



**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  $\Delta ABC$* 

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

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

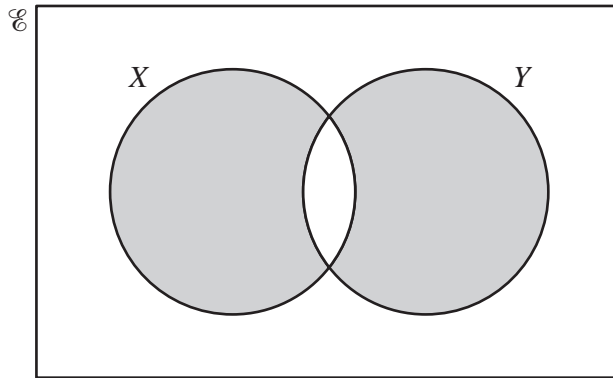
$$\Delta = \frac{1}{2} bc \sin A.$$

- 1 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]

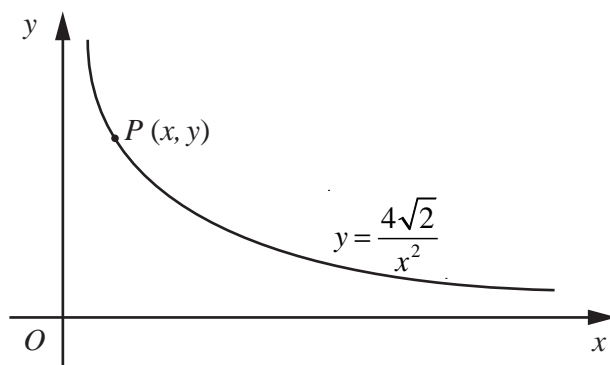
(b)



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

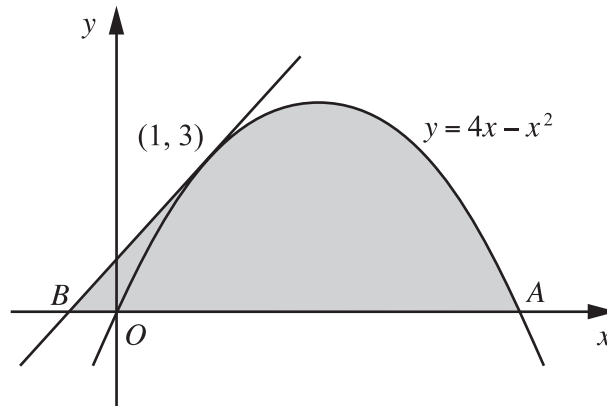
$$g(x) = \frac{20}{x + 1} \text{ for } x \geq 0.$$

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]

**BLANK PAGE**

**BLANK PAGE**

**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.