Mathematics Standard 2 — HSC Reference Sheet

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Measurement

Area of a sector

$$A = \frac{\theta}{360}\pi r^2$$

Arc length

$$l = \frac{\theta}{360} \times 2\pi r$$

Pythagoras' theorem

$$c^2 = a^2 + b^2$$

Right-triangle trigonometry (SOH CAH TOA)

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

Sine rule

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

Cosine rule

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

Area of a triangle (two sides, included angle)

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

Surface area of a sphere

$$SA = 4\pi r^2$$

Volume of a sphere

$$V = \frac{4}{3}\pi r^3$$

Volume of a cone

$$V = \frac{1}{3}\pi r^2 h$$

Volume of a prism / cylinder

$$V = Ah$$

Simpson's rule

$$A \approx \frac{h}{2}(d_f + d_l)$$

Limits of accuracy

$$\text{Absolute error} = \tfrac{1}{2} \times \text{precision}$$

Area of a trapezium

$$A = \frac{h}{2}(a + b)$$

Financial Mathematics

Simple interest

$$I = Prn$$

Compound interest — future value

$$FV = PV(1 + r)^n$$

Compound interest — present value

$$PV = FV(1 + r)^{-n}$$

Straight-line (flat-rate) depreciation

$$S = V_0 - Dn$$

Declining-balance (reducing-value) depreciation

$$S = V_0(1 - r)^n$$

Future value of an annuity

$$FV = M\frac{(1 + r)^n - 1}{r}$$

Present value of an annuity

$$PV = M\frac{1 - (1 + r)^{-n}}{r}$$

Statistical Analysis

Mean (average)

$$\bar{x} = \frac{\sum x}{n}$$

Standard deviation (population, σ)

$$\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{n}}$$

z-score (standardised score)

$$z = \frac{x - \mu}{\sigma}$$

Empirical rule (68-95-99.7 rule)

$$68\%, 95\%, 99.7\%$$

Least-squares regression line

$$\hat{y} = a + bx$$

Pearson's correlation coefficient

$$-1 \le r \le 1$$

Outlier (IQR rule)

$$x < Q_1 - 1.5\,\text{IQR} \text{ or } x > Q_3 + 1.5\,\text{IQR}$$

Algebra & Linear/Non-linear Relationships

Gradient of a line

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Gradient–intercept form of a line

$$y = mx + b$$

Point–gradient form / general linear equation

$$y - y_1 = m(x - x_1)$$

Exponential model

$$y = a \cdot b^x$$

Networks

Euler's formula for connected planar graphs

$$V - E + F = 2$$

Minimum spanning tree (Prim's / Kruskal's)

$$\text{Total weight} = \sum (\text{weights of selected edges})$$

Shortest path (Dijkstra's algorithm concept)

$$d(v) = \min\big(d(u) + w(u, v)\big)$$

Critical path analysis — float time

$$\text{Float} = \text{LST} - \text{EST}$$

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