The Need-to-know List

In order to be able to fully appreciate the calculus that you learn this year, you need to be *completely comfortable* with the following fundamental building blocks.

1   Arithmetic/Algebra

$(a + b)^2 = a^2 + 2ab + b^2$ $\qquad\qquad$ NOT $= a^2 + b^2$!!!!!
$a^2 - b^2 = (a + b) \times (a - b)$
$x^3 + y^3 = (x + y) \times (x^2 - xy + y^2)$
$x^3 - y^3 = (x - y) \times (x^2 + xy + y^2)$
$(a + b)/c = a/c + b/c$
$c/(a + b)$ $\qquad\qquad\qquad\qquad$ Does NOT Simplify!!!!!!

Know how to **factor** and **find roots of** polynomials.

2   Powers

Simplifies	Does Not Simplify
$x^a x^b = x^{a+b}$	$x^a + x^b$
$a^x a^y = a^{x+y}$	$a^x + a^y$
$x^a y^a = (xy)^a$	
$(x^a)^b = x^{ab}$	$x^{(a^b)}$
$x^{-a} = 1/x^a$	
$\sqrt{xy} = \sqrt{x}\sqrt{y}$	$\sqrt{x + y}$
$\sqrt{x^2} = |x|$	

Memorize these special values!

$1^0 = 1 \quad 0^1 = 0 \quad 0^0 = \text{undefined}$

3   Trigonometry/Triangles (Review Later)

SOH-CAH-TOA: $\sin(\theta) = \frac{\text{OPP}}{\text{HYP}}$, $\cos(\theta) = \frac{\text{ADJ}}{\text{HYP}}$, $\tan(\theta) = \frac{\text{OPP}}{\text{ADJ}}$
$\qquad \sin^2(x) + \cos^2(x) = 1 \qquad$ For all x's!
$\qquad\qquad a^2 + b^2 = c^2 \qquad$ For right triangles, hypotenuse c.

Memorize these special values!

$30° = \pi/6 \quad 45° = \pi/4 \quad 90° = \pi/2 \quad 180° = \pi \quad 360° = 2\pi$

0	**1/2**	**$\sqrt{2}/2$**	**$\sqrt{3}/2$**	**1**
$\sin(0)$	$\sin(\pi/6)$	$\sin(\pi/4)$	$\sin(\pi/3)$	$\sin(\pi/2)$
$\cos(\pi/2)$	$\cos(\pi/3)$	$\cos(\pi/4)$	$\cos(\pi/6)$	$\cos(0)$

Key Identities

$\sin(2x) = 2\sin(x)\cos(x) \qquad$ Sine Double Angle
$\cos(2x) = \cos^2(x) - \sin^2(x) \qquad$ Cosine Double Angle
$\sin^2 x = [1 - \cos(2x)]/2 \qquad$ Sine Half-Angle
$\cos^2 x = [1 + \cos(2x)]/2 \qquad$ Cosine Half-Angle