

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 ΔABC

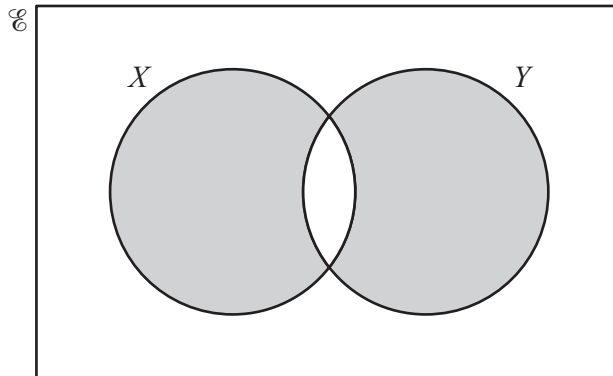
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} .$$

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

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

- 1 The equation of a curve is given by $y = x^2 + ax + 3$, where a is a constant. Given that this equation can also be written as $y = (x + 4)^2 + b$, find
- (i) the value of a and of b , [2]
- (ii) the coordinates of the turning point of the curve. [1]
- 2 (a) Illustrate the following statements using a separate Venn diagram for each.
- (i) $A \cap B = \emptyset$, (ii) $(C \cup D) \subset E$. [2]

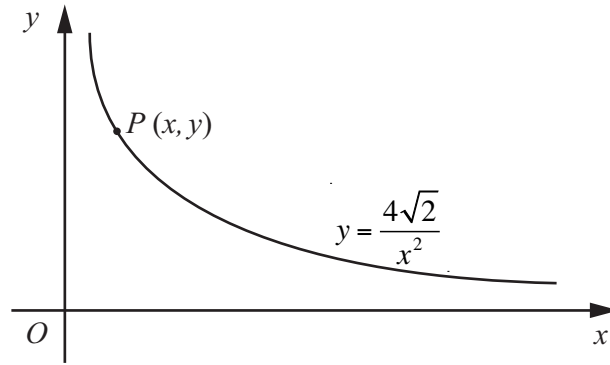
(b)



Express, in set notation, the set represented by the shaded region. [2]

- 3 Find the coordinates of the points where the straight line $y = 2x - 3$ intersects the curve $x^2 + y^2 + xy + x = 30$. [5]
- 4 (i) Sketch, on the same diagram, the graphs of $y = x - 3$ and $y = |2x - 9|$. [3]
- (ii) Solve the equation $|2x - 9| = x - 3$. [2]
- 5 Find the coefficient of x^3 in the expansion of
- (i) $(1 + 3x)^8$, [2]
- (ii) $(1 - 4x)(1 + 3x)^8$. [3]
- 6 (a) Given that $\sin x = p$, find an expression, in terms of p , for $\sec^2 x$. [2]
- (b) Prove that $\sec A \operatorname{cosec} A - \cot A \equiv \tan A$. [4]

7



The diagram shows part of the curve $y = \frac{4\sqrt{2}}{x^2}$. The point $P(x, y)$ lies on this curve.

(i) Write down an expression, in terms of x , for $(OP)^2$. [1]

(ii) Denoting $(OP)^2$ by S , find an expression for $\frac{dS}{dx}$. [2]

(iii) Find the value of x for which S has a stationary value and the corresponding value of OP . [3]

8 Solve the equation

(i) $2^{2x+1} = 20$, [3]

(ii) $\frac{5^{4y-1}}{25^y} = \frac{125^{y+3}}{25^{2-y}}$. [4]

9 Given that $\mathbf{A} = \begin{pmatrix} 4 & 1 \\ 2 & 3 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 3 & -5 \\ 0 & 2 \end{pmatrix}$ and $\mathbf{C} = \begin{pmatrix} 4 \\ 1 \end{pmatrix}$, calculate

(i) \mathbf{AB} , [2]

(ii) \mathbf{BC} , [2]

(iii) the matrix \mathbf{X} such that $\mathbf{AX} = \mathbf{B}$. [4]

10 (a) Find

(i) $\int \frac{12}{(2x-1)^4} dx$, [2]

(ii) $\int x(x-1)^2 dx$. [3]

(b) (i) Given that $y = 2(x-5)\sqrt{x+4}$, show that $\frac{dy}{dx} = \frac{3(x+1)}{\sqrt{x+4}}$. [3]

(ii) Hence find $\int \frac{(x+1)}{\sqrt{x+4}} dx$. [2]

11 The function f is defined by

$$f(x) = (x + 1)^2 + 2 \text{ for } x \geq -1.$$

Find

- (i) the range of f , [1]
 (ii) $f^2(1)$, [1]
 (iii) an expression for $f^{-1}(x)$. [3]

The function g is defined by

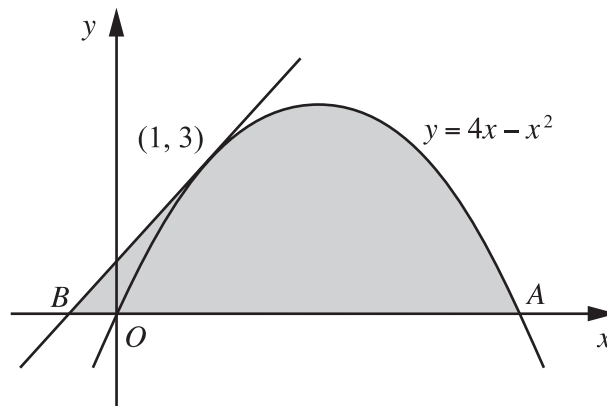
$$g(x) = \frac{20}{x + 1} \text{ for } x \geq 0.$$

Find

- (iv) $g^{-1}(2)$, [2]
 (v) the value of x for which $fg(x) = 38$. [4]

12 Answer only **one** of the following two alternatives.

EITHER



The diagram shows the curve $y = 4x - x^2$, which crosses the x -axis at the origin O and the point A . The tangent to the curve at the point $(1, 3)$ crosses the x -axis at the point B .

- (i) Find the coordinates of A and of B . [5]
 (ii) Find the area of the shaded region. [5]

OR

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

The points $A(-2, 2)$, $B(4, 4)$ and $C(5, 2)$ are the vertices of a triangle. The perpendicular bisector of AB and the line through A parallel to BC intersect at the point D . Find the area of the quadrilateral $ABCD$. [10]

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