

**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**

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

**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,  $\sigma$ )**

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

**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**

$$-1 \leq r \leq 1$$

**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)

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

Critical path analysis — float time

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

