OCR
Oxford Cambridge and RSA

AS Level Mathematics A

H230/02 Pure Mathematics and Mechanics

Question Set 1

1 In triangle ABC, $AB = 20\,\text{cm}$ and angle $B = 45°$.

(a) Given that $AC = 16\,\text{cm}$, find the two possible values for angle C, correct to 1 decimal place. **[4]**

(b) Given instead that the area of the triangle is $75\sqrt{2}\,\text{cm}^2$, find BC. **[2]**

2 **(a)** The curve $y = \frac{2}{3+x}$ is translated by four units in the positive x-direction. State the equation of the curve after it has been translated. **[2]**

(b) Describe fully the single transformation that transforms the curve $y = \frac{2}{3+x}$ to $y = \frac{5}{3+x}$. **[2]**

3 In each of the following cases choose one of the statements

$$P \Rightarrow Q \qquad P \Leftarrow Q \qquad P \Leftrightarrow Q$$

to describe the relationship between P and Q

(a) P: $y = 3x^5 - 4x^2 + 12x$

Q: $\frac{dy}{dx} = 15x^4 - 8x + 12$ **[1]**

(b) P: $x^5 - 32 = 0$ where x is

real Q: $x = 2$ **[1]**

(c) P: $\ln y < 0$

Q: $y < 1$ **[1]**

4 **(a)** Express $4x^2 - 12x + 11$ in the form $a(x+b)^2 + c$. **[3]**

(b) State the number of real roots of the equation $4x^2 - 12x + 11 = 0$. **[1]**

(c) Explain fully how the value of r is related to the number of real roots of the equation $p(x+q)^2 + r = 0$ where p, q and r are real constants and $p > 0$. **[2]**

5 **In this question you must show detailed reasoning.**

The line $x + 5y = k$ is a tangent to the curve $x^2 - 4y = 10$. Find the value of the constant k. **[5]**

6 A pan of water is heated until it reaches 100 °C. Once the water reaches 100 °C, the heat is switched off and the temperature T °C of the water decreases. The temperature of the water is modelled by the equation

$$T = 25 + ae^{-kt},$$

where t denotes the time, in minutes, after the heat is switched off and a and k are positive constants.

(a) Write down the value of a. **[1]**

(b) Explain what the value of 25 represents in the equation $T = 25 + ae^{-kt}$. **[1]**

When the heat is switched off, the initial rate of decrease of the temperature of the water is 15 °C per minute.

(c) Calculate the value of k. **[3]**

(d) Find the time taken for the temperature of the water to drop from 100 °C to 45 °C. **[3]**

(e) A second pan of water is heated, but the heat is turned off when the water is at a temperature of less than 100 °C. Suggest how the equation for the temperature as the water cools would be modified by this. **[1]**

7 **(a)** Show that the equation

$$2\sin x \tan x = \cos x + 5$$

can be expressed in the form

$$3\cos^2 x + 5\cos x - 2 = 0.$$ **[3]**

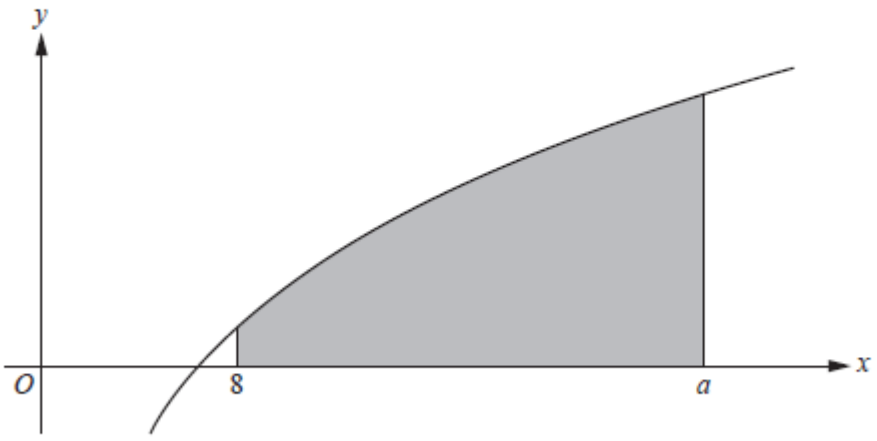
(b) Hence solve the equation

$$2\sin 2\theta \tan 2\theta = \cos 2\theta + 5,$$

giving all values of θ between 0° and 180°, correct to 1 decimal place. **[5]**

8 **In this question you must show detailed reasoning.**

The diagram shows part of the graph of $y = 2x^{\frac{1}{3}} - \frac{7}{x^{\frac{1}{3}}}$. The shaded region is enclosed by the curve, the x-axis and the lines $x = 8$ and $x = a$, where $a > 8$.



Given that the area of the shaded region is 45 square units, find the value of a. **[9]**

Total Marks for Question Set 1: 50