Based on the 2022 Advanced Information from Edexcel exam board

Predicted A level Mathematics Paper 1 June 2022

Set A

Time: 2 hours

Information for Candidates

- This predicted paper is based on the 2022 advance information from Edexcel exam board
- There are 12 questions in this question paper
- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets.
- Full marks may be obtained for answers to ALL questions

Advice to candidates:

- You must ensure that your answers to parts of questions are clearly labelled.
- You must show sufficient working to make your methods clear to the Examiner
- Answers without working may not gain full credit

Disclaimer: There is no guarantee that any specific topic will be examined this way in the summer and you cannot rely on this as your only source of revision. Visit www.naikermaths.com for more practice papers and plenty of revision resources to help you in your revision.

Question 1

(a) On Diagram 1 sketch the graphs of

(i) $y = x(3 - x)$

(ii) $y = x(x - 2)(5 - x)$

showing clearly the coordinates of the points where the curves cross the coordinate axes. **(4)**

(b) Show that the x coordinates of the points of intersection of

$$y = x(3 - x) \quad \text{and} \quad y = x(x - 2)(5 - x)$$

are given by the solutions to the equation $x(x^2 - 8x + 13) = 0$ **(3)**

The point P lies on both curves. Given that P lies in the first quadrant,

(c) find, using algebra and showing your working, the exact coordinates of P. **(5)**

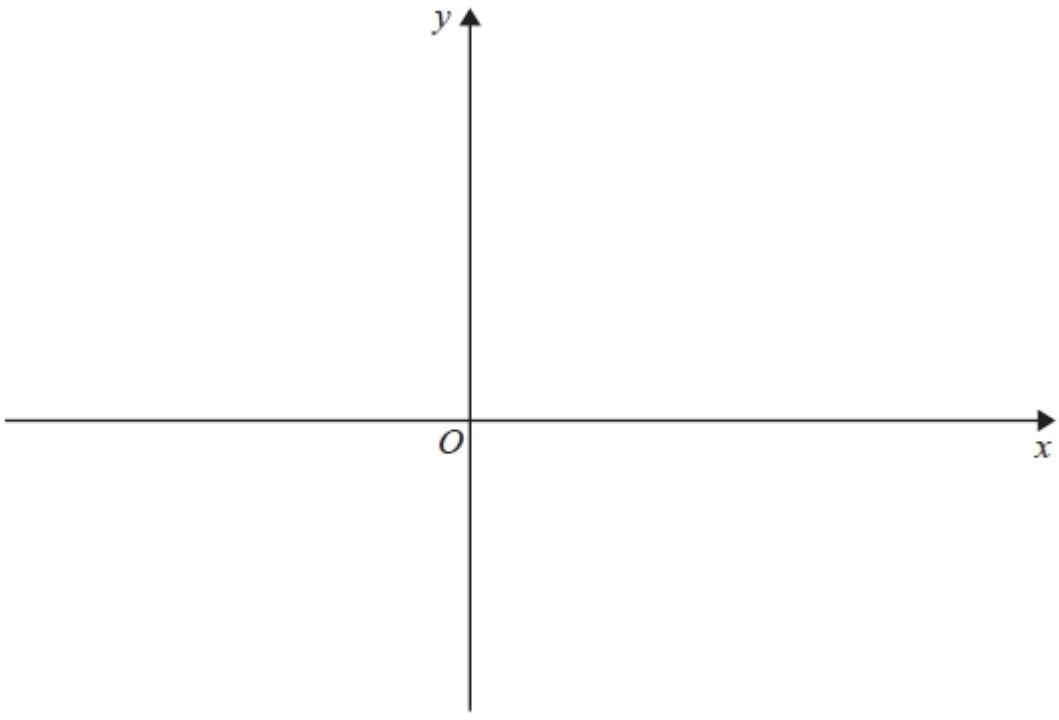

Diagram 1

(Total for question = 12 marks)

Question 2

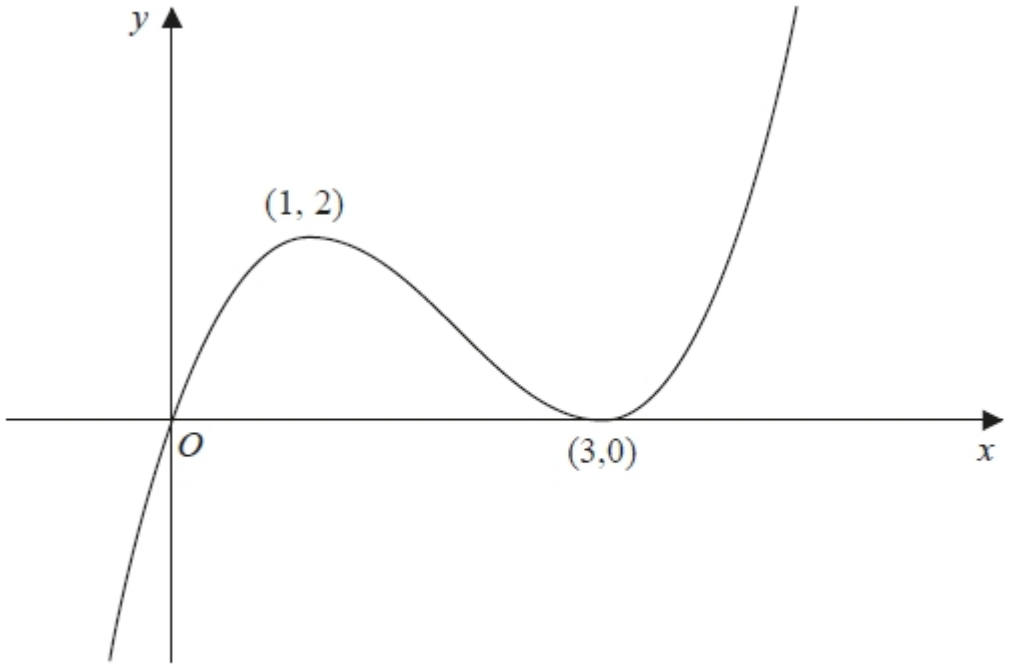

Figure 1

Figure 1 shows a sketch of the curve with equation $y = f(x)$, where $x \in \mathbb{R}$ and $f(x)$ is a polynomial.

The curve passes through the origin and touches the x-axis at the point (3, 0)

There is a maximum turning point at (1, 2) and a minimum turning point at (3, 0)

On separate diagrams, sketch the curve with equation

(i) $y = 3f(2x)$ **(3)**

(ii) $y = f(-x) - 1$ **(3)**

On each sketch, show clearly the coordinates of

- the point where the curve crosses the y-axis
- any maximum or minimum turning points

(Total for question = 6 marks)

Question 3

$$f(x) = kx^3 - 15x^2 - 32x - 12 \qquad \text{where } k \text{ is a constant}$$

Given $(x - 3)$ is a factor of $f(x)$,

(a) show that $k = 9$ **(2)**

(b) Using algebra and showing each step of your working, fully factorise $f(x)$. **(4)**

(c) Solve, for $0 \leq \theta < 360°$, the equation

$$9\cos^3\theta - 15\cos^2\theta - 32\cos\theta - 12 = 0$$

giving your answers to one decimal place. **(2)**

(Total for question = 8 marks)

Question 4

A circle C has equation

$$(x - k)^2 + (y - 2k)^2 = k + 7$$

where k is a positive constant.

(a) Write down, in terms of k,

(i) the coordinates of the centre of C,

(ii) the radius of C. **(2)**

Given that the point $P(2, 3)$ lies on C

(b) (i) show that $5k^2 - 17k + 6 = 0$

(ii) hence find the possible values of k. **(3)**

The tangent to the circle at P intersects the x-axis at point T.

Given that $k < 2$

(c) calculate the exact area of triangle OPT. **(5)**

(Total for question = 10 marks)

Question 5

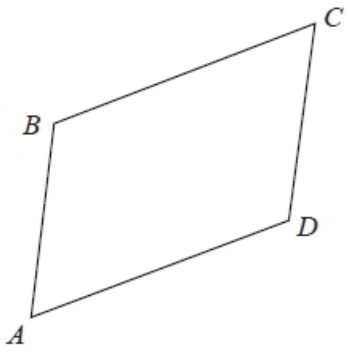

Figure 1

Figure 1 shows a sketch of parallelogram *ABCD*.

Given that $\overrightarrow{AB} = 6\mathbf{i} - 2\mathbf{j} + 3\mathbf{k}$ and $\overrightarrow{BC} = 2\mathbf{i} + 5\mathbf{j} + 8\mathbf{k}$

(a) find the size of angle *ABC*, giving your answer in degrees, to 2 decimal places. **(3)**

(b) Find the area of parallelogram *ABCD*, giving your answer to one decimal place. **(2)**

(Total for question = 5 marks)

Question 6

Ben is saving for the deposit for a house over a period of 60 months.

Ben saves £100 in the first month and in each subsequent month, he saves £5 more than the previous month, so that he saves £105 in the second month, £110 in the third month, and so on, forming an arithmetic sequence.

(a) Find the amount Ben saves in the 40th month. **(2)**

(b) Find the total amount Ben saves over the 60-month period. **(3)**

Lina is also saving for a deposit for a house.

Lina saves £600 in the first month and in each subsequent month, she saves £10 less than the previous month, so that she saves £590 in the second month, £580 in the third month, and so on, forming an arithmetic sequence.

Given that, after n months, Lina will have saved exactly £18 200 for her deposit,

(c) form an equation in n and show that it can be written as

$$n^2 - 121n + 3640 = 0$$ **(3)**

(d) Solve the equation in part (c). **(2)**

(e) State, with a reason, which of the solutions to the equation in part (c) is **not** a sensible value for n. **(1)**

(Total for question = 11 marks)

Question 7

The temperature, θ °C, inside an oven, t minutes after the oven is switched on, is given by

$$\theta = A - 180e^{-kt}$$

where A and k are positive constants.

Given that the temperature inside the oven is initially 18 °C,

(a) find the value of A. **(2)**

The temperature inside the oven, 5 minutes after the oven is switched on, is 90 °C.

(b) Show that $k = p \ln q$ where p and q are rational numbers to be found. **(4)**

Hence find

(c) the temperature inside the oven 9 minutes after the oven is switched on, giving your answer to 3 significant figures, **(2)**

(d) the rate of increase of the temperature inside the oven 9 minutes after the oven is switched on. Give your answer in °C min^{-1} to 3 significant figures. **(3)**

(Total for question = 11 marks)

Question 8

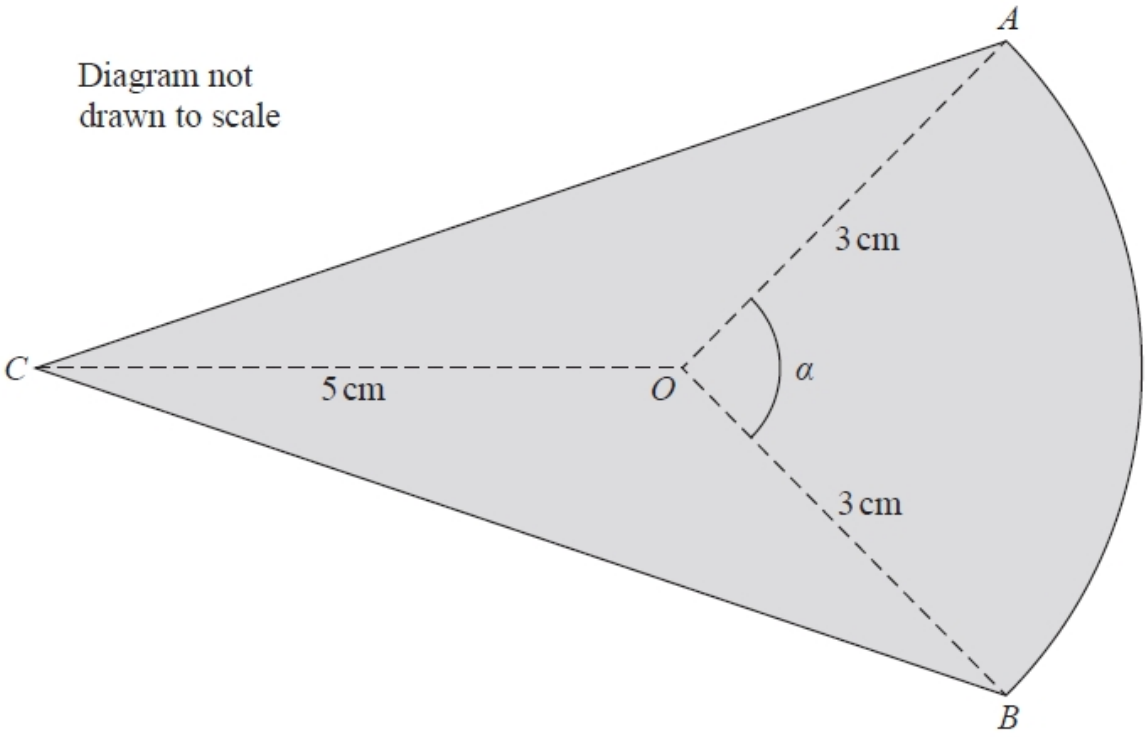

Figure 1

Figure 1 shows the design for a badge.

The design consists of two congruent triangles, *AOC* and *BOC*, joined to a sector *AOB* of a circle centre *O*.

- Angle *AOB* = α
- *AO* = *OB* = 3 cm
- *OC* = 5 cm

Given that the area of sector *AOB* is 7.2 cm^2

(a) show that α = 1.6 radians. **(2)**

(b) Hence find

(i) the area of the badge, giving your answer in cm^2 to 2 significant figures,

(ii) the perimeter of the badge, giving your answer in cm to one decimal place. **(8)**

(Total for question = 10 marks)

Question 9

Given $y = 2x(3x - 1)^5$,

(*a*) find $\frac{dy}{dx}$, giving your answer as a single fully factorised expression. **(4)**

(*b*) Hence find the set of values of x for which $\frac{dy}{dx} \leqslant 0$ **(2)**

(Total for question = 6 marks)

Question 10

In this question you must show all stages of your working.

Solutions relying entirely on calculator technology are not acceptable.

(a) Prove that

$$\frac{\sin 2x}{\cos x} + \frac{\cos 2x}{\sin x} \equiv \operatorname{cosec} x \qquad x \neq \frac{n\pi}{2} \quad n \in \mathbb{Z}$$

(3)

(b) Hence solve, $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$

$$7 + \frac{\sin 4\theta}{\cos 2\theta} + \frac{\cos 4\theta}{\sin 2\theta} = 3\cot^2 2\theta$$

giving your answers in radians to 3 significant figures where appropriate.

(5)

(Total for question = 8 marks)

Question 11

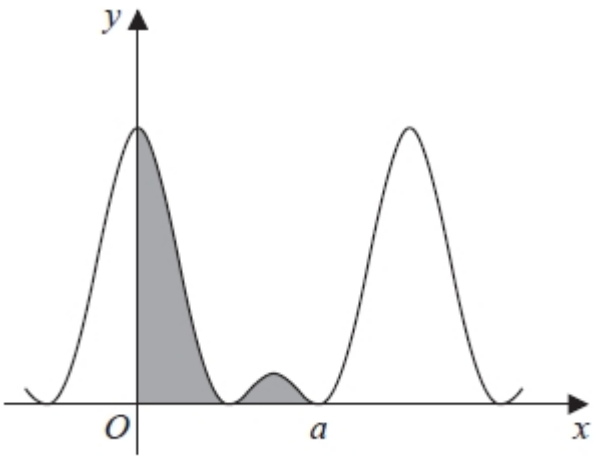

Figure 4

Figure 4 shows a sketch of part of the curve with equation

$$y = (1 + 2\cos 2x)^2$$

(a) Show that

$$(1 + 2\cos 2x)^2 \equiv p + q\cos 2x + r\cos 4x$$

where p, q and r are constants to be found. **(2)**

The curve touches the positive x-axis for the second time when $x = a$, as shown in Figure 4.

The regions bounded by the curve, the y-axis and the x-axis up to $x = a$ are shown shaded in Figure 4.

(b) Find, using algebraic integration and making your method clear, the exact total area of the shaded regions. Write your answer in simplest form. **(5)**

(Total for question = 7 marks)

Question 12

(a) A student's attempt to answer the question

"Prove by contradiction that if n^3 is even, then n is even"

is shown below. Line 5 of the proof is missing.

Assume that there exists a number n such that n^3 is even, but n is odd.

If n is odd then $n = 2p + 1$ where $p \in \mathbb{Z}$

So $n^3 = (2p + 1)^3$

$= 8p^3 + 12p^2 + 6p + 1$

$=$

This contradicts our initial assumption, so if n^3 is even, then n is even.

Complete this proof by filling in line 5. **(1)**

(b) Hence, prove by contradiction that $\sqrt[3]{2}$ is irrational. **(5)**

(Total for question = 6 marks)

TOTAL FOR PAPER IS 100 MARKS