

A Level Mathematics A

H240/02 Pure Mathematics and Statistics

Question Set 5

(i)
$$(2x+3)^7$$
 [2]

(ii)
$$x^3 \ln x$$
 [3]

(b) Find
$$\int \cos 5x \, dx$$
. [2]

(c) Find the equation of the curve through
$$(1, 3)$$
 for which $\frac{dy}{dx} = 6x - 5$. [2]

2 Simplify fully
$$\frac{2x^3 + x^2 - 7x - 6}{x^2 - x - 2}$$
. [4]

$$\frac{(y(-1)(x+1)(2x+1))}{(y(-1)(x+1)(2x+1))} = -2x(+3)$$

- 3 In this question you should assume that -1 < x < 1.
 - (a) For the binomial expansion of $(1-x)^{-2}$

(ii) write down the term in
$$x^n$$
. [1]

(b) Write down the sum to infinity of the series $1 + x + x^2 + x^3 + \dots$

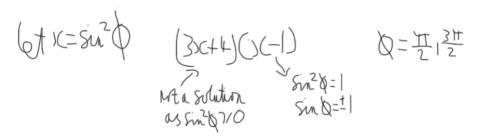
(c) Hence or otherwise find and simplify an expression for $2+3x+4x^2+5x^3+...$ in the form $\frac{a-x}{(b-x)^2}$ where a and b are constants to be determined. [3]

[1]

$$\begin{array}{ccc} (A-IC) & (I-JL)^{-2} \\ = A-JL & (I+2)C+3IC^{2} & ... \\ & A+2LIC-JL & a=2 \\ & a=2 & 2aJ-JL=3JL & a=2 \end{array}$$

4 In this question you must show detailed reasoning.

Solve the equation $3\sin^4\phi + \sin^2\phi = 4$, for $0 \le \phi < 2\pi$, where ϕ is measured in radians. [5]



5 (a) Determine the set of values of n for which $\frac{n^2-1}{2}$ and $\frac{n^2+1}{2}$ are positive integers. [3]

- A 'Pythagorean triple' is a set of three positive integers a, b and c such that $a^2 + b^2 = c^2$.
- (b) Prove that, for the set of values of n found in part (a), the numbers n, $\frac{n^2-1}{2}$ and $\frac{n^2+1}{2}$ form a Pythagorean triple. [2]

$$\frac{R^{2}+\frac{(R^{2}-1)^{2}}{2}-\frac{(R^{2}+1)^{2}}{2}R^{2}+\frac{R^{4}-2R^{2}+1}{4}-\frac{R^{4}+2R^{2}+1}{4}R^{2}-\frac{L_{1}R^{2}}{4}R^{2}-R^{2}}{4}$$

Prove that
$$\sqrt{2}\cos(2\theta + 45^\circ) \equiv \cos^2\theta - 2\sin\theta\cos\theta - \sin^2\theta$$
, where θ is measured in degrees.

$$= 45^{2} - 265 = 51^{2} = 51$$

A and B are fixed points in the x-y plane. The position vectors of A and B are a and b respectively.

State, with reference to points A and B, the geometrical significance of

(a) the quantity
$$a - b$$
,

(b) the vector $\frac{1}{2}(\mathbf{a} + \mathbf{b})$.

The circle P is the set of points with position vector \mathbf{p} in the x-y plane which satisfy

$$\left|\mathbf{p} - \frac{1}{2}(\mathbf{a} + \mathbf{b})\right| = \frac{1}{2}\left|\mathbf{a} - \mathbf{b}\right|.$$

- (c) State, in terms of a and b,
 - (i) the position vector of the centre of P,

It is now given that $\mathbf{a} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 4 \\ 5 \end{pmatrix}$ and $\mathbf{p} = \begin{pmatrix} x \\ v \end{pmatrix}$.

(d) Find a cartesian equation of P.

$$(12)^{2}+16)^{2}$$
 $=40$
 $(12-3)^{2}+(y-2)^{2}-140$

(a) Determine an expression for P in terms of t.

[7]

[2]

$$\frac{1}{|OO-P|} - 1$$

(b) Describe how the population changes over time.

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Total Marks for Question Set 5: 50 Marks



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