Formula book

Mathematical Methods 2025

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

Mensuration			
circumference of a circle	$C = 2\pi r$	area of a circle	$A = \pi r^2$
area of a parallelogram	$A = bh$	area of a trapezium	$A = \frac{1}{2}(a+b)h$
area of a triangle	$A = \frac{1}{2}bh$	total surface area of a cone	$S = \pi rs + \pi r^2$
total surface area of a cylinder	$S = 2\pi rh + 2\pi r^2$	surface area of a sphere	$S = 4\pi r^2$
volume of a cone	$V = \frac{1}{3}\pi r^2 h$	volume of a cylinder	$V = \pi r^2 h$
volume of a prism	$V = Ah$	volume of a pyramid	$V = \frac{1}{3}Ah$
volume of a sphere	$V = \frac{4}{3}\pi r^3$		

Graph equations		
quadratic	$y = a(x-h)^2 + k$	$y = a(x-x_1)(x-x_2)$
cubic	$y = a(x-h)^3 + k$	$y = a(x-x_1)(x-x_2)(x-x_3)$
circle	$(x-h)^2 + (y-k)^2 = r^2$	
square root	$y = a\sqrt{x-h} + k$	
reciprocal	$y = \frac{a}{(x-h)} + k$	
exponential	$y = r^{(x-h)} + k$ (where $r > 0$)	
logarithmic	$y = \log_a(x-h) + k$ (where $a > 1$)	
trigonometric	$y = a\sin(b(x-h)) + k$	$y = a\cos(b(x-h)) + k$

Logarithms		
exponents and logarithms	$a^x = b \Leftrightarrow x = \log_a(b)$	
logarithmic laws and definitions	$\log_a(x) + \log_a(y) = \log_a(xy)$	$\log_a(x^n) = n\log_a(x)$
	$\log_a(x) - \log_a(y) = \log_a\left(\frac{x}{y}\right)$	$\log_a(x) = \frac{\log_b(x)}{\log_b(a)}$
	$\log_a(1) = 0$	$\log_a(a) = 1$

Calculus

$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$		$\int_a^b f(x)dx \approx \text{limit of sums } \sum_i f(x_i)\delta x_i$ $\int_a^b f(x)dx = F(b) - F(a)$
$\frac{d}{dx}(f(x) + g(x)) = \frac{d}{dx}f(x) + \frac{d}{dx}g(x)$		$\int (f(x) + g(x))dx = \int f(x)dx + \int g(x)dx$ $\int k f(x)dx = k\int f(x)dx$
$\frac{d}{dx}x^n = nx^{n-1}$		$\int x^n dx = \frac{x^{n+1}}{n+1} + c \text{ for } n \neq -1$
$\frac{d}{dx}e^x = e^x$	$\frac{d}{dx}e^{f(x)} = f'(x)e^{f(x)}$	$\int e^x dx = e^x + c$
$\frac{d}{dx}\ln(x) = \frac{1}{x}$	$\frac{d}{dx}\ln(f(x)) = \frac{f'(x)}{f(x)}$	$\int \frac{1}{x}dx = \ln(x) + c \text{ for } x > 0$
$\frac{d}{dx}\sin(x) = \cos(x)$	$\frac{d}{dx}\sin(f(x)) = f'(x)\cos(f(x))$	$\int \sin(x)dx = -\cos(x) + c$
$\frac{d}{dx}\cos(x) = -\sin(x)$	$\frac{d}{dx}\cos(f(x)) = -f'(x)\sin(f(x))$	$\int \cos(x)dx = \sin(x) + c$
chain rule	If $y = f(u)$ and $u = g(x)$ then $\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$	
product rule	$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$	
quotient rule	$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$	
trapezoidal rule	$\int_a^b f(x)dx \approx \frac{w}{2}\left[f(x_0) + 2\left(f(x_1) + f(x_2) + f(x_3) + \ldots f(x_{n-1})\right) + f(x_n)\right]$ where $w = \frac{b-a}{n}$	

Trigonometry

cosine rule	$c^2 = a^2 + b^2 - 2ab\cos(C)$
sine rule	$\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)}$
area of a triangle	$\text{area} = \frac{1}{2}bc\sin(A)$
Pythagorean identity	$\sin^2(A) + \cos^2(A) = 1$

Statistics		
binomial theorem	$(x+y)^n = x^n + \binom{n}{1}x^{n-1}y + \ldots + \binom{n}{r}x^{n-r}y^r + \ldots + y^n$	
binomial probability	$P(X=r) = \binom{n}{r}p^r(1-p)^{n-r}$	
discrete random variable X	mean	$E(X) = \mu = \sum p_i x_i$
	variance	$Var(X) = \sum p_i (x_i - \mu)^2$
	standard deviation	$\sqrt{Var(X)}$
continuous random variable X	mean	$E(X) = \mu = \int_{-\infty}^{\infty} x\, p(x)\, dx$
	variance	$Var(X) = \sigma^2 = \int_{-\infty}^{\infty} (x-\mu)^2\, p(x)\, dx$
Bernoulli distribution	mean	p
	variance	$p(1-p)$
binomial distribution	mean	np
	variance	$np\,(1-p)$
sample proportion	mean	p
	standard deviation	$\sqrt{\frac{p(1-p)}{n}}$
approximate confidence interval for p	$\left(\hat{p} - z\sqrt{\frac{\hat{p}(1-\hat{p})}{n}},\ \hat{p} + z\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}\right)$	
approximate margin of error	$z\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$	
complementary probability	$P(\overline{A}) = 1 - P(A)$	
general addition rule for probability	$P(A \cup B) = P(A) + P(B) - P(A \cap B)$	
probability of independent events	$P(A \cap B) = P(A)P(B)$	
conditional probability	$P(A \cap B) = P(A \mid B)P(B)$	