

MAWA FORMULA SHEET FOR MATHEMATICS SPECIALIST (Unit 1)

Combinatorics

Combinations

$${}^nC_r = \binom{n}{r} = \frac{n!}{r!(n-r)!}$$

Inclusion – exclusion principle

$$|A \cup B| = |A| + |B| - |A \cap B|$$

$$|A \cup B \cup C| = |A| + |B| + |C| - |A \cap B| - |A \cap C| - |B \cap C| + |A \cap B \cap C|$$

Permutations

$${}^nP_r = n(n-1)(n-2)\dots(n-r+1) = \frac{n!}{(n-r)!}$$

Vectors in the plane

Magnitude of a vector

$$|\mathbf{a}| = |(a_1, a_2)| = \sqrt{a_1^2 + a_2^2}$$

Unit vector

$$\hat{\mathbf{a}} = \frac{\mathbf{a}}{|\mathbf{a}|}$$

Scalar product

$$\mathbf{a} \cdot \mathbf{b} = |\mathbf{a}| |\mathbf{b}| \cos \theta \text{ or } \mathbf{a} \cdot \mathbf{b} = a_1 b_1 + a_2 b_2$$

Vector projection (of \mathbf{a} on \mathbf{b})

$$\mathbf{p} = (\mathbf{a} \cdot \hat{\mathbf{b}}) \cdot \hat{\mathbf{b}} = |\mathbf{a}| \cos \theta \cdot \hat{\mathbf{b}}$$

Trigonometric functions formulae from Mathematical Methods

Angle sum and difference identities

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

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

Area of a sector

$$A = \frac{1}{2} r^2 \theta$$

Area of a segment

$$A = \frac{1}{2} r^2 \hat{\theta}$$

Length of an arc

$$l = r\theta$$

Length of a chord

$$l \hat{=} 2r \sin \frac{1}{2} \theta$$

Sine rule

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

Cosine rule

$$c^2 = a^2 + b^2 - 2ab \cos C$$

Cot(x)=1/(tanx)

Tan(x)=sin(x)/cos(x)