FORMULA SHEET:
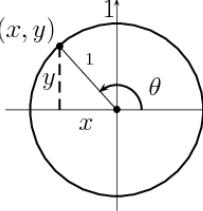## MHF4U 12 ADVANCED FUNCTIONS

TRIGONOMETRY

$$x^2 + y^2 = r^2$$

$$\sin\theta = \frac{y}{r} \qquad \csc\theta = \frac{r}{y}$$

$$\cos\theta = \frac{x}{r} \qquad \sec\theta = \frac{r}{x}$$

$$\tan\theta = \frac{y}{x} \qquad \cot\theta = \frac{x}{y}$$

$$arc\ length\ a = r\theta$$

Quotient Identity: $\quad \tan\theta = \frac{sin\theta}{cos\theta}$

Pythagorean Identities:
$$\sin^2\theta + \cos^2\theta = 1$$
$$\tan^2\theta + 1 = \sec^2\theta$$
$$\cot^2\theta + 1 = \csc^2\theta$$

Compound Angle Formulae:
$$\sin(a+b) = sinacosb + cosasinb$$
$$cos(a+b) = cosacosb - sinasinb$$
$$tan(a+b) = \frac{tana + tanb}{1 - tanatanb}$$

Double Angle Formulae: $\sin(2a) = 2sinacosa$
$$cos(2a) = \cos^2 a - \sin^2 a$$
$$= 1 - 2\sin^2 a$$
$$= 2\cos^2 a - 1$$
$$tan(2a) = \frac{2tana}{1 - \tan^2 a}$$

MODELLING FUNCTIONS

Linear	$y = mx + b$	Initial value b
Exponential	$y = ab^x$	Initial value a
Logistic	$y = \dfrac{c}{1+ab^x}$	Carrying capacity c

POLYNOMIALS

Difference of Squares: $x^2 - y^2 = (x - y)(x + y)$
Difference of Cubes: $x^3 - y^3 = (x - y)(x^2 + xy + y^2)$
Sum of Cubes: $\quad x^3 + y^3 = (x + y)(x^2 - xy + y^2)$

RATIONAL EQUATIONS $\quad \frac{p(x)}{q(x)}$

Vertical Asymptotes: $\quad q(x) = 0$
Horizontal Asymptote : $y=0 \rightarrow \partial p < \partial q$
$$y = \frac{a_n}{a_n} \rightarrow \partial p = \partial q$$
Oblique Asymptote: $\quad y = quotient \rightarrow \partial p = \partial q + 1$
Zeroes : $\quad p(x) = 0$
y-intercept: $\quad$ set $x = 0$

RECIPROCAL EQUATIONS $\quad \frac{1}{f(x)}$

Vertical Asymptotes: $\quad f(x) = 0$
Horizontal Asymptote : $y=0$
Zeroes : $\quad$ none
y-intercept: $\quad \frac{1}{y-int}$

Rate of CHANGE

Average rate of change = slope of secant = $\frac{\Delta y}{\Delta x}$

Instantaneous rate of change
$$= \text{slope of tangent}$$
$$= \frac{f(x+h)-f(x)}{h}$$

LOGARITHM LAWS

$$log_a b = \frac{log_c b}{log_c a} \qquad\qquad log_a(b^c) = clog_a b$$
$$log_a(bc) = log_a b + log_a c \qquad a^{log_a b} = b$$
$$log_a\left(\frac{b}{c}\right) = log_a b - log_a c$$