

AS Level Mathematics A

H230/01 Pure Mathematics and Statistics

Question Set 3

1 It is given that $f(x) = 3x - \frac{5}{x^3}$.

Find

(a) $f'(x)$, [3]

(b) $f''(x)$, [2]

(c) $\int f(x) dx$. [3]

2 The circle $x^2 + y^2 - 4x + ky + 12 = 0$ has radius 1.

Find the two possible values of the constant k . [4]

3 In this question you must show detailed reasoning.

(a) The polynomial $f(x)$ is defined by $f(x) = 2x^3 + 3x^2 - 8x + 3$.

(i) Show that $f(1) = 0$. [1]

(ii) Solve the equation $f(x) = 0$. [4]

(b) Hence solve the equation $2 \sin^3 \theta + 3 \sin^2 \theta - 8 \sin \theta + 3 = 0$ for $0^\circ \leq \theta < 360^\circ$. [5]

4 (a) Find the coordinates of the stationary points on the curve $y = x^3 - 6x^2 + 9x$. [4]

(b) The equation $x^3 - 6x^2 + 9x + k = 0$ has exactly one real root.

Using your answers from part (a) or otherwise, find the range of possible values of k . [2]

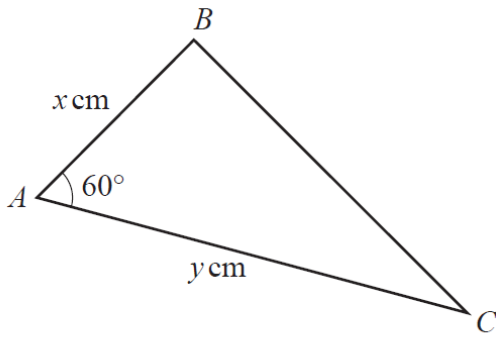
5 (a) Prove that the following statement is **not** true.

m is an odd number greater than 1 $\Rightarrow m^2 + 4$ is prime. [1]

(b) By considering separately the case when n is odd and the case when n is even, prove that the following statement is true.

n is a positive integer $\Rightarrow n^2 + 1$ is not a multiple of 4. [4]

6



The diagram shows triangle ABC , with $AB = x$ cm, $AC = y$ cm and angle $BAC = 60^\circ$. It is given that the area of the triangle is $(x+y)\sqrt{3}$ cm².

(a) Show that $4x + 4y = xy$. [2]

When the vertices of the triangle are placed on the circumference of a circle, AC is a diameter of the circle.

(b) Determine the value of x and the value of y . [4]

7 (a) Write down an expression for the gradient of the curve $y = e^{kx}$. [1]

(b) The line L is a tangent to the curve $y = e^{\frac{1}{2}x}$ at the point where $x = 2$.

Show that L passes through the point $(0, 0)$. [4]

(c) Determine the coordinates of the point of intersection of the curves $y = 3e^x$ and $y = 1 - 2e^{\frac{1}{2}x}$. [6]

Total Marks for Question Set 3: 50

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