

Prior learning

Parallelogram	$A = bh$ (b base, h height)
Triangle	$A = \frac{1}{2}(bh)$ (b base, h height)
Trapezoid	$A = \frac{1}{2}(a + b)h$ (a, b parallel sides, h height)
Circle	$A = \pi r^2$ (r radius)
Circumference	$C = 2\pi r$ (r radius)
Cuboid	$V = lwh$ (l length, w width, h height)
Cylinder	$V = \pi r^2 h$ (r radius, h height)
Prism	$V = Ah$ (A area of cross-section, h height)
Cylinder, curved surface	$A = 2\pi rh$ (r radius, h height)
Distance (2D)	$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$
Midpoint (2D)	$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

Topic 1: Number and algebra

1.2 Arithmetic: n th term	$u_n = u_1 + (n - 1)d$
Arithmetic: sum	$S_n = \frac{n}{2}(2u_1 + (n - 1)d); \quad S_n = \frac{n}{2}(u_1 + u_n)$
1.3 Geometric: n th term	$u_n = u_1 r^{n-1}$
Geometric: sum	$S_n = \frac{u_1(r^n - 1)}{r - 1} = \frac{u_1(1 - r^n)}{1 - r}, \quad r \neq 1$
1.4 Compound interest	$FV = PV \times \left(1 + \frac{r}{100k}\right)^{kn}$ FV future value, PV present value, n number of years, k compounding periods per year, $r\%$ nominal annual rate of interest
1.5 Exponents, logs	$a^x = b \iff x = \log_a b, \quad a > 0, b > 0, a \neq 1$

1.7 Exponents, logs	$\log_a xy = \log_a x + \log_a y$ $\log_a \frac{x}{y} = \log_a x - \log_a y$ $\log_a x^m = m \log_a x \quad \log_a x = \frac{\log_b x}{\log_b a}$
1.8 Geometric: infinite sum	$S_\infty = \frac{u_1}{1 - r}, \quad r < 1$
1.9 Binomial theorem	$(a + b)^n = a^n + {}^nC_1 a^{n-1} b + \dots + {}^nC_r a^{n-r} b^r + \dots + b^n$ ${}^nC_r = \frac{n!}{r!(n - r)!}$

Topic 2: Functions

2.1 Straight line	$y = mx + c; \quad ax + by + d = 0; \quad y - y_1 = m(x - x_1)$
Gradient	$m = \frac{y_2 - y_1}{x_2 - x_1}$
2.6 Axis of symmetry	$f(x) = ax^2 + bx + c \Rightarrow$ axis of symmetry $x = -\frac{b}{2a}$
2.7 Quadratic formula	$ax^2 + bx + c = 0 \Rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \quad a \neq 0$

Discriminant	$\Delta = b^2 - 4ac$
2.9 Exp and log functions	$a^x = e^{x \ln a}; \quad \log_a a^x = x = a^{\log_a x}, \quad a, x > 0, a \neq 1$

Topic 3: Geometry and trigonometry

3.1 Distance (3D)	$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2 + (z_1 - z_2)^2}$
Midpoint (3D)	$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}, \frac{z_1 + z_2}{2}\right)$
Right pyramid	$V = \frac{1}{3}Ah$ (A area of the base, h height)
Right cone	$V = \frac{1}{3}\pi r^2 h$ (r radius, h height)
Cone, curved surface	$A = \pi rl$ (r radius, l slant height)
Sphere volume	$V = \frac{4}{3}\pi r^3$ (r radius)

Sphere surface	$A = 4\pi r^2$ (r radius)
3.2 Sine rule	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Cosine rule	$c^2 = a^2 + b^2 - 2ab \cos C; \quad \cos C = \frac{a^2 + b^2 - c^2}{2ab}$
Triangle	$A = \frac{1}{2}ab \sin C$
3.4 Arc length	$l = r\theta$ (r radius, θ angle in radians)
Sector area	$A = \frac{1}{2}r^2\theta$ (r radius, θ angle in radians)
3.5 Tangent	$\tan \theta = \frac{\sin \theta}{\cos \theta}$
3.6 Pythagorean	$\cos^2 \theta + \sin^2 \theta = 1$
Double angle	$\sin 2\theta = 2 \sin \theta \cos \theta$ $\cos 2\theta = \cos^2 \theta - \sin^2 \theta = 2 \cos^2 \theta - 1 = 1 - 2 \sin^2 \theta$

Topic 4: Statistics and probability

4.2 Interquartile range	$\text{IQR} = Q_3 - Q_1$
4.3 Mean $\bar{x}$	$\bar{x} = \frac{\sum_{i=1}^k f_i x_i}{n}, \quad \text{where } n = \sum_{i=1}^k f_i$
4.5 Probability	$P(A) = \frac{n(A)}{n(U)}$
Complementary	$P(A) + P(A') = 1$
4.6 Combined	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$
Mutually exclusive	$P(A \cup B) = P(A) + P(B)$
Conditional	$P(A B) = \frac{P(A \cap B)}{P(B)}$
Independent	$P(A \cap B) = P(A)P(B)$
4.7 Expected value (discrete)	$E(X) = \sum xP(X = x)$
4.8 Binomial $X \sim B(n, p)$	$E(X) = np \quad \text{Var}(X) = np(1 - p)$
4.12 Standardized normal	$z = \frac{x - \mu}{\sigma}$

Topic 5: Calculus

5.3 Derivative of x^n	$f(x) = x^n \Rightarrow f'(x) = nx^{n-1}$
5.5 Integral of x^n	$\int x^n dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$
Area, $f(x) > 0$	$A = \int_a^b y dx$
5.6 Derivative of $\sin x$	$f(x) = \sin x \Rightarrow f'(x) = \cos x$
Derivative of $\cos x$	$f(x) = \cos x \Rightarrow f'(x) = -\sin x$
Derivative of e^x	$f(x) = e^x \Rightarrow f'(x) = e^x$
Derivative of $\ln x$	$f(x) = \ln x \Rightarrow f'(x) = \frac{1}{x}$
Chain rule	$y = g(u), \text{ where } u = f(x) \Rightarrow \frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$
Product rule	$y = uv \Rightarrow \frac{dy}{dx} = u \frac{dv}{dx} + v \frac{du}{dx}$
Quotient rule	$y = \frac{u}{v} \Rightarrow \frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$
5.9 Acceleration	$a = \frac{dv}{dt} = \frac{d^2s}{dt^2}$
Distance travelled	$\text{distance} = \int_{t_1}^{t_2} v(t) dt$
Displacement	$\text{displacement} = \int_{t_1}^{t_2} v(t) dt$
5.10 Standard integrals	$\int \frac{1}{x} dx = \ln x + C \quad \int \sin x dx = -\cos x + C$ $\int \cos x dx = \sin x + C \quad \int e^x dx = e^x + C$
5.11 Area to x -axis	$A = \int_a^b y dx$