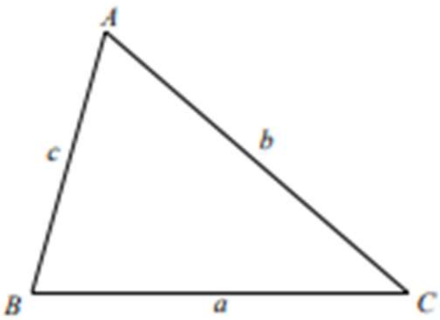
Math Formulas

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,



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

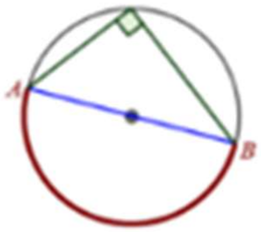
$$a^2 = b^2 + c^2 - 2bc\cos A$$

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

Go to onlinemathlearning.com for more free math resources

Math Formulas

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



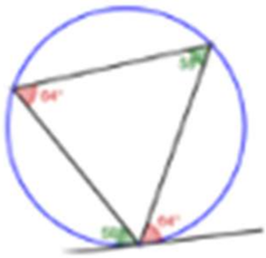
Angle in a semicircle = 90°

Angle between tangent and radius = 90°

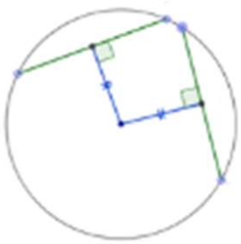
Angle at the centre is twice the angle at the circumference

Angles in the same segment are equal

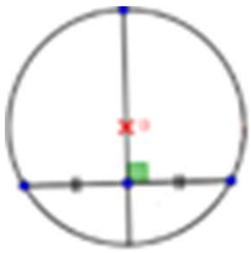
Opposite angles of a cyclic quadrilateral sum to 180°



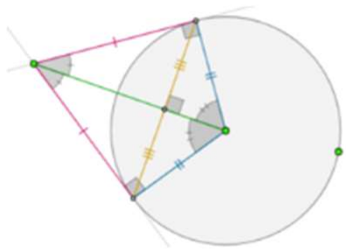
Alternate segment theorem



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.

Math Formulas

Useful information and formulas to remember:

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	$\sqrt[3]{1000}=10$	$10^3 = 1000$

Rules of Indices

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

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

Prime Numbers

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

Repeating Decimals to Fractions

1. Let the repeating decimal be x.
2. If the repeating part is not after the decimal point, multiply x by a power of 10 such that the repeating part aligns after the decimal point.
3. Multiply x by the next power of 10 such that the repeating part aligns after the decimal point.
4. Subtract (2) from (3) to eliminate the repeating part.
5. Solve for x by dividing.
6. Simplify the fraction if necessary.

Let $x = 0.\overline{34} = 0.3434\ldots$

$100x = 34.\overline{34}$

$100x - x = 34.\overline{34} - 0.\overline{34}$

$99x = 34$

$x = \frac{34}{99}$

Let $x = 3.0\overline{15} = 3.01515\ldots$

$10x = 30.\overline{15}$

$1000x = 3015.\overline{15}$

$1000x - 10x = 3015.\overline{15} - 30.\overline{15}$

$900x = 2985$

$x = \frac{2985}{900} = \frac{199}{60}$

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

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

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

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

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

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:

$156000. = 1.56 \times 10^5$

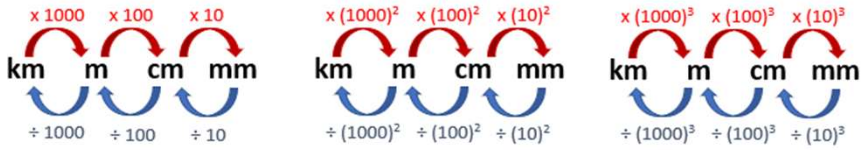
Move decimal point 5 places left, exponent goes up by 5

$0.0000053 = 5.3 \times 10^{-6}$

Move decimal point 6 places right, exponent goes down by 6

Math Formulas

Converting Metric Measurements



Metric Lengths | Metric Areas | Metric Volumes

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

Proportion

Direct	Inverse
$y \propto x$	$y \propto \frac{1}{x}$
$y = kx$	$y = \frac{k}{x}$

Pythagoras' Theorem

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

Simple Interest Formula

I = Prt

I = Interest
P = Principal (Initial Value)
r = Interest Rate
t = time (years)

A = P + I

Compound Interest Formula

$$A = P\left(1 + \frac{r}{100}\right)^t$$

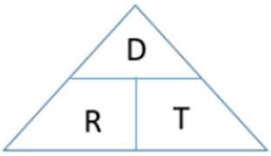
A = Future Value
P = Principal (Initial Value)
r % = Interest Rate
t = Time

Arc & Area

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

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

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



Distance = Rate x Time
Rate = Distance ÷ Time
Time = Distance ÷ Rate

SOHCAHTOA

	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	$\sqrt{3}$	∞

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°

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

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

sum of exterior angles in a polygon = 360°

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

Similar Figures & Scales

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

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

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

Math Formulas

Factorise Expressions

$$ax + bx + kay + kby = x(a+b) + ky(a+b) = (x+ky)(a+b)$$
$$a^2x^2 - b^2y^2 = (ax+by)(ax-by)$$
$$a^2 + 2ab + b^2 = (a+b)^2$$
$$ax^3 + bx^2 + cx = x(ax^2 + bx + c)$$

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.
$$x + \frac{b}{2} = \pm\sqrt{c + \left(\frac{b}{2}\right)^2}$$

Factor Trinomials with No Guessing

Find the two numbers that will make these equations true.

Put the two numbers in the expression and simplify.

$$ax^2 + bx + c$$
$$\square \times \square = ac$$
$$\square + \square = b$$
$$\frac{1}{a}(ax + \square)(ax + \square)$$

$$8x^2 + 2x - 3$$
$$\boxed{6} \times \boxed{-4} = -24$$
$$\boxed{6} + \boxed{-4} = 2$$
$$\frac{1}{8}(8x + \boxed{6})(8x + \boxed{-4})$$
$$= \frac{1}{8}(2)(4x+3)(4)(2x-1)$$
$$= (4x+3)(2x-1)$$

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

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)

Coordinate Geometry

Equation of straight Line $y = mx + c$

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

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

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: $m_1 = -\frac{1}{m_2}$

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

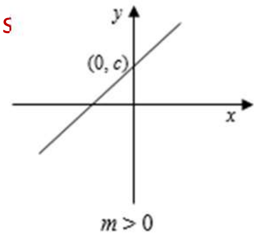
The vector $k\begin{pmatrix} x \\ y \end{pmatrix}$ is parallel to $\begin{pmatrix} x \\ y \end{pmatrix}$

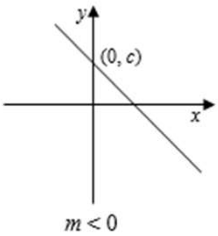
Magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ is $\sqrt{x^2 + y^2}$

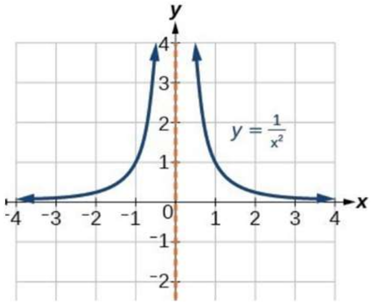
Math Formulas

Linear Functions

y = mx + c







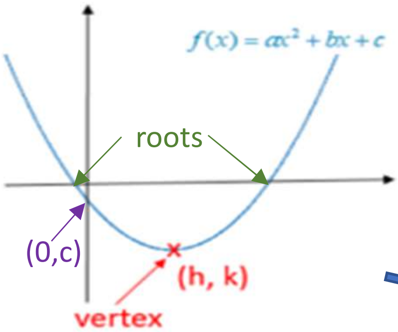
Quadratic Functions

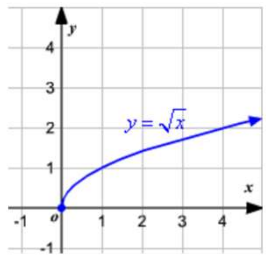
$y = ax^2 + bx + c$

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

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

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





Convert Quadratic Equation to Vertex Form

$y = ax^2 + bx + c$

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

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

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

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

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

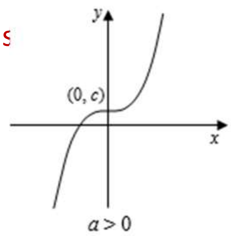
$y = a(x - h)^2 + k$ (vertex form)

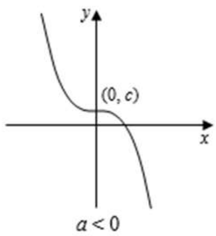
$h = -\frac{b}{2a}$ (the x-coordinate of the vertex)

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

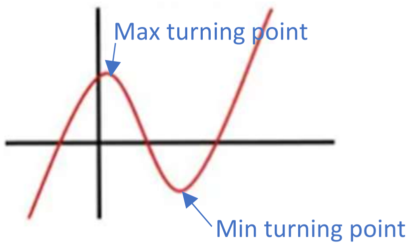
Cubic Functions

$y = ax^3 + c$





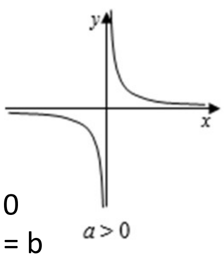
$y = ax^3 + bx^2 + cx + d$

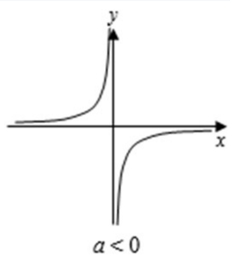


Reciprocal Functions

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

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





Curved Graphs

$y = ax^n$

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

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

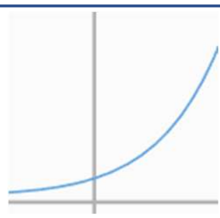
$\frac{d^2y}{dx^2} < 0$ (max)

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

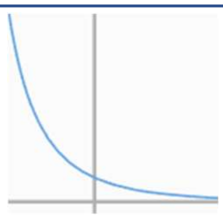
Exponential Functions

$y = ar^x + b$

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



Exponential growth
r > 1



Exponential Decay
r < 1

Math Formulas

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

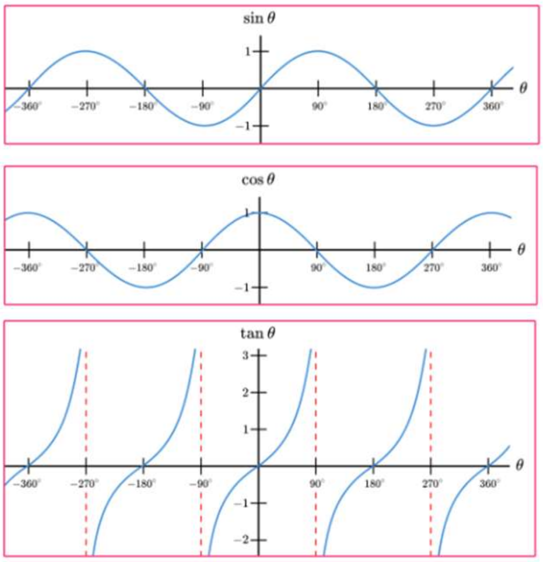
Cumulative Frequency Graph

Lower Quartile at 25% percentile
Median at 50% percentile
Upper Quartile at 75% percentile
Inter-quartile range = upper quartile – lower quartile

Histogram

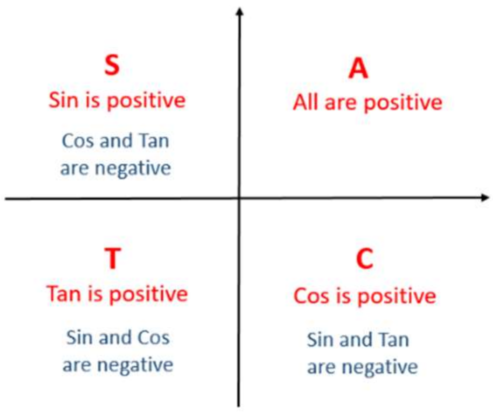
frequency density = frequency ÷ class width

Trig Graphs



The CAST Diagram

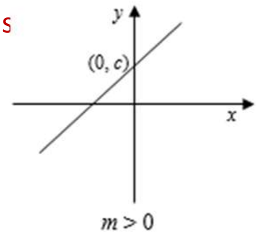
The CAST diagram helps us to see which quadrants the trig ratios are positive.

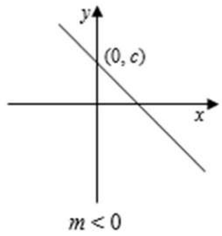


Sketching Graphs

Linear Functions

y = mx + c





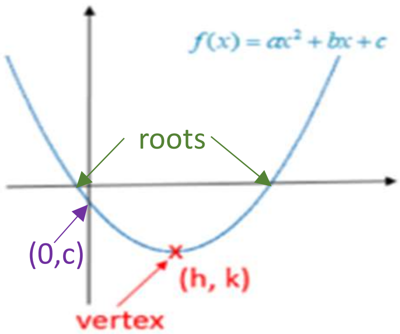
Quadratic Functions

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

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

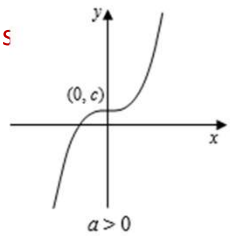
$$h = -\frac{b}{2a}$$

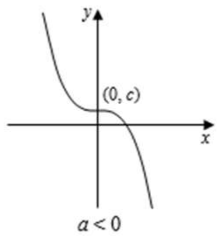
$a > 0$, u shape
$a < 0$, n shape



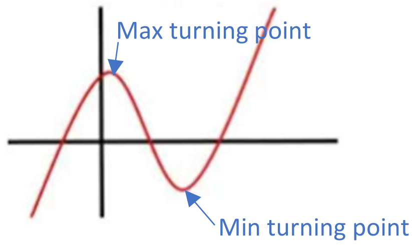
Cubic Functions

$$y = ax^3 + c$$





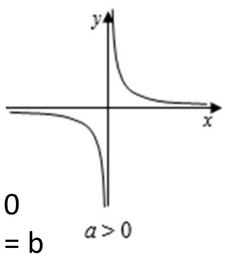
$$y = ax^3 + bx^2 + cx + d$$

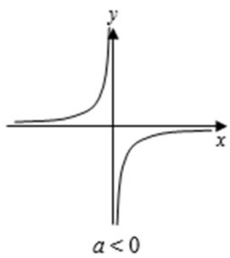


Reciprocal Functions

$$y = \frac{a}{x} + b$$

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





Exponential Functions

$$y = ar^x + b$$

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