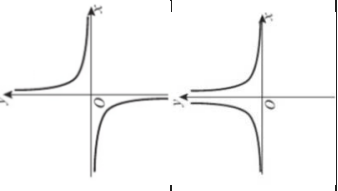


| Year 1 Knowledge Organiser Pure | |
|--|--|
| 1. Surds and Indices | $\sqrt[n]{a^m} = \frac{m}{n}\sqrt[n]{a^n}$ |
| 2. Quadratics | |
| Quadratic Formula $ax^2 + bx + c = 0$ | $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ |
| $b^2 - 4ac > 0$ | Two distinct real roots |
| $b^2 - 4ac = 0$ | One repeated real root |
| $b^2 - 4ac < 0$ | No real roots |
| 3. Equations and Inequalities | |
| Domain | The set of possible inputs, x |
| Range | The set of possible outputs, f(x) |
| 4. Graphs and Transformations | |
| $y = \frac{k}{x}, k > 0$ |  |
| $y = \frac{k}{x^2}, k > 0$ | |
| $f(x) \rightarrow f(x - a)$ | Translation $\begin{pmatrix} a \\ 0 \end{pmatrix}$ |
| $f(x) \rightarrow f(x) + b$ | Translation $\begin{pmatrix} 0 \\ b \end{pmatrix}$ |
| $f(x) \rightarrow f(cx)$ | Stretch scale factor 1/c in the x direction |
| $f(x) \rightarrow df(x)$ | Stretch scale factor d in the y direction |
| $f(x) \rightarrow f(-x)$ | Reflection in the y axis |
| $f(x) \rightarrow -f(x)$ | Reflection in the x axis |
| 5. Coordinate Geometry of Straight Lines | |
| $y - y_1 = m(x - x_1)$ | $m =$ gradient $(x_1, y_1) =$ point on line |
| 6. Coordinate Geometry of Circles | |
| Equation of circle radius r and centre (a,b) | $(x - a)^2 + (y - b)^2 = r^2$ |
| Perpendicular bisector to AB | A straight line which is perpendicular to AB and passes through midpoint of AB |
| Perpendicular from the centre... | Bisects the chord |
| The angle between a tangent and a radius in a circle is... | 90° |
| Perpendicular bisectors... | Intersect at the centre |
| 7. Proof & Polynomials | |
| Factor Theorem $f(p) = 0 \Leftrightarrow$ | $(x - p)$ is a factor of $f(x)$ |

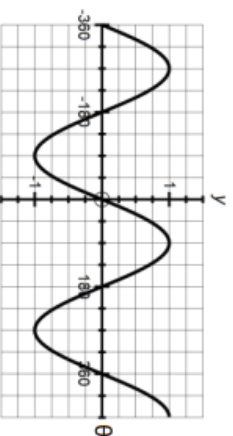
8. Binomial Expansion

| | |
|-------------------------------|---|
| $n! =$ | $n \times (n-1) \times (n-2) \times \dots \times 2 \times 1$ |
| $\binom{n}{r} = {}^n C_r =$ | $\frac{n!}{r!(n-r)!}$ |
| Binomial Series $(a + b)^n =$ | $a^n + \binom{n}{1} a^{n-1}b + \binom{n}{2} a^{n-2}b^2 + \dots + \binom{n}{r} a^{n-r}b^r + \dots + b^n$ |
| Binomial term | $\binom{n}{r} a^{n-r} b^r$ |

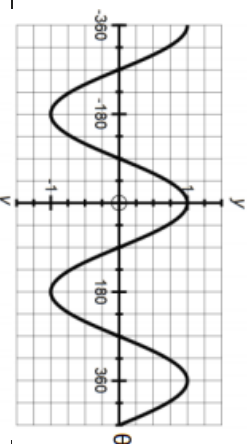
9. Trigonometric Ratios

| | |
|------------------------|---|
| Sine rule for length | $\frac{a}{\sin(A)} = \frac{b}{\sin(B)} = \frac{c}{\sin(C)}$ |
| Cosine rule for length | $a^2 = b^2 + c^2 - 2bc \cos A$ |
| Cosine rule for angles | $\cos(A) = \frac{b^2 + c^2 - a^2}{2bc}$ |
| Area of a triangle | $Area = \frac{1}{2} ab \sin C$ |

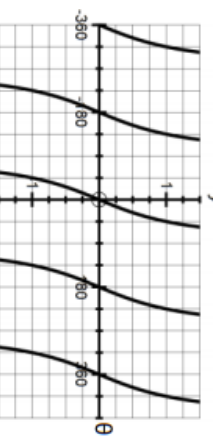
$Y = \sin x$



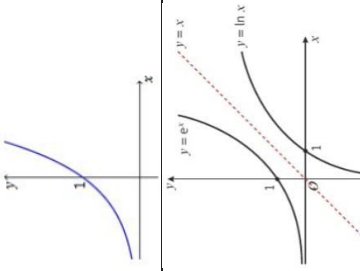
$Y = \cos x$



$Y = \tan x$



| | | | | | | |
|-----|-----------|----------------------|----------------------|----------------------|------------|--|
| | 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 | $\sqrt{3}$ | Undefined | |

| | |
|---------------------------------|---|
| 10. Trigonometric Identities | |
| $\sin^2 x + \cos^2 x =$ | 1 |
| $\frac{\sin x}{\cos x} =$ | $\tan x$ |
| 11. Vectors | |
| Magnitude $ a =$ | $\sqrt{a^2 + b^2}$, where $a = \begin{pmatrix} a \\ b \end{pmatrix}$ |
| Unit vector in direction $a =$ | $\frac{a}{ a }$ |
| 12. Differentiation | |
| First Principles $f'(x) =$ | $\lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$ |
| $f(x)$ increasing | $f'(x) \geq 0$ |
| $f(x)$ decreasing | $f'(x) \leq 0$ |
| Stationary point | $f'(x) = 0$ |
| $f''(a) > 0$ and $f(x) = 0$ | Minimum |
| $f''(a) < 0$ and $f(x) = 0$ | Maximum |
| $f''(a) = 0$ and $f(x) = 0$ | Need to look at points either side to determine nature |
| 13. Integration | |
| $\int_a^b f'(x) dx =$ | $[f(x)]_a^b = f(b) - f(a)$ |
| 14. Exponentials and Logarithms | |
| $y = a^x$ |  |
| $y = e^x$ and $y = \ln x$ | |
| $y = e^{kx}$ | $\frac{dy}{dx} = ke^{kx}$ |
| $\log_a n = x \Leftrightarrow$ | $a^x = n$ |
| $e^{\ln x} = \ln(e^x) =$ | x |
| $\log_a x + \log_a y =$ | $\log_a xy$ |
| $\log_a x - \log_a y =$ | $\log_a \frac{x}{y}$ |
| $\log_a x^k =$ | $k \log_a x$ |
| $\log_a x =$ | $\frac{\log_b x}{\log_b a}$ |
| $\frac{1}{\log_a x} =$ | $\log_x a$ |