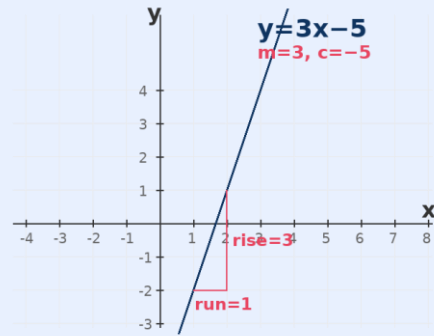


# YEAR 10 MATHS- ALGEBRA & FORMULAE CHEAT SHEET

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## LINEAR RELATIONS

**Example:**  $y = 3x - 5$



- Gradient:  $m = 3$
- y-intercept:  $c = -5$  at  $(0, -5)$

### Equation of a Line

**Gradient-Intercept Form:**

$$y = mx + c$$

- $m$  = gradient (slope),  $c$  = y-intercept

**General Form:**

$$ax + by + c = 0$$

**Point-Gradient Form:**

$$y - y_1 = m(x - x_1)$$

### Gradient

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{\text{rise}}{\text{run}}$$

- Positive ↗ | Negative ↘
- Zero gradient: horizontal | Undefined gradient: vertical

### Angle of a Line with x-axis

$$m = \tan(\theta)$$

### Tips

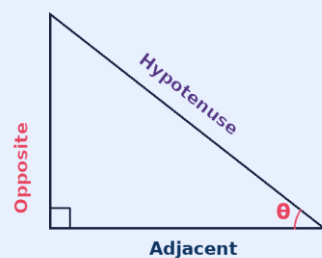
- Parallel lines:  $m_1 = m_2$
- Perpendicular:  $m_1 \times m_2 = -1$
- Midpoint:

$$M = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

- Distance:

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

## TRIGONOMETRY



Remember: **SOH CAH TOA**

## QUADRATICS

### Quadratic Forms

**General Form:**

$$y = ax^2 + bx + c$$

**Turning Point Form:**

$$y = a(x - h)^2 + k$$

- Vertex at  $(h, k)$

**Factored Form:**

$$y = a(x - p)(x - q)$$

- x-intercepts at  $x = p$  and  $x = q$

### Quadratic Formula

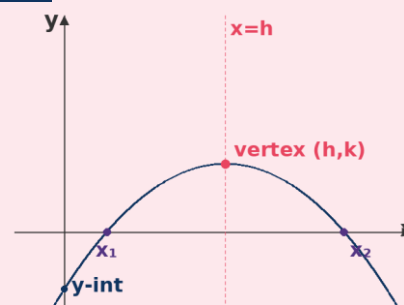
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

### Discriminant

$$\Delta = b^2 - 4ac$$

- $\Delta > 0$ : 2 real solutions
- $\Delta = 0$ : 1 real solution
- $\Delta < 0$ : no real solutions

### Graph Features



- $a > 0$ : happy face  $\cup$
- $a < 0$ : sad face  $\cap$
- Axis of symmetry:  $x = h$

## TRANSFORMATIONS

**From  $y = x^2$**

$$y = a(x - h)^2 + k$$

- $a$ : dilation from the x-axis
- If  $a < 0$ : reflection in x-axis
- $h$ : horizontal translation
- $k$ : vertical translation

## TRIGONOMETRY

**Sine (SOH):**

$$\sin(\theta) = \frac{\text{Opposite}}{\text{Hypotenuse}}$$

**Cosine (CAH):**

$$\cos(\theta) = \frac{\text{Adjacent}}{\text{Hypotenuse}}$$

**Tangent (TOA):**

$$\tan(\theta) = \frac{\text{Opposite}}{\text{Adjacent}}$$

## INDEX LAWS

### Multiplication

$$a^m \times a^n = a^{m+n}$$

### Division

$$a^m \div a^n = a^{m-n}$$

### Power of a Power

$$(a^m)^n = a^{mn}$$

### Zero Index

$$a^0 = 1$$

### Negative Index

$$a^{-n} = \frac{1}{a^n}$$

### Fractional Index

$$a^{\frac{1}{n}} = \sqrt[n]{a}$$

$$a^{\frac{m}{n}} = \sqrt[n]{a^m}$$

### Power of a Product

$$(ab)^n = a^n b^n$$

### Power of a Fraction

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

## LOG LAWS

### Product Rule

$$\log_a(xy) = \log_a(x) + \log_a(y)$$

### Quotient Rule

$$\log_a\left(\frac{x}{y}\right) = \log_a(x) - \log_a(y)$$

### Power Rule

$$\log_a(x^n) = n \log_a(x)$$

### Log of Base

$$\log_a(a) = 1$$

### Log of 1

$$\log_a(1) = 0$$

### Inverse Property

$$a^{\log_a(x)} = x$$

### Change of Base

$$\log_a(x) = \frac{\log_m(x)}{\log_m(a)}$$

## EXPANDING & FACTORISING

### Expanding

**Single Brackets:**

$$a(b + c) = ab + ac$$

**Double Brackets (FOIL):**

$$(a + b)(c + d) = ac + ad + bc + bd$$

### Perfect Squares

$$(a + b)^2 = a^2 + 2ab + b^2$$

$$(a - b)^2 = a^2 - 2ab + b^2$$

### Difference of Two Squares

$$a^2 - b^2 = (a + b)(a - b)$$

### Factorising

**Common Factor:**

$$ab + ac = a(b + c)$$

**Trinomials:**

$$x^2 + bx + c = (x + p)(x + q)$$

- Find two numbers that multiply to  $c$  and add to  $b$

### Completing the Square

$$x^2 + bx = \left(x + \frac{b}{2}\right)^2 - \left(\frac{b}{2}\right)^2$$

## CUBIC EXPRESSIONS

### Perfect Cube (Sum)

$$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

### Perfect Cube (Difference)

$$(a - b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

### Sum of Two Cubes

$$a^3 + b^3 = (a + b)(a^2 - ab + b^2)$$

### Difference of Two Cubes

$$a^3 - b^3 = (a - b)(a^2 + ab + b^2)$$

### Remainder Theorem

If  $P(x)$  is a cubic expression and it is divided by  $(ax + b)$ , the remainder will be given by  $P\left(\frac{-b}{a}\right)$ .

### Factor Theorem

If  $P(x)$  is a cubic expression and  $(ax + b)$  is a factor, then  $P\left(\frac{-b}{a}\right) = 0$ .