

# MATH 115 FORMULA SHEET

## Logarithms and Exponentials

The value  $A$  after  $t$  years of an investment of principal  $P$  paying interest at an annual rate  $r$ :

$$\text{with interest compounded } n \text{ times a year: } A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

$$\text{with interest compounded continuously: } A = Pe^{rt}$$

The population  $P$  after time  $t$ , with initial population  $P_0$  and relative growth rate  $k$ :

$$P = P_0 e^{kt}$$

The mass  $M$  of a radioactive element after time  $t$ , with initial amount  $M_0$ , and relative decay rate  $k$ :

$$M = M_0 e^{-kt}$$

Change of base formula:

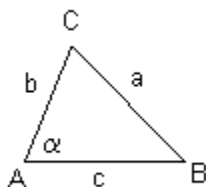
$$\log_a x = \frac{\log_b x}{\log_b a}$$

## Trigonometry:

Arc Length: ( $\theta$  in radians):  $S = r\theta$

Notation:  $\sin^2(\theta) = (\sin \theta)^2$

Law of Cosines:  $a^2 = b^2 + c^2 - 2bc \cos \alpha$



## Addition and Subtraction Formulas:

$$\begin{aligned}\sin(a + b) &= \sin a \cos b + \cos a \sin b \\ \sin(a - b) &= \sin a \cos b - \cos a \sin b \\ \cos(a + b) &= \cos a \cos b - \sin a \sin b \\ \cos(a - b) &= \cos a \cos b + \sin a \sin b\end{aligned}$$

## Double Angle Formulas:

$$\begin{aligned}\sin(2a) &= 2 \sin a \cos a \\ \cos(2a) &= \cos^2 a - \sin^2 a\end{aligned}$$

## Half-angle Formulas:

$$\begin{aligned}\sin\left(\frac{a}{2}\right) &= \pm \sqrt{\frac{1 - \cos(a)}{2}} \\ \cos\left(\frac{a}{2}\right) &= \pm \sqrt{\frac{1 + \cos(a)}{2}}\end{aligned}$$