Tools for Math Review Sheet

$y = (\text{slope})x + (\text{y-intercept})$

Area of square = $(\text{length of side})^2$
Circumference of circle of radius $r = 2\pi r$
Area circle of radius $r = \pi r^2$
Area triangle = $\frac{1}{2}(\text{base} \times \text{height})$
Surface area cube = $6(\text{length side})^2$
Volume cube = $(\text{length side})^3$
Volume sphere = $\frac{4}{3} \pi r^3$

$a^x \cdot a^y = a^{x+y}$

$a^x + a^y = a^{x+y}$

$(a^x)^y = a^{xy}$

$a^{-b} = \frac{1}{a^b}$

The logarithm of a number is the exponent by which a fixed number, the base, has to be raised to produce that number. The log base $a$ of a number $y$ is the power of $a$ that yields $y$.

$log_a y = log_a a^x = x$  

e.g. $log_{10} 1000 = log_{10} 10^3 = 3$

$log_{10}$ is commonly described as just log.

Log$_e$ is commonly described as ln.

$e = 2.718281828459045235360287471352662497757244709369995...$

$log_a a = 1$  

e.g. $log 10 = log 10^1 = 1$  
or  
$ln e = ln e^1 = 1$

$log_a (b\cdot c) = log_a b + log_a c$

$log_a (b\div c) = log_a b - log_a c$

$log_a b^c = c \log_a b$  

e.g. $ln 2^3 = -3 \ln 2$
Population at time $t = P(t)$
Population at time $0 = P_0$
$r = \text{rate}$

Rate has units of 1/time, e.g. a rate of change of 12% per year corresponds to 0.12/yr
$t = \text{time}$

\[ P(t) = P_0 e^{rt} \]

for doubling $P(t) = 2P_0$
so $2P_0 = P_0 e^{rt}$
$2 = e^{rt}$
$\ln 2 = \ln (e^{rt})$
$\ln 2 = rt \ln e$
$\ln 2 = rt$
$\frac{\ln 2}{r} = t$
$0.69 \frac{\ln 2}{r} = t$
$t = \frac{0.69}{r}$
A radian is the ratio between the length of an arc and its radius. It is normally described in terms of pi ($\pi$) and as a unitless quantity.

A complete circle has an arc length of $2\pi r$ (its circumference), so a complete circle is $2\pi$ radians.

$$\text{Radian} = \frac{\text{length of arc}}{\text{radius}} = \frac{2\pi r}{r} = 2\pi$$

A complete circle is $360^\circ$, $360^\circ$ is $2\pi$ radians, leading to the following conversion factor.

$$\frac{360^\circ}{2\pi} = \frac{180^\circ}{\pi}$$

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$$\sin \alpha = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{y}{r}$$

$$\cos \alpha = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{x}{r}$$

$$\tan \alpha = \frac{\text{opposite}}{\text{adjacent}} = \frac{y}{x}$$