Mathematical Formulae

Note: This is not the formulae list provided in all major examinations. This is only for personal reference.

Laws of Indices

$$a^m \times b^n = a^{m+n}$$

$$a^m \div b^n = a^{m-n}$$

$$(a^m)^n = a^{mn}$$

$$a^m \times b^m = (ab)^m$$

$$a^m \div b^m = \left(\frac{a}{b}\right)^m$$

$$a^{-n} = \frac{1}{a^n}$$

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

$$a^{\frac{m}{n}} = (\sqrt[n]{a})^m = \sqrt[n]{a^m}$$

Percentage

$$\%\text{ increase} = \frac{\text{Increase in value}}{\text{Original value}} \times 100\%$$

$$\%\text{ decrease} = \frac{\text{Decrease in value}}{\text{Original value}} \times 100\%$$

Speed

$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

Algebra

$$(a + b)^2 = a^2 + 2ab + b^2$$

$$(a - b)^2 = a^2 - 2ab + b^2$$

$$a^2 - b^2 = (a + b)(a - b)$$

General Formula for $ax^2 + bx + c = 0$

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

Number Pattern

$$T_n = T_1 + (n - 1)d$$

Simple Interest

$$I = \frac{PRT}{100}$$

Compound Interest

$$\text{Total amount} = P\left(1 + \frac{r}{100}\right)^n$$

Polygons

$$\text{Sum of interior angles} = (n-2) \times 180^\circ$$
$$\text{Sum of exterior angles} = 360^\circ$$

Areas of Similar Figures

$$\frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2$$

Volumes of Similar Solids

$$\frac{V_1}{V_2} = \left(\frac{l_1}{l_2}\right)^3$$

Trigonometry for Right-Angled Triangles

$$\sin\theta = \frac{opp}{hyp}$$
$$\cos\theta = \frac{adj}{hyp}$$
$$\tan\theta = \frac{opp}{adj}$$

Further Trigonometry

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$
$$a^2 = b^2 + c^2 - 2bc\cos A$$
$$\text{Area of Triangle} = \frac{1}{2}ab\sin C$$

Sectors

$$\text{Arc Length} = \frac{\theta^\circ}{360^\circ} \times 2\pi r$$
$$= \frac{\theta}{2\pi} \times 2\pi r$$
$$= r\theta$$

$$\text{Sector Area} = \frac{\theta^\circ}{360^\circ} \times \pi r^2$$
$$= \frac{\theta}{2\pi} \times \pi r^2$$
$$= \frac{1}{2}r^2\theta$$

Coordinate Geometry

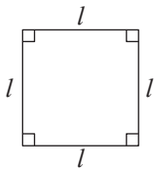
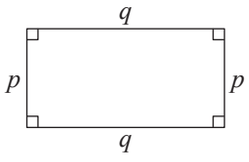
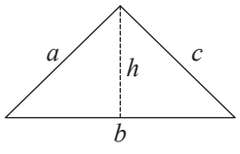
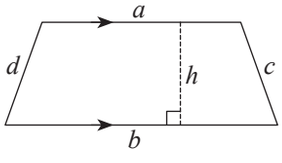
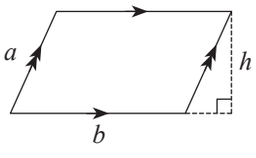
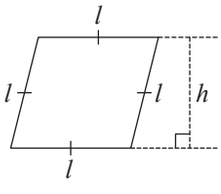
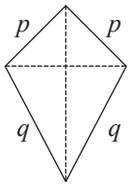
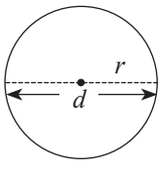
$$\text{Length} = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$
$$\text{Gradient} = \frac{y_2 - y_1}{x_2 - x_1}$$

Statistics

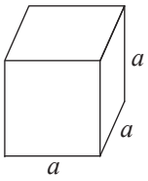
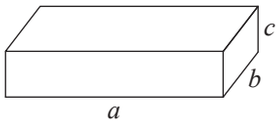
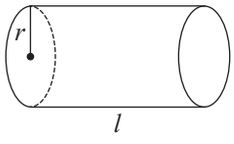
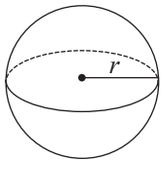
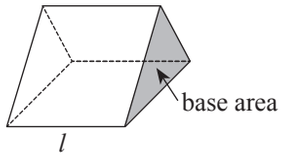
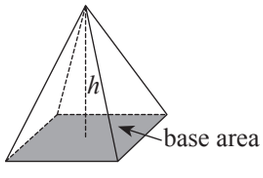
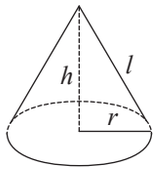
$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$
$$\text{Standard Deviation} = \sqrt{\frac{\Sigma fx^2}{\Sigma f} - \left(\frac{\Sigma fx}{\Sigma f}\right)^2}$$

$$\text{Interquartile range} = \text{Upper quartile} - \text{Lower quartile}$$

Perimeter and Area of Plane Figures

Name	Figure	Area and Perimeter
Square		Area = l^2 Perimeter = $4l$
Rectangle		Area = pq Perimeter = $2(p + q)$
Triangle		Area = $\frac{1}{2}bh$ Perimeter = $a + b + c$
Trapezium		Area = $\frac{1}{2}(a + b)h$ Perimeter = $a + c + b + d$
Parallelogram		Area = bh Perimeter = $2(a + b)$
Rhombus		Area = lh Perimeter = $4l$
Kite		Area = $\frac{1}{2}$ × product of the two diagonals Perimeter = $2(p + q)$
Circle		Area = πr^2 Perimeter = $2\pi r$ or πd

Volume and Surface Area of Solids

Name	Figure	Volume and Total surface area
Cube		Volume = a^3 Total surface area = $6a^2$
Cuboid		Volume = abc Total surface area = $2ac + 2bc + 2ab$
Cylinder		Volume = $\pi r^2 l$ Total surface area of closed cylinder $= 2\pi rl + 2\pi r^2$ Total surface area of open cylinder $= 2\pi rl + \pi r^2$
Sphere		Volume = $\frac{4}{3}\pi r^3$ Total surface area = $4\pi r^2$
Prism		Volume = base area × length Total surface area = sum of areas of the 5 faces
Pyramid		Volume = $\frac{1}{3}$ × base area × height Total surface area = sum of areas of the 5 faces
Cone		Volume = $\frac{1}{3}\pi r^2 h$ Total surface area = $\pi rl + \pi r^2$