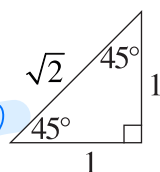


Trigonometric Functions

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

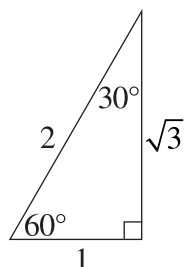
$$A = \frac{1}{2}ab \sin C \quad (\text{Triangle})$$

* 2 sides, 2 opp sides → $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ (Flip to find angle)



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

* 3 sides, 1 angle → $\cos C = \frac{a^2 + b^2 - c^2}{2ab}$



$$l = r\theta \quad (\text{arc in radians})$$

$$A = \frac{1}{2}r^2\theta \quad (\text{area of sector in radians})$$

Trigonometric identities

$$\sec A = \frac{1}{\cos A}, \quad \cos A \neq 0$$

$$\operatorname{cosec} A = \frac{1}{\sin A}, \quad \sin A \neq 0$$

$$\cot A = \frac{\cos A}{\sin A}, \quad \sin A \neq 0$$

$$\cos^2 x + \sin^2 x = 1 \quad \text{★ divide by } \cos^2(x) \text{ to get } 1 + \tan^2 x = \sec^2(x)$$

Compound angles

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\text{If } t = \tan \frac{A}{2} \text{ then } \sin A = \frac{2t}{1 + t^2}$$

$$\cos A = \frac{1 - t^2}{1 + t^2}$$

$$\tan A = \frac{2t}{1 - t^2}$$

$$\cos A \cos B = \frac{1}{2} [\cos(A - B) + \cos(A + B)]$$

$$\sin A \sin B = \frac{1}{2} [\cos(A - B) - \cos(A + B)]$$

$$\sin A \cos B = \frac{1}{2} [\sin(A + B) + \sin(A - B)]$$

$$\cos A \sin B = \frac{1}{2} [\sin(A + B) - \sin(A - B)]$$

$$\sin^2 nx = \frac{1}{2} (1 - \cos 2nx)$$

$$\cos^2 nx = \frac{1}{2} (1 + \cos 2nx)$$

Statistical Analysis

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

score → x , mean → μ , sd → σ , z-score → z

An outlier is a score

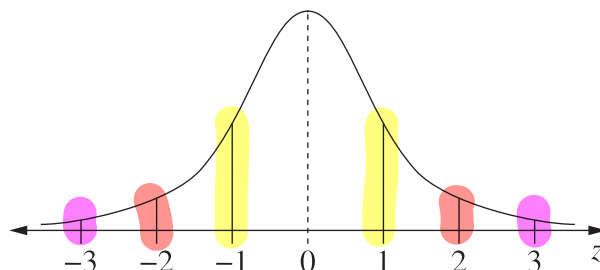
less than $Q_1 - 1.5 \times IQR$

or

more than $Q_3 + 1.5 \times IQR$

$$IQR = Q_3 - Q_1$$

Normal distribution



- approximately 68% of scores have z-scores between -1 and 1 (16%, 34%, 34%, 16%)
- approximately 95% of scores have z-scores between -2 and 2 (2.5%, 47.5%, 47.5%, 2.5%)
- approximately 99.7% of scores have z-scores between -3 and 3 (0.15%, 49.85%, 49.85%, 0.15%)

$$E(X) = \mu$$

$$\operatorname{Var}(X) = E[(X - \mu)^2] = E(X^2) - \mu^2$$

Probability

$$P(A \cap B) = P(A)P(B)$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)}, \quad P(B) \neq 0$$

$$p(\bar{A}) = 1 - p(A)$$

independent events
 $p(A \cap B) = p(A)p(B)$
 $p(A|B) = p(A)$

Continuous random variables

$$P(X \leq r) = \int_a^r f(x) dx$$

$$P(a < X < b) = \int_a^b f(x) dx$$

Binomial distribution

$$P(X = r) = {}^nC_r p^r (1 - p)^{n-r}$$

$$X \sim \operatorname{Bin}(n, p)$$

$$\Rightarrow P(X = x)$$

$$= \binom{n}{x} p^x (1 - p)^{n-x}, \quad x = 0, 1, \dots, n$$

$$E(X) = np$$

$$\operatorname{Var}(X) = np(1 - p)$$