AQA A-Level Maths 2022 Paper 1 B

Do nut turn over the page until instructed to do so.

This assessment is out of 100 marks and you will be given 120 minutes.

When you are asked to by your teacher write your full name below

Name:

Total Marks: / 100



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1 Let the sequence $\{u_n\}$ be defined by the recurrence relation $u_{n+1} = \frac{u_n}{u_{n-1}}$ with $u_1 = 4$ and $u_2 = 7$, then the period of $\{un\}$ is: 1 2 4 6 [1 mark]

2 The coordinates of there minimum point of a polynomial p(x) are (2, -6).

What are the coordinates of the minimum point of 2f(x - 1) + 3?

$$(3, -12) \qquad (3, -9) \qquad (1, -9) \qquad (3, -3)$$

[1 mark]

3 The function f(x) is shown below



Which of the following is the gradient function of f(x)?









Find the Cartesian equation of the curve with parametric equations $x = 2 + 3 \sec(t)$, $y = 1 + 4 \tan(t)$, $0 \le \theta \le 2\pi$. [4 marks]

5 Let
$$p(x) = 2x^3 + ax^2 + bx + 60$$

a) Given that (x - 5) is a factor of p(x) and $p\left(\frac{3}{2}\right) = 0$, find the values of *a* and *b*.

[5 marks]

b) Hence, fully factorise p(x)

[2 marks]

c) Sketch p(x), giving the coordinates of all intersections with the axes.

[3 marks]

6 Describe how to obtain the graph of $y = 3 \sin\left(x - \frac{\pi}{2}\right)$ from the graph of $y = \sin(x)$.

[4 marks]

7 a) Expand $(3 - x)^{-3}$ using the binomial theorem. Your expansion should show terms up to, and including, x^3 .

[4 marks]

b) Hence, find a polynomial approximation for $\frac{1}{(2 + \cos(x))^3}$ which is valid for small angles. Any terms of a greater order than x^4 may be disregarded.

[3 marks]

- 8 Flora invests $\pounds 2000$ in a savings account which pays simple interest at a rate of 2.5 \%.
 - a) Assuming no withdrawals are made , how much will be in Flora's account after 6 years

[3 marks]

b) After how many years will there be more than $\pounds 3060$ in the account?

[3 marks]

9 Show that the curve $x^2y + 3xy = 10$ has only one stationary point and find its coordinates.

[8 marks]

10 Find, by using the substitution $x = 2\sin(\theta)$, the definite integral

$$\int_{-\sqrt{3}}^{\sqrt{3}} \sqrt{4 - x^2} \, \mathrm{d}x$$

[10 marks]

a) Find the integral
$$\int_{-3}^{1} (x+2)(x-1)(x+3) \, dx$$

[2 marks]

b) Approximate this integral using the trapezium rule with 4 strips.

[3 marks]

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c) Calculate the percentage error made in the approximation by the trapezium rule with 4 strips.

[1 marks]

d) What would the error be if using the trapezium rule for the integral of a linear function. Explain your answer.

[2 marks]

e) Explain why, with reference to a diagram, the integral computed in (a) is not the area between the curve y = (x + 3)(x - 1)(x + 2) and the *x*-axis.

[2 marks]

12 A sequence of triangular tiles is to be cut from a sheet of ABS plastic.

The first tile to be cut has two side lengths of 4 cm with an angle of 60° between these tiles. Subsequent tiles are made by enlarging the previous tile by a scale factor of a $\frac{1}{2}$.

Show that all tiles can be cut from a sheet of ABS of area $10\ {\rm cm^2}.$ [6 marks]

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- **13** The points A(2,6) and B(6,2) lie on the circumference of a circle.
 - a) Find the equation of the perpendicular bisector of A and B [4 marks]

b) Given that the line -5x + 9y = -12 passes through the centre of the circle, find the centre and radius of the circle. Fully justify your answer.

[4 marks]

c) Hence, write down the equation of the circle.

[1 mark]

d) Find the area of the portion of the circle which is above the x-axis.

[6 marks]

14 A craftsperson wants to make the design shown below. It is required that the triangle is the same area as the sector of the circle.



a) Show that
$$\frac{50\pi}{3} = \frac{225}{2}\sin(\theta)$$

[3 marks]

b) Set up a Newton-Raphson method to solve the equation derived in part (a). Use $x_1 = \frac{\pi}{3}$ and complete 3 iterations.

[4 marks]

c) Solve the equation exactly and determine to how many decimal places the Newton-Raphson solution is correct to?

[2 marks]

15 The tangent to the curve y = (x + 2)(x - 3)(x - 6) at the point *A*, where x = 4 meets the curve again at the point *B*. Find the distance |AB|.

[8 marks]