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0606/22

May/June 2017

2 hours

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

DO **NOT** WRITE IN ANY BARCODES.

You are reminded of the need for clear presentation in your answers.

The total number of marks for this paper is 80.

This document consists of **12** printed pages.

Mathematical Formulae**1. ALGEBRA***Quadratic Equation*

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \dots + \binom{n}{r} a^{n-r} b^r + \dots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY*Identities*

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for $\triangle ABC$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

1 Solve $|5x + 3| = |1 - 3x|$. [3]

2 **Without using a calculator**, express $\left(\frac{1 + \sqrt{5}}{3 - \sqrt{5}}\right)^{-2}$ in the form $a + b\sqrt{5}$, where a and b are integers. [5]

- 3 Without using a calculator, factorise the expression $10x^3 - 21x^2 + 4$. [5]

- 4 The point P lies on the curve $y = 3x^2 - 7x + 11$. The normal to the curve at P has equation $5y + x = k$. Find the coordinates of P and the value of k . [6]

5 (i) Show that $\frac{d}{dx}[0.4x^5(0.2 - \ln 5x)] = kx^4 \ln 5x$, where k is an integer to be found. [2]

(ii) Express $\ln 125x^3$ in terms of $\ln 5x$. [1]

(iii) Hence find $\int (x^4 \ln 125x^3) dx$. [2]

6 Show that the roots of $px^2 + (p - q)x - q = 0$ are real for all real values of p and q . [4]

7 (a) Given that $a^7 = b$, where a and b are positive constants, find,

(i) $\log_a b$, [1]

(ii) $\log_b a$. [1]

(b) Solve the equation $\log_{81} y = -\frac{1}{4}$. [2]

(c) Solve the equation $\frac{32^{x^2-1}}{4^{x^2}} = 16$. [3]

8 Solutions to this question by accurate drawing will not be accepted.

The points A and B are $(-8, 8)$ and $(4, 0)$ respectively.

(i) Find the equation of the line AB . [2]

(ii) Calculate the length of AB . [2]

The point C is $(0, 7)$ and D is the mid-point of AB .

(iii) Show that angle ADC is a right angle. [3]

The point E is such that $\overrightarrow{AE} = \begin{pmatrix} 4 \\ -7 \end{pmatrix}$.

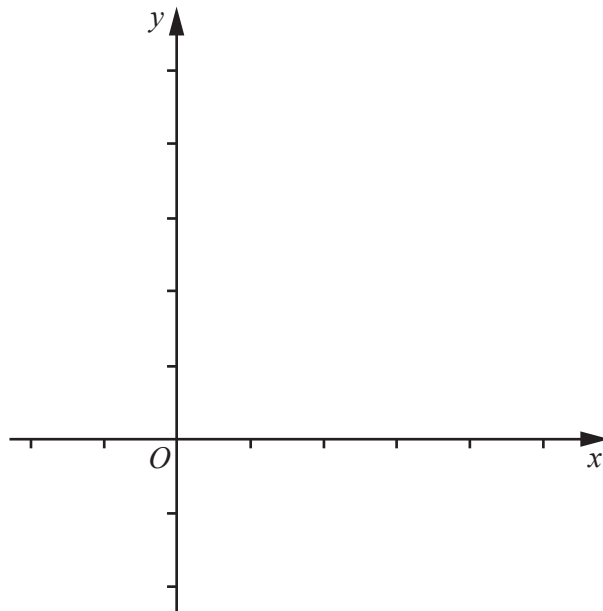
(iv) Write down the position vector of the point E . [1]

(v) Show that $ACBE$ is a parallelogram. [2]

9 A function f is defined, for $x \leq \frac{3}{2}$, by $f(x) = 2x^2 - 6x + 5$.

(i) Express $f(x)$ in the form $a(x - b)^2 + c$, where a , b and c are constants. [3]

(ii) On the same axes, sketch the graphs of $y = f(x)$ and $y = f^{-1}(x)$, showing the geometrical relationship between them. [3]

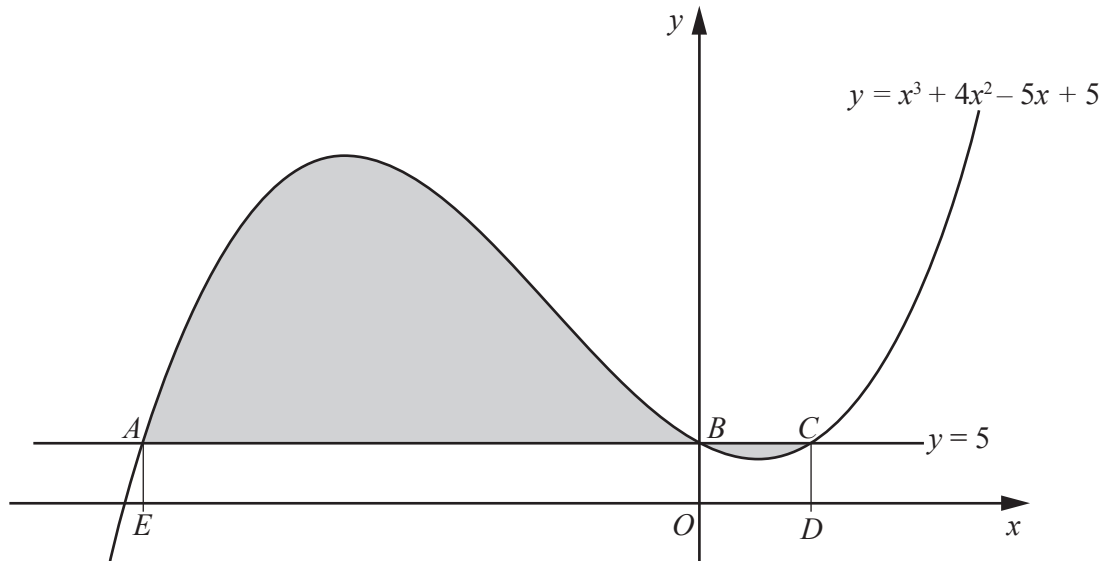


(iii) Using your answer from part (i), find an expression for $f^{-1}(x)$, stating its domain. [3]

10 Solve the equation

(i) $4 \sin\left(3x - \frac{\pi}{4}\right) = 3$ for $0 \leq x \leq \frac{\pi}{2}$ radians, [4]

(ii) $2 \tan^2 y + \sec^2 y = 14 \sec y + 3$ for $0^\circ \leq y \leq 360^\circ$. [5]



The diagram shows part of the curve $y = x^3 + 4x^2 - 5x + 5$ and the line $y = 5$. The curve and the line intersect at the points A , B and C . The points D and E are on the x -axis and the lines AE and CD are parallel to the y -axis.

(i) Find $\int (x^3 + 4x^2 - 5x + 5) dx$. [2]

(ii) Find the area of each of the rectangles $OEAB$ and $OBCD$. [4]

- (iii) Hence calculate the total area of the shaded regions enclosed between the line and the curve. You must show all your working. [4]

12 The function g is defined, for $x > -\frac{1}{2}$, by $g(x) = \frac{3}{2x+1}$.

(i) Show that $g'(x)$ is always negative. [2]

(ii) Write down the range of g . [1]

The function h is defined, for all real x , by $h(x) = kx + 3$, where k is a constant.

(iii) Find an expression for $hg(x)$. [1]

(iv) Given that $hg(0) = 5$, find the value of k . [2]

(v) State the domain of hg . [1]

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