii) uses the gym given that the member uses the swimming pool.

[2 marks]

Answer _____

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7 (b) Explain whether or not the events G and S are independent.

[2 marks]

6

Turn over for the next question

8 (a) In a school, the proportion of students who are right-handed is 0.612

A random sample of 25 students is selected from the school.

Calculate the probability that exactly 18 of these students are right-handed.

[2 marks]

Answer _____

8 (b) A second random sample of 50 children is selected from the school.

The random variable X represents the number of children in the second sample who are in their final year at the school.

X can be modelled by a binomial distribution with $n = 50$ and $p = 0.15$

8 (b) (i) Calculate E(X) and Var(X).

[2 marks]

E(X) = _____ Var(X) = _____

Do not write outside the box

8 (b) (ii) Find $P(6 \leq X < 9)$

[3 marks]

Answer _____

7

Turn over for the next question

9 The discrete random variable X can take only the values 1, 2, 3 and 4

The probability distribution function of X is given in the table where k is a positive constant.

x	1	2	3	4
$P(X = x)$	0.3	k	0.25	$2k$

9 (a) Show that $k = 0.15$

[2 marks]

9 (b) Find $\mathrm{E}(X)$

[1 mark]

Answer _____

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9 (c) Find $\mathrm{Var}(X)$

[2 marks]

Answer _____

9 (d) Find $\mathrm{Var}(4X - 5)$

[2 marks]

Answer _____

7

Turn over for the next section

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Section C

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

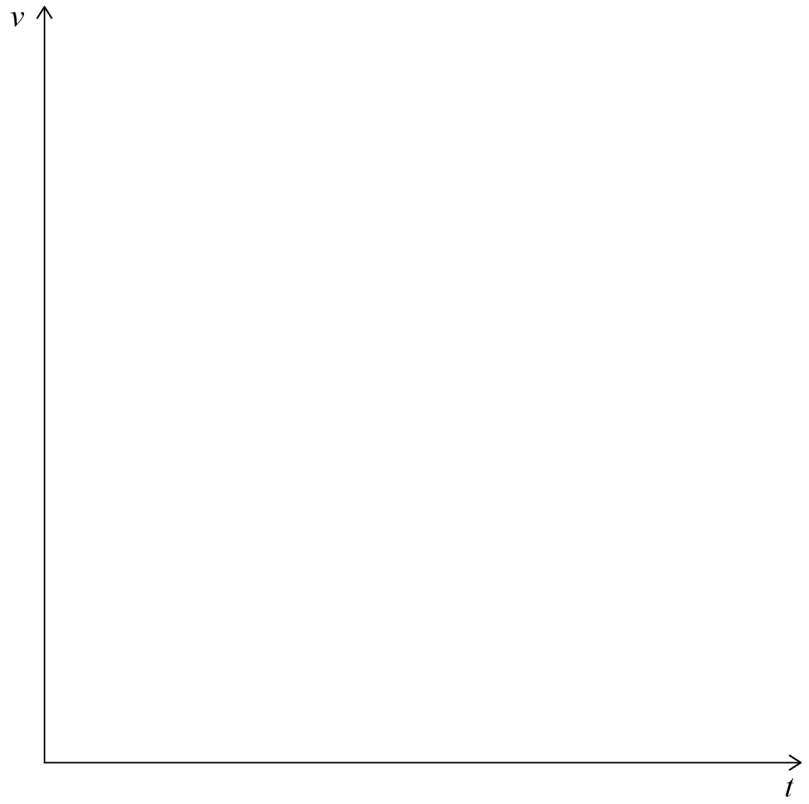
10 Estelle ran a 100-metre race in 16 seconds.

- in the first 5 seconds she accelerated uniformly, travelling a distance of 20 metres.
- in the next 6 seconds she ran at a constant speed.
- in the last 5 seconds she decelerated uniformly.

10 (a) Sketch on the axes below a velocity-time graph for Estelle's run.

Show clearly the value of Estelle's maximum speed.

[2 marks]



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10 (b) Find Estelle's speed when she crossed the finish line.

[3 marks]

Answer _____

5

Turn over for the next question

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11 Two toy cars A and B are moving in the same direction on a smooth horizontal track when they collide. Just before they collide the speed of A is 6 m s^{-1} and the speed of B is 2 m s^{-1}. Immediately after the collision they move together with a speed of 3.6 m s^{-1}.

If the mass of B is 2 kg more than the mass of A, find the mass of A.

[4 marks]

Answer _____

4

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12 A particle moves in a straight line.

At time t seconds, where $t \geq 0$, it has a velocity of $(2t^3 - 15t^2 + 24t + 9)$ m s^{-1}

Find the velocity of the particle when it first stops accelerating.

[5 marks]

Answer _____

5

Turn over for the next question

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13 A van of mass $3000\ \text{kg}$ is used to pull a fairground ride of mass $2000\ \text{kg}$ into position on horizontal ground. The ride is connected to the van by a horizontal tow bar.

As they move a constant resistance force of 600 newtons acts on the ride and a constant resistance force of S newtons acts on the van.

When a forward driving force of 2200 newtons acts on the van, both the van and ride accelerate at $0.15\ \text{m s}^{-2}$

13 (a) Find the value of S.

[3 marks]

Answer _____

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13 (b) Find the tension in the tow bar.

[3 marks]

Answer _____

6

END OF QUESTIONS

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