2 UNIT MATHEMATICS FORMULA SHEET

SURDS

1. $\sqrt{a} \times \sqrt{a} = a$
2. $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$
3. $a\sqrt{b} + c\sqrt{b} = (a+b)\sqrt{b}$
4. $a\sqrt{b} \times c\sqrt{b} = ac\sqrt{b^2} = acb$
5. $\sqrt{a^2 b} = \sqrt{a^2} \times \sqrt{b} = a\sqrt{b}$

Cubic Factorization:

1. $x^3 + y^3 = (x+y)(x^2 - xy + y^2)$
2. $x^3 - y^3 = (x-y)(x^2 + xy + y^2)$

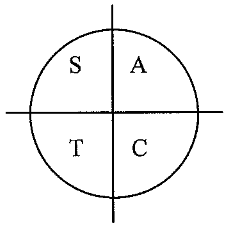
General Equation of a Circle

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

Quadratic Formula:

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

ASTC – All Stations To Central



Pythagorean Identities:

$A.$ $\sin^2\theta + \cos^2\theta = 1$

$B.$ If $\div A$ by $\cos^2\theta$

$\tan^2\theta + 1 = \sec^2\theta$

$C.$ If $\div A$ by $\sin^2\theta$

$\cot^2\theta + 1 = co\sec^2\theta$

Sign of ratios:

1. $\sin(90 - \theta) = \cos\theta$
2. $\cos(90 - \theta) = \sin\theta$
3. $\tan(90 - \theta) = \cot\theta$
4. $\cot(90 - \theta) = \tan\theta$

$\tan\theta$ = gradient of line

Cosine Rule:

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

or

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

Sine Rule:

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

Axis of Symmetry:

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

Area of Triangle:

$$A = \frac{1}{2}ab\sin C$$

Point Gradient Formula:

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

Even function – y axis

$f(-x) = f(x)$

Odd function – origin

$f(-x) = -f(x)$

The Parabola:

$(x-h)^2 = -4a(y-k)$

vertex (h, k)

Perpendicular distance:

$$d = \left| \frac{ax_1 + by_1 + c}{\sqrt{a^2 + b^2}} \right|$$

Sum and Product of Roots:

$$\alpha + \beta = \frac{-b}{a} \quad \text{and} \quad \alpha\beta = \frac{c}{a}$$

Sum of n terms of an Arithmetic (l is the n^{th} term)

$$S_n = \frac{n}{2}[2a + (n-1)d] \quad \text{or} \quad S_n = \frac{n}{2}(a + l)$$

nth term of an Arithmetic Series:

$T_n = a + (n-1)d$

nth term of an Geometric Series:

$T_n = ar^{n-1}$

Sum of n terms of a Geometric Series:

$$S_n = \frac{a(r^n - 1)}{r - 1} \text{ for } |r| > 1 \qquad S_n = \frac{a(1 - r^n)}{1 - r} \text{ for } |r| < 1$$

Infinite Sum of a Geometric Series:

$$S_\infty = \frac{a}{1-r} \quad \text{if } |r| < 1$$

Product Rule:

$$\frac{d}{dx}u(x).v(x) = u\frac{dv}{dx} + v\frac{du}{dx}$$

Quotient Rule:

$$\frac{d}{dx}\left(\frac{u(x)}{v(x)}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$$

Stationary Points:

$\frac{dy}{dx} = 0$

If $f''(x) > 0$ then Minimum

If $f''(x) < 0$ then Maximum

Graphing:

$\frac{dy}{dx} > 0$ function is increasing

$\frac{dy}{dx} < 0$ function is decreasing

$\frac{d^2y}{dx^2} > 0$ concave up

$\frac{d^2y}{dx^2} < 0$ concave down

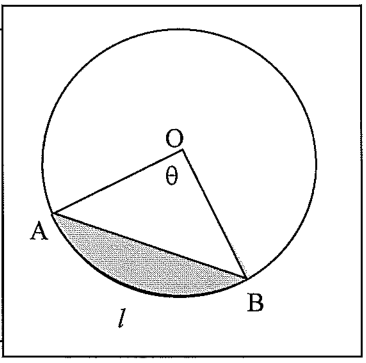
Chain rule:

$$\frac{d}{dx}[f(x)]^n = n[f(x)]^{n-1}.f'(x)$$

Length of Arc AB = $l = r\theta_{rad}$ units

Area of Sector AOB = $\frac{1}{2}r^2\theta_{rad}$ units^2

Area of Segment = $\frac{1}{2}r^2(\theta_{rad} - \sin\theta_{rad})$ units^2



Trapezoidal Rule:

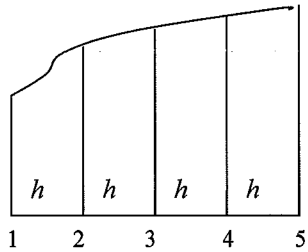
$$A \approx \frac{h}{2}\left(first + last + 2(others)\right)$$

Simpson's Rule:

$$A \approx \frac{h}{3}\{First + Last + 4(Odd) + 2(Even)\}$$

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

x	1	2	3	4	5
f(x)	12	14	15.3	16	16.4
Trapezoidal:	**1**	**2**	**2**	**2**	**1**
Simpson's:	**1**	**4**	**2**	**4**	**1**
	y_0	y_1	y_2	y_3	y_n



Revolution about x-axis:

$$V = \pi\int_a^b y^2\,dx$$

Revolution about y-axis:

$$V = \pi\int_a^b x^2\,dy$$

Derivatives:

1. $f(x) = ax^2 + bx + c$

   $f'(x) = 2ax + b$

2. $f(x) = ae^{bx^2+cx+d}$

   $f'(x) = (2bx + c)ae^{bx^2+cx+d}$

3. $f(x) = a\ln u$

   $f'(x) = \frac{a.f'(u)}{u}$

4. $f(x) = a\sin(bx^2 + cx + d)$

   $f'(x) = (2bx + c)a\cos(bx^2 + cx + d)$ — or sin ⇒ cos

5. $f(x) = a\cos(bx^2 + cx + d)$

   $f'(x) = -(2bx + c)a\sin(bx^2 + cx + d)$ — or cos ⇒ - sin

6. $f(x) = a\tan(bx^2 + cx + d)$

   $f'(x) = (2bx + c)a\sec^2(bx^2 + cx + d)$ — or tan ⇒ $\sec^2$

LOGS:

1. $If\ \log_a b = c,\ then\ b = a^c$
2. $\log_a 1 = 0$
3. $\log_a a = 1$
4. $\log_a(xy) = \log_a x + \log_a y$
5. $\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$
6. $\log_a x^n = n\log_a x$
7. Change of base: $\log_a x = \frac{\log_b x}{\log_b a}$

Exponential Growth:

$$N = N_0e^{kt}$$

Exponential decay:

$$N = N_0e^{-kt}$$

$$\int\frac{f'(x)}{f(x)}dx = \log_e[f(x)] + c$$