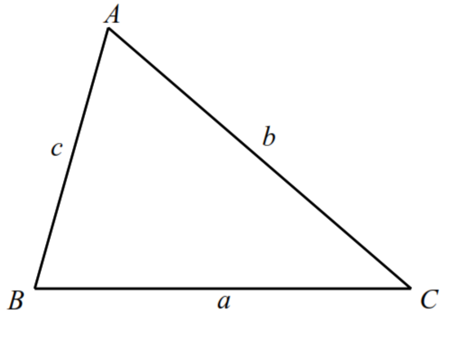
Math Formulas

This page gives the list of formulas included in the 0580 Question Paper for 2025 to 2027

Area, A, of triangle, base b, height h.	$A = \frac{1}{2}bh$
Area, A, of circle of radius r.	$A = \pi r^2$
Circumference, C, of circle of radius r.	$C = 2\pi r$
Curved surface area, A, of cylinder of radius r, height h.	$A = 2\pi rh$
Curved surface area, A, of cone of radius r, sloping edge l.	$A = \pi rl$
Surface area, A, of sphere of radius r.	$A = 4\pi r^2$
Volume, V, of prism, cross-sectional area A, length l.	$V = Al$
Volume, V, of pyramid, base area A, height h.	$V = \frac{1}{3}Ah$
Volume, V, of cylinder of radius r, height h.	$V = \pi r^2 h$
Volume, V, of cone of radius r, height h.	$V = \frac{1}{3}\pi r^2 h$
Volume, V, of sphere of radius r.	$V = \frac{4}{3}\pi r^3$

For the equation $ax^2 + bx + c = 0$, where $a \neq 0$,
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

For the triangle shown,



$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\text{Area} = \frac{1}{2}ab\sin C$$

Go to onlinemathlearning.com for more free math resources

Math Formulas
Number

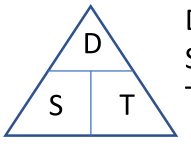
Perfect Squares	Square Roots	Squares
1	$\sqrt{1}=1$	$1^2 = 1$
4	$\sqrt{4}=2$	$2^2 = 4$
9	$\sqrt{9}=3$	$3^2 = 9$
16	$\sqrt{16}=4$	$4^2 = 16$
25	$\sqrt{25}=5$	$5^2 = 25$
36	$\sqrt{36}=6$	$6^2 = 36$
49	$\sqrt{49}=7$	$7^2 = 49$
64	$\sqrt{64}=8$	$8^2 = 64$
81	$\sqrt{81}=9$	$9^2 = 81$
100	$\sqrt{100}=10$	$10^2 = 100$
121	$\sqrt{121}=11$	$11^2 = 121$
144	$\sqrt{144}=12$	$12^2 = 144$
169	$\sqrt{169}=13$	$13^2 = 169$
196	$\sqrt{196}=14$	$14^2 = 196$
225	$\sqrt{225}=15$	$15^2 = 225$

Perfect Cubes	Cube Roots	Cubes
1	$\sqrt[3]{1}=1$	$1^3=1$
8	$\sqrt[3]{8}=2$	$2^3=8$
27	$\sqrt[3]{27}=3$	$3^3=27$
64	$\sqrt[3]{64}=4$	$4^3=64$
125	$\sqrt[3]{125}=5$	$5^3=125$
1000	$\sqrt[3]{1000}=10$	$10^3=1000$

Prime Numbers

2,3,5,7,11,13,17,19,23,29,31,37, ...

Speed, Distance, Time



Distance = Speed × Time
Speed = Distance ÷ Time
Time = Distance ÷ Speed

Simple Interest

$$I = \frac{PRT}{100}$$

I = Interest
P = Principal
R = Rate
T = Time (years)

Compound Interest Growth & Decay

$$A = P\left(1 \pm \frac{R}{100}\right)^n$$

A = Amount
P = Principal
R = Rate
n = Number of periods

Convert to Standard Form

Move the decimal point until there is one digit to the left of the decimal point.

Exponent goes up ← Decimal point moves left • Decimal point moves right → Exponent goes down

Examples:

$156000. = 1.56 \times 10^5$
Move decimal point 5 places left, exponent goes up by 5

$0.0000053 = 5.3 \times 10^{-6}$
Move decimal point 6 places right, exponent goes down by 6

Rules of Indices

For $a \neq 0, b \neq 0$

Rule	Example
$a^x \times a^y = a^{x+y}$	$a^3 \times a^2 = a^{3+2} = a^5$
$a^x \div a^y = a^{x-y}$	$a^6 \div a^2 = a^{6-2} = a^4$
$(a^x)^y = a^{xy}$	$(a^2)^3 = a^{2\times 3} = a^6$
$a^0 = 1$	$a^0 = 1$
$a^{-x} = \frac{1}{a^x}$	$a^{-5} = \frac{1}{a^5}$
$a^{\frac{x}{y}} = \sqrt[y]{a^x} = (\sqrt[y]{a})^x$	$a^{\frac{3}{5}} = \sqrt[5]{a^3} = (\sqrt[5]{a})^3$

Repeating Decimals to Fractions

1. Let the repeating decimal be x.
2. Let n = the number of repeating digits.
3. Multiply the repeating decimal by 10^n
4. Subtract (1) from (3) to eliminate the repeating part.
5. Solve for x, expressing your answer as a fraction in its simplest form.

$\text{Let } x = .30\overline{2} = .30222\ldots$
$10x = 3.0222\ldots$
$10x - x = 3.022\ldots - .3022\ldots$
$9x = 2.72$
$x = \frac{2.72}{9} = \frac{68}{225}$

$\text{Let } x = 1.\overline{34} = 1.3434\ldots$
$100x = 134.\overline{34}$
$100x - x = 134.\overline{34} - 1.\overline{34}$
$99x = 133$
$x = \frac{133}{99} = 1\frac{34}{99}$

Math Formulas
Algebra

Factorise Expressions

$$ax + bx + kay + kby = x(a+b) + ky(a+b) = (x+ky)(a+b)$$

$$a^2x^2 - b^2y^2 = (ax+by)(ax-by)$$

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

$$ax^3 + bx^2 + cx = x(ax^2 + bx + c)$$

Factor Trinomials with No Guessing

$$ax^2 + bx + c$$

Find the two numbers that will make these equations true.

$$\square \times \square = ac$$

$$\square + \square = b$$

Put the two numbers in the expression and simplify.

$$\frac{1}{a}(ax + \square)(ax + \square)$$

$$8x^2 + 2x - 3$$

$$\boxed{6} \times \boxed{-4} = -24$$

$$\boxed{6} + \boxed{-4} = 2$$

$$\frac{1}{8}(8x + \boxed{6})(8x + \boxed{-4})$$

$$= \frac{1}{8}(2)(4x+3)(4)(2x-1)$$

$$= (4x+3)(2x-1)$$

Solve Simultaneous Equations

By Substitution

x + 3y = 6
2x + 8y = −12

x + 3y = 6 → x = -3y + 6
Substitute
2x + 8y = −12
2(-3y + 6) + 8y = −12

-6y + 12 + 8y = −12
2y = −24
y = −12

x + 3(-12) = 6
x = 42
(substitute into one of the original equations to find the ordered pair solution)

by Elimination

2x + 3y = 16
5x − 4y = −6

2x + 3y = 16 (× 5) → 10x + 15y = 80
5x − 4y = −6 (× -2) → −10x + 8y = 12
make coefficient opposites

10x + 15y = 80
\+ −10x + 8y = 12
23y = 92
y = 4
Add to (eliminate one variable)

2x + 3(4) = 16
x = 2
(substitute into one of the original equations to find the ordered pair solution)

Proportion

Direct: $y = kx$ Inverse: $y = \dfrac{k}{x}$

Completing the Square

Solve Quadratics

1. If a ≠ 1, divide the quadratic by a.
2. Write the quadratic in the form
$$x^2 + bx = c$$
3. Add (b/2)² to both sides of the equation.
$$x^2 + bx + \left(\frac{b}{2}\right)^2 = c + \left(\frac{b}{2}\right)^2$$
4. Factor the left side of the equation into a perfect square.
$$\left(x + \frac{b}{2}\right)^2 = c + \left(\frac{b}{2}\right)^2$$
5. Square root both sides of the equation and solve for x.
$$x + \frac{b}{2} = \pm\sqrt{c + \left(\frac{b}{2}\right)^2}$$

Linear sequence: $an + b$. 1st level difference = a
Quadratic sequence: $an^2 + b$. 2nd level diff = $2a$
Cubic sequence: $an^3 + b$. 3rd level diff = $6a$

Find the nth term of the linear sequence: 8, 11, 14, 17, …

5, 8, 11, 14, 17, …
+3 +3 +3 +3

nth term = 3n + 5

Rationalise the Denominator

In order to **rationalise** the denominator, we need to get rid of all surds that are in the denominator.

If the denominator has just one term we can multiply the numerator and denominator by that surd.

$$\frac{a}{\sqrt{b}} = \frac{a}{\sqrt{b}} \times \frac{\sqrt{b}}{\sqrt{b}}$$

Multiply top and bottom by the surd in the denominator

$$= \frac{a\sqrt{b}}{\sqrt{b^2}}$$

$$= \frac{a\sqrt{b}}{b}$$

If the denominator has two terms then we need to multiply the numerator and denominator by the conjugate.

$$\frac{a}{b-\sqrt{c}} = \frac{a}{b-\sqrt{c}} \times \frac{b+\sqrt{c}}{b+\sqrt{c}}$$

Multiply by the conjugate

$$= \frac{a(b+\sqrt{c})}{(b-\sqrt{c})(b+\sqrt{c})}$$

$$= \frac{a(b+\sqrt{c})}{b^2 - b\sqrt{c} + b\sqrt{c} - \sqrt{c^2}}$$

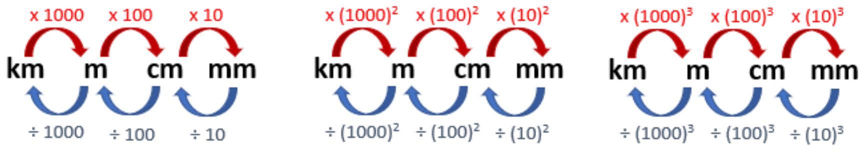
$$= \frac{a(b+\sqrt{c})}{b^2 - c}$$

$$\frac{a}{b+\sqrt{c}} = \frac{a}{b+\sqrt{c}} \times \frac{b-\sqrt{c}}{b-\sqrt{c}} = \frac{a(b-\sqrt{c})}{b^2 - c}$$

Go to onlinemathlearning.com for more free math resources

Math Formulas
Geometry

Converting Metric Measurements



Metric Lengths | Metric Areas | Metric Volumes

1 litre = 1000 cm^3
1 m^3 = 1000 litres

Angles

- sum of angles at a point = 360°.
- sum of angles on a straight line = 180°.
- angle sum of a triangle = 180°.
- angle sum of a quadrilateral = 360°
- vertically opposite angles are equal. (X)
- corresponding angles are equal. (F)
- alternate angles are equal. (Z)
- co-interior angles sum to 180°. (C)

Triangles

Equilateral: 3 sides equal, each angle = 60°
Isosceles: 2 sides & 2 angles the same
Scalene: no sides or angles are the same
Right-angled: one angle is 90°

Congruent Triangles: SSS, SAS, AAS, ASA, RHS
Similar Triangle: AA, ratio of sides

sum of interior angles in a polygon: $(n-2)\times 180°$

size of interior angle in a regular polygon: $\dfrac{(n-2)\times 180°}{n}$

sum of exterior angles in a polygon = 360°

size of exterior angle in a regular polygon: $\dfrac{360°}{n}$

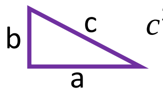
Arc & Area

$$\text{arc of sector} = \frac{\theta}{360}\times 2\pi r$$

$$\text{area of sector} = \frac{\theta}{360}\times \pi r^2$$

$$\text{area of trapezium} = \frac{1}{2}(a+b)h$$

Pythagoras' Theorem



$$c^2 = a^2 + b^2$$

Similar Figures & Scales

$$\frac{l_1}{l_2} = \frac{b_1}{b_2}, \frac{A_1}{A_2} = \left(\frac{l_1}{l_2}\right)^2, \frac{V_1}{V_2} = \left(\frac{l_1}{l_2}\right)^3$$

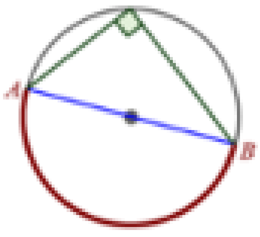
$$\left(\frac{A_1}{A_2}\right)^3 = \left(\frac{V_1}{V_2}\right)^2$$

Shape	Number of Lines of Symmetry	Order of Rotational Symmetry
Square	4	4
Rectangle	2	2
Parallelogram	0	2
Rhombus	2	2
Trapezium	0	1
Kite	1	1
Equilateral triangle	3	3

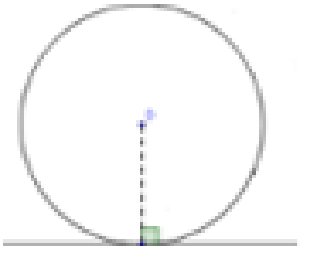
Go to onlinemathlearning.com for more free math resources

Math Formulas
Circle Theorems

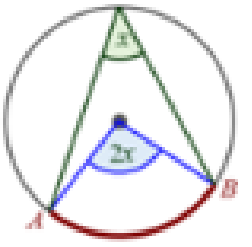
You will need to know the following **Circle Theorems** (giving reasons for the answers)



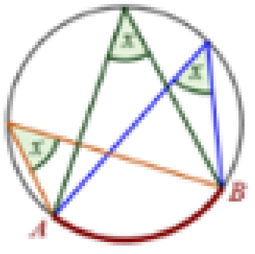
Angle in a semicircle = 90°



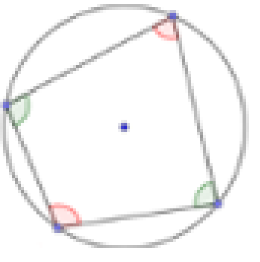
Angle between tangent and radius = 90°



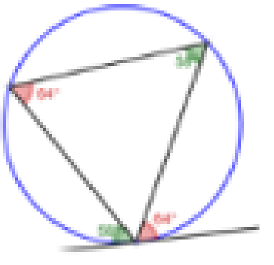
Angle at the centre is twice the angle at the circumference



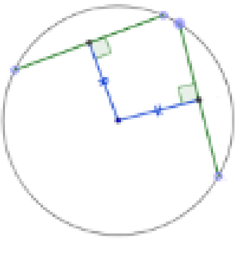
Angles in the same segment are equal



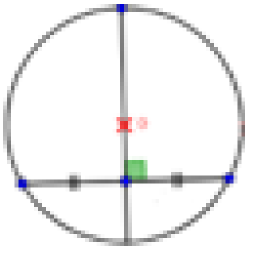
Opposite angles of a cyclic quadrilateral sum to 180°



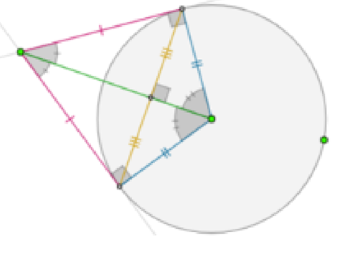
Alternate segment theorem



Equal chords are equidistant from the centre



The perpendicular bisector of a chord passes through the centre

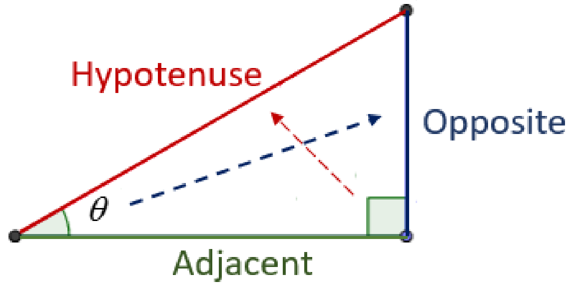


Tangents from an external point are equal in length.

Go to onlinemathlearning.com for more free math resources

Math Formulas
Trigonometry

SOHCAHTOA



SOH $\quad \text{Sin}\,\theta = \dfrac{\text{Opposite}}{\text{Hypotenuse}}$

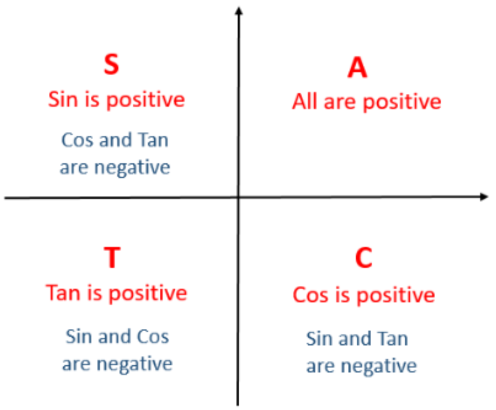
CAH $\quad \text{Cos}\,\theta = \dfrac{\text{Adjacent}}{\text{Hypotenuse}}$

TOA $\quad \text{Tan}\,\theta = \dfrac{\text{Opposite}}{\text{Adjacent}}$

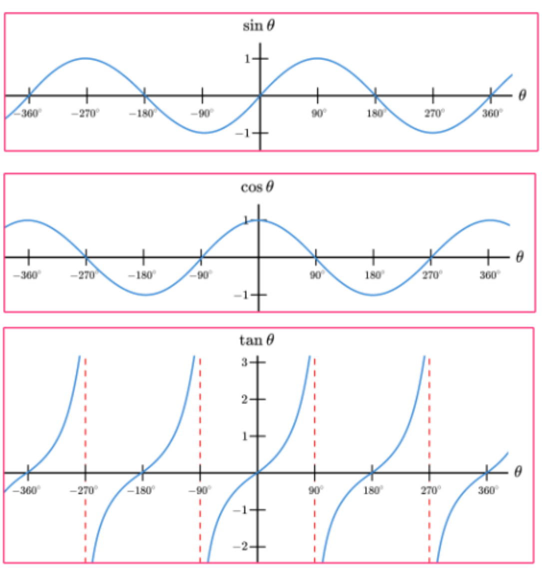
	0°	30°	45°	60°	90°
sin	0	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$	0
tan	0	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$	∞

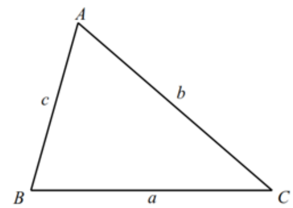
The CAST Diagram

The CAST diagram helps us to see which quadrants the trig ratios are positive.



Trig Graphs





$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

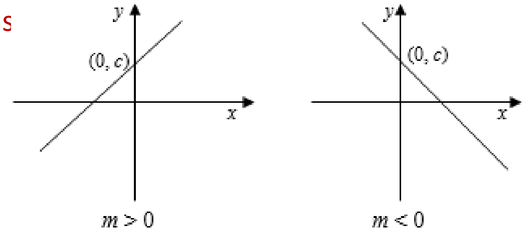
$$a^2 = b^2 + c^2 - 2bc\cos A$$

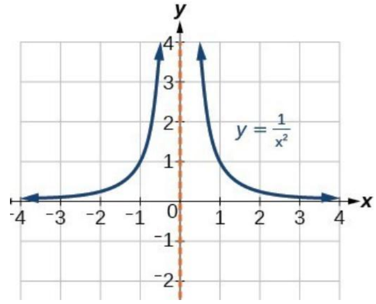
$$\text{Area} = \frac{1}{2}ab\sin C$$

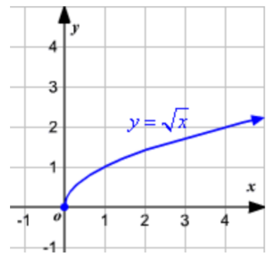
Go to onlinemathlearning.com for more free math resources

Math Formulas
Sketching Graphs

Linear Functions
y = mx + c







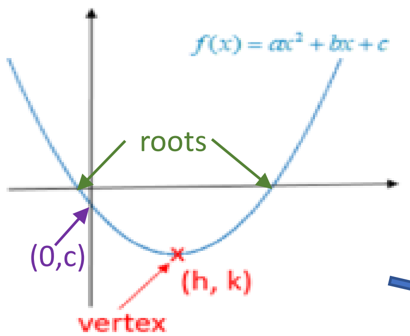
Quadratic Functions

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

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

$$h = -\frac{b}{2a}$$

$a > 0$, u shape
$a < 0$, n shape



Convert Quadratic Equation to Vertex Form

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

$$y = a\left(x^2 + \frac{b}{a}x\right) + c$$

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

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

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

$$y = a\left(x + \frac{b}{2a}\right)^2 + \left(c - \frac{b^2}{4a}\right)$$

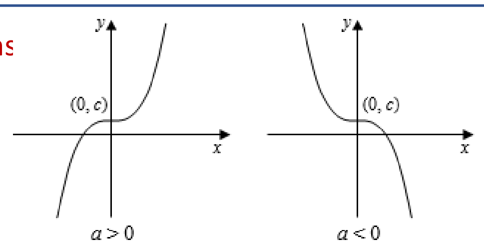
$$y = a(x - h)^2 + k \text{ (vertex form)}$$

$$h = -\frac{b}{2a} \text{ (the x-coordinate of the vertex)}$$

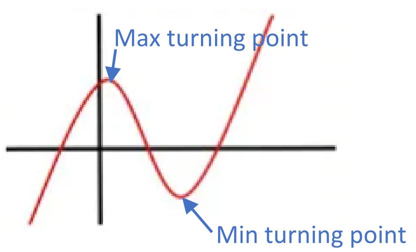
$$k = c - \frac{b^2}{4a} \text{ (the y-coordinate of the vertex)}$$

Cubic Functions

$$y = ax^3 + c$$



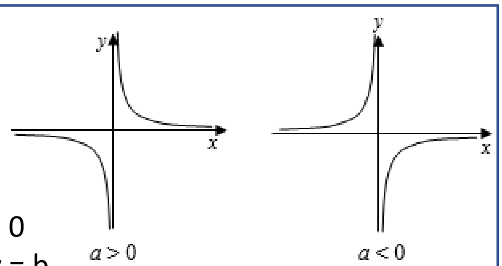
$$y = ax^3 + bx^2 + cx + d$$



Reciprocal Functions

$$y = \frac{a}{x} + b = ax^{-1} + b$$

Vertical asymptotes at x = 0
Horizontal asymptote at y = b



Curved Graphs

$$y = ax^n$$

$$\frac{dy}{dx} = anx^{n-1} \text{ (gradient at point x)}$$

$$\frac{dy}{dx} = 0$$ (stationary point, turning point, min, max)

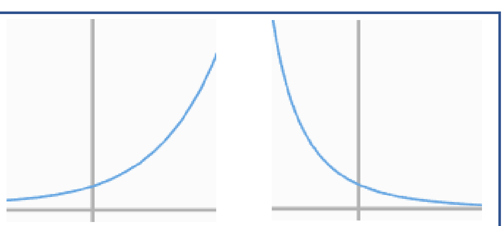
$$\frac{d^2y}{dx^2} < 0 \text{ (max)}$$

$$\frac{d^2y}{dx^2} > 0 \text{ (min)}$$

Exponential Functions

$$y = ar^x + b$$

y-intercept at (0,a)
Horizontal asymptote at y = b



Exponential growth
$r > 1$

Exponential Decay
$r < 1$

Go to onlinemathlearning.com for more free math resources

Math Formulas

Transformations

1. Reflection of a shape in a straight line.
2. Rotation of a shape about a centre through an angle.
3. Enlargement of a shape from a centre by a scale factor. (Positive, fractional and negative scale factors may be used).
4. Translation of a shape by a vector $\begin{pmatrix} x \\ y \end{pmatrix}$

Vectors

The vector $k\begin{pmatrix} x \\ y \end{pmatrix}$ is parallel to $\begin{pmatrix} x \\ y \end{pmatrix}$

Magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ is $\sqrt{x^2 + y^2}$

Cumulative Frequency Graph

Lower Quartile at 25% percentile

Median at 50% percentile

Upper Quartile at 75% percentile

Inter-quartile range = upper quartile – lower quartile

Coordinate Geometry

Equation of straight Line $y = mx + c$

Gradient Formula $m = \dfrac{y_2 - y_1}{x_2 - x_1}$

Midpoint Formula $\left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right)$

Distance Formula $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

When 2 lines are parallel: $m_1 = m_2$

When 2 lines are perpendicular: $m_1 = -\dfrac{1}{m_2}$

Mean

Individual values: $\text{Mean} = \dfrac{\text{sum of values}}{\text{number of values}}$

Frequency Table: $\text{Mean} = \dfrac{\text{sum of (value} \times \text{frequency)}}{\text{total frequency}}$

Frequency Table with Intervals: $\text{Mean} = \dfrac{\text{sum of (interval midpoint} \times \text{frequency)}}{\text{total frequency}}$

Histogram

frequency density = frequency ÷ class width

Go to onlinemathlearning.com for more free math resources