

# Formula sheet: Mathematics - v2024

## Trigonometry

Pythagorean identity

$$\cos^2(x) + \sin^2(x) = 1 \quad (1)$$

Angle sum and difference identities

$$\cos(\alpha - \beta) = \cos(\alpha) \cos(\beta) + \sin(\alpha) \sin(\beta) \quad (2)$$

$$\cos(\alpha + \beta) = \cos(\alpha) \cos(\beta) - \sin(\alpha) \sin(\beta) \quad (3)$$

$$\sin(\alpha - \beta) = \sin(\alpha) \cos(\beta) - \cos(\alpha) \sin(\beta) \quad (4)$$

$$\sin(\alpha + \beta) = \sin(\alpha) \cos(\beta) + \cos(\alpha) \sin(\beta) \quad (5)$$

$$\tan(\alpha - \beta) = \frac{\tan(\alpha) - \tan(\beta)}{1 + \tan(\alpha) \tan(\beta)} \quad (6)$$

$$\tan(\alpha + \beta) = \frac{\tan(\alpha) + \tan(\beta)}{1 - \tan(\alpha) \tan(\beta)} \quad (7)$$

Double-angle formulae

$$\cos(2x) = \cos^2(x) - \sin^2(x) \quad (8)$$

$$= 2 \cos^2(x) - 1 \quad (9)$$

$$= 1 - 2 \sin^2(x) \quad (10)$$

$$\sin(2x) = 2 \sin(x) \cos(x) \quad (11)$$

$$\tan(2x) = \frac{2 \tan(x)}{1 - \tan^2(x)} \quad (12)$$

## Integrals

$$\int a^x dx = \frac{a^x}{\ln(a)} + C \quad (a \neq 1) \quad (13)$$

$$\int \ln(x) dx = x \ln(x) - x + C \quad (14)$$

$$\int \log_a(x) dx = \frac{1}{\ln(a)}(x \ln(x) - x) + C \quad (a > 0 \text{ and } a \neq 1) \quad (15)$$

$$\int \sin(x) dx = -\cos(x) + C \quad (16)$$

$$\begin{aligned} \int \frac{1}{1+x^2} dx &= \arctan(x) + C \\ &= \tan^{-1}(x) + C \end{aligned} \quad (17)$$

$$\begin{aligned} \int \frac{1}{\sqrt{1-x^2}} dx &= \arcsin(x) + C \\ &= \sin^{-1}(x) + C \end{aligned} \quad (18)$$