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, and Fractions

$(a+b)^2 = a^2 + 2ab + b^2$, **NOT** $= a^2 + b^2$**!!!!!**

$a^2 - b^2 = (a+b) \times (a-b)$

$x^3 + y^3 = (x+y) \times (x^2 - xy + y^2)$

$x^3 - y^3 = (x-y) \times (x^2 + xy + y^2)$

$$(a+b)/c = a/c + b/c$$

$c/(a+b)$ **does NOT simplify!!!!!!**

$$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$$

$$\frac{\frac{a}{b}}{\frac{c}{d}} = \frac{ad}{bc} \qquad \frac{a}{\frac{c}{d}} = \frac{ad}{c} \qquad \frac{\frac{a}{b}}{c} = \frac{a}{bc}$$

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

2. Powers

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

Memorize these special values!

$1^0 = 1 \quad 0^1 = 0 \quad 0^0 =$ undefined

3. Areas and Volumes

Area of a rectangle (square):	$A_{\text{rect}} = lw$ $(A_{\text{sq}} = l^2)$
Area of a triangle:	$A_{\text{tri}} = \frac{1}{2}bh$
Area of a circle:	$A_{\text{circ}} = \pi r^2$
Volume of any prism:	$V_{\text{prism}} = Ah$
(rectangular prism):	$(V_{\text{box}} = lwh)$
(cylinder):	$(V_{\text{cyl}} = \pi r^2 h)$
Volume of a sphere:	$V_{\text{sph}} = \frac{4}{3}\pi r^3$

4. Trigonometry and Triangles

SOH-CAH-TOA: $\sin(\theta) = \frac{\text{OPP}}{\text{HYP}}$, $\cos(\theta) = \frac{\text{ADJ}}{\text{HYP}}$, $\tan(\theta) = \frac{\text{OPP}}{\text{ADJ}}$

$\sin^2(x) + \cos^2(x) = 1$ For all x's!

$a^2 + b^2 = c^2$ 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

$\sin(2x) = 2\sin(x)\cos(x)$ Sine Double Angle

$\cos(2x) = \cos^2(x) - \sin^2(x)$ Cosine Double Angle

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

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