Dr. Pete's useful stuff*

Area and Volume

Surface area of sphere $= 4\pi r^2$
Curved surface area of cone $= \pi r \ell$
(ℓ = slant height)
Area of trapezium $= \frac{1}{2}(a+b)h$
Area of triangle $= \frac{1}{2}bh$
Area of sector $= \frac{1}{2}r^2\theta$

Volume of pyramid or cone $= \frac{1}{3}Ah$
(base area $A = \pi r^2$ for cone)
Volume of a sphere $= \frac{4}{3}\pi r^3$
In a triangle ABC

(i) $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C} = 2R$

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

Center of mass

$$X_{\text{cm}} = \frac{\sum m_i x_i}{\sum m_i} = \frac{\sum m_i x_i}{M}$$ similarly for Y_{cm} Z_{cm} $\vec{V}_{\text{cm}}$ $\vec{A}_{\text{cm}}$

Quadratic functions

$ax^2 + bx + c = 0 \Rightarrow x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ sum of roots $= -\dfrac{b}{a}$ product of roots $= \dfrac{c}{a}$

Exponents

$a^m \times a^n = a^{m+n}$ $a^m / a^n = a^{m-n}$ $(a \neq 0)$ $(a^m)^n = a^{mn}$ $(ab)^m = a^m b^m$ $a^0 = 1$ $(a \neq 0)$

Logarithms

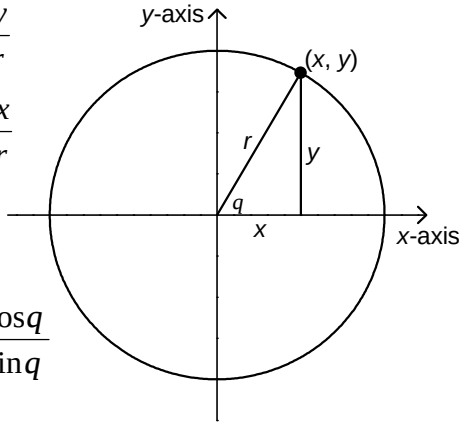
$y = b^x \Leftrightarrow \log_b y = x$
$\log_b x + \log_b y = \log_b(xy)$
$\log_b x - \log_b y = \log_b(x/y)$
$y = \exp(x) \Leftrightarrow x = \ln(y)$
$\log_b x^n = n \log_b y$
$\log_b x = \log_a x / \log_a b$
$(\ln(y) \equiv \log_e y)$
$y^x = e^{x \ln(y)}$
$\log_e x = 2.3026 \times \log_{10} x$

Trig functions

$\tan\theta = \dfrac{y}{x} = \dfrac{\sin\theta}{\cos\theta}$

$\sin\theta = \dfrac{y}{r}$

$\cos\theta = \dfrac{x}{r}$



$y = r\sin\theta$
$x = r\cos\theta$
$y = x\tan\theta$

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

$\sin(90° \pm \theta) = \cos\theta$
$\cos(90° \pm \theta) = \mp\sin\theta$

$\sin(180° \pm \theta) = \mp\sin\theta$
$\cos(180° \pm \theta) = -\cos\theta$

$\operatorname{cosec}\theta = \dfrac{r}{y} = \dfrac{1}{\sin\theta}$

$\cot\theta = \dfrac{x}{y} = \dfrac{\cos\theta}{\sin\theta}$

$\sec\theta = \dfrac{r}{x} = \dfrac{1}{\cos\theta}$

Complex numbers

$z = x + iy = r(\cos\theta + i\sin\theta)$ $e^{i\theta} = \cos\theta + i\sin\theta$ $e^{i\pi} = -1$

Hyperbolic functions

$\cosh x = \frac{1}{2}(e^x + e^{-x})$
$\cosh x + \sinh x = e^x$
$\sinh x = \frac{1}{2}(e^x - e^{-x})$
$\cosh^2 x - \sinh^2 x = 1$
$\tanh x = \dfrac{\sinh x}{\cosh x} = \dfrac{e^x - e^{-x}}{e^x + e^{-x}}$

Kinematic equations (const. a)

$v = v_o + at$ $x = x_o + v_o t + \frac{1}{2}at^2$ $v^2 = v_o^2 + 2a(x - x_o)$;
where $x = x_o$ and $v = v_o$, when $t = 0$