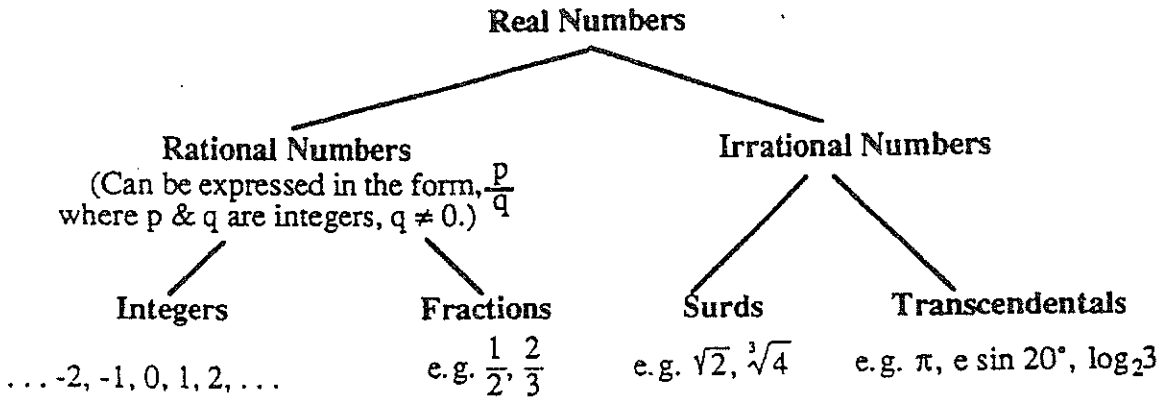
2 UNIT SUMMARY

ARITHMETIC AND ALGEBRA



Order of Operation (BIDMAS)

1. Brackets
2. Indices
3. Division and multiplication, from left to right
4. Addition and subtraction, from left to right

Fractions

$$\frac{a}{b} \pm \frac{c}{d} = \frac{ad \pm bc}{bd}$$

$$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$$

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$$

Factorisation

1.	Common Factor	$ab + ac = a(b + c)$
2.	Grouping In Pairs	$ac + ad - bc - bd = a(c + d) - b(c + d)$ $= (a - b)(c + d)$
3.	Perfect Square	$a^2 \pm 2ab + b^2 = (a \pm b)^2$
4.	Difference of Two Squares	$a^2 - b^2 = (a - b)(a + b)$
5.	Quadratic	e.g. $2x^2 + x - 6 = (2x - 3)(x + 2)$
6.	Sum & Difference of Two Cubes	$a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2)$

Rectangular Hyperbola

$xy = c$ is a rectangular hyperbola.

Asymptotes are $x = 0$ and $y = 0$ (that is, y and x axes, respectively).

If $c > 0$, branches of hyperbola are in quadrants 1 & 3.

If $c < 0$, branches of hyperbola are in quadrants 2 & 4.

Domain of Composite Function

Domain of $y = \frac{h(x)}{g(x)}$ is all real x, except values of x for which $g(x) = 0$.

Domain of $y = \sqrt{g(x)}$ is found by solving $g(x) \geq 0$ for x.

Domain of $y = \log_n g(x)$ is found by solving $g(x) > 0$ for x.

Regions of the Cartesian Plane

To draw $y \leq f(x)$ or $y \geq f(x)$, first sketch $y = f(x)$ as an unbroken curve.

To draw $y < f(x)$ or $y > f(x)$, first sketch $y = f(x)$ as a broken curve.

Then substitute point, for example (0, 0), into inequality to determine which side of curve to shade.

Tips For Curve Sketching

Graph of $y = f(x) + c$ is graph of $y = f(x)$ raised c units, where $c > 0$.

Graph of $y = f(x) - c$ is graph of $y = f(x)$ lowered c units, where $c > 0$.

Graph of $y = -f(x)$ is reflection of $y = f(x)$ in the x-axis.

Graph of $y = f(-x)$ is reflection of $y = f(x)$ in the y-axis.

Graph of $x = f(y)$ is reflection of $y = f(x)$ in the line $y = x$.

To graph $y = |f(x)|$, graph $y = f(x)$ using a broken line.

For portion of graph above the x-axis, leave unchanged.

For portion of graph below x-axis, reflect in the x-axis.

Even and Odd Functions

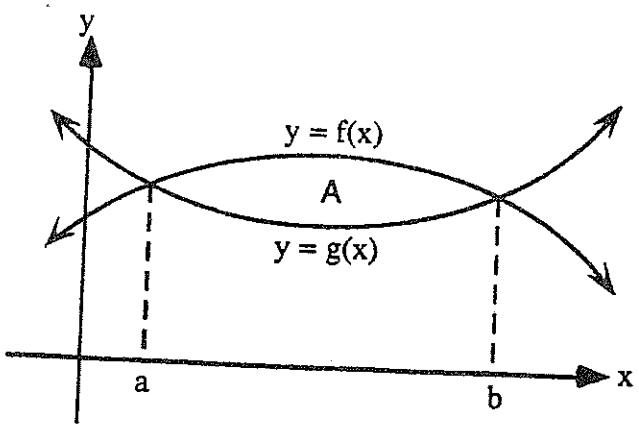
A function is **even** iff $f(-x) = f(x)$

An even function is symmetrical in the y-axis.

A function is **odd** iff $f(-x) = -f(x)$

An odd function has point symmetry. It maps onto itself when rotated 180° about (0, 0).

Area Between Two Curves



Area between curves, $A = \int_a^b [f(x) - g(x)]\,dx$

This formula may even be applied when area is partly above and partly below x-axis!

Volume of Revolution

If A_x (on previous page) is rotated about the x-axis through one revolution, $V_x = \pi \int_a^b y^2\,dx$

If A_y (on previous page) is rotated about the y-axis through one revolution, $V_y = \pi \int_c^d x^2\,dy$

Approximations of Definite Integrals

The Trapezoidal Rule

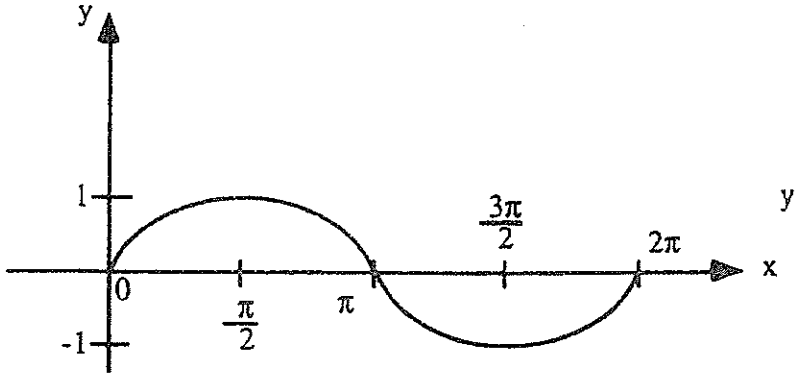
$$\int_a^b f(x)\,dx \approx \frac{b-a}{2}\left[f(a) + f(b)\right]$$

Simpson's Rule

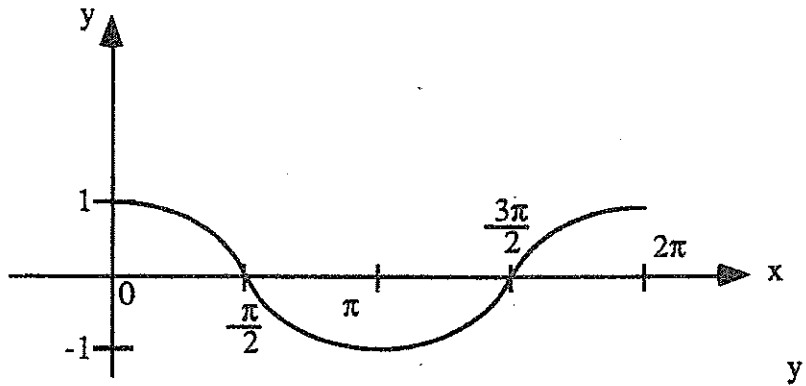
$$\int_a^b f(x)\,dx \approx \frac{b-a}{6}\left[f(a) + 4f\left(\frac{a+b}{2}\right) + f(b)\right]$$

$$\approx \frac{h}{3}\left[f(a) + 4f\left(\frac{a+b}{2}\right) + f(b)\right]$$

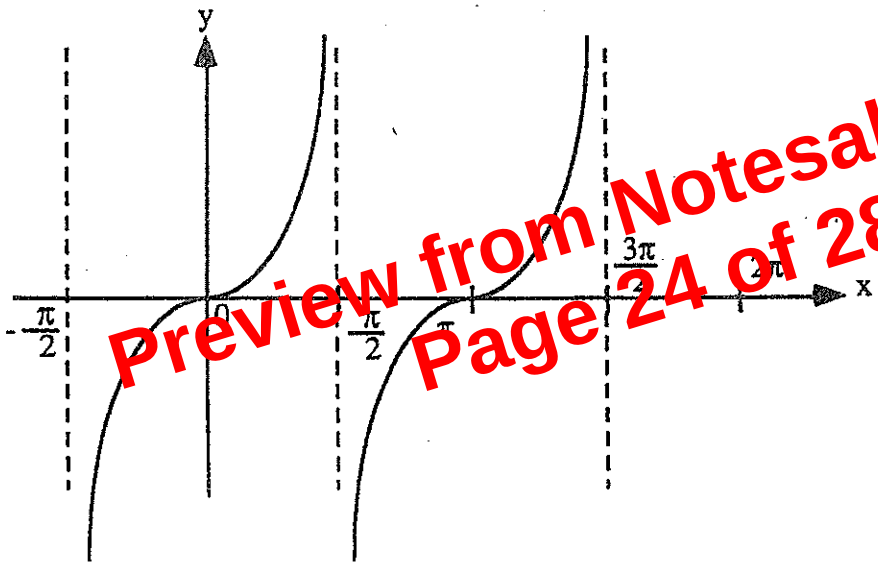
Graphs of Trigonometric Functions



$y = \sin x$, for $0 \leq x \leq 2\pi$



$y = \cos x$, for $0 \leq x \leq 2\pi$



$y = \tan x$, for $-\frac{\pi}{2} \leq x \leq \frac{3\pi}{2}$

Amplitude & Period of Trigonometric Functions

Consider the graphs of $y = a \sin nx + b$ and $y = a \cos nx + b$, where $n > 0$.

amplitude = $|a|$

period = $\frac{2\pi}{n}$

If $b > 0$, $y = a \sin nx$ or $y = a \cos nx$ is raised b units.

If $b < 0$, $y = a \sin nx$ or $y = a \cos nx$ is lowered b units.

Consider the graph of $y = \tan nx$, where $n > 0$.

period = $\frac{\pi}{n}$