

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

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

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

Binomial Expansion

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

where n is a positive integer and $\binom{n}{r} = \frac{n!}{r!(n-r)!} = \frac{n(n-1)\dots(n-r+1)}{r!}$

2. TRIGONOMETRY

Identities

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

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

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

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$$

$$\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$$

$$\sin 2A = 2 \sin A \cos A$$

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

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

Formulae for $\triangle ABC$

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

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

$$\Delta = \frac{1}{2} ab \sin C$$

- 1 Given that $\sqrt{64^x} = \frac{2^{1+9x}}{16}$, find the value of x and hence, $\sqrt{64^x}$ in the form $n\sqrt{2}$ where n is an integer. [4]
- 2 Solve the equation $\sqrt{7x+2} + 2x = 0$, explaining why you would or would not reject the solutions obtained. [4]
- 3 Given the area of a rectangle $ABCD$ is $(46 - 14\sqrt{7})$ cm and the length of the rectangle AB is $(10 + \sqrt{7})$ cm. Find, without using a calculator,
- (i) the width of the rectangle BC and show that $BC = (6 - 2\sqrt{7})$ cm, [3]
- (ii) the exact value of AC^2 in the form $(c + d\sqrt{7})$, where c and d are integers. [3]
- 4 (a) Solve the simultaneous equations:
- $$5^y = 25^{x+\frac{3}{2}},$$
- $$y = 3x^2 - 5.$$
- [4]
- (b) Find the greatest value of the integer a for which $ax^2 + 5x - 2$ is ^{negative} ~~positive~~ for all real x . [3]
- (c) Find the range of values of k for which the line $x + 3ky + 1 = 0$ meets the curve $y^2 = 2x - 7$. [3]
- 5 (i) Express $y = -2x^2 + 12x - 11$ in the form $y = a(x+h)^2 + k$, where a , h and k are constants. [3]
- (ii) Sketch the graph of $y = -2x^2 + 12x - 11$, labelling the turning point, the line of symmetry and the y -intercept of the curve. [3]

End of Paper