PRECALC & ALGEBRA REVIEW

EXPONENT

- MULTIPLICATION
  If the two numbers have the same base but different exponents, you can multiply the two numbers by finding the sum of the two exponents
  EXAMPLE $x^2x^4 = x^6$

- DIVISION
  If the numbers have the same base but different exponents, you can divide the numbers by finding the difference.
  $\frac{x^4}{x^2} = x^2$

- RAISING AN EXPONENT TO EXPONENT
  When an exponent is raised to another exponent, you mulitply the two exponents together.
  $(x^2)^4 = x^8$

FRACTIONS

- ADDING/SUBTRACTING Find the if the fractions have common denominators. If not, modifify the fractions so they have common denominators.
  WARNING When changing the denominator of the fraction, do not forget to also change the numerator.
  After finding the common denominators, do the appropriate operations to the fractions.

$$\frac{12}{24} + \frac{12}{24} - \frac{1}{24} = \frac{23}{24}$$

- MULTIPLICATION
  Unlike addition or subtraction, there is no need to find the common denominators. Just multiply the denominator and numerator across.

$$\frac{2}{24} * \frac{3}{5} = \frac{6}{120} \text{ Reduced form } \frac{1}{40}$$

- DIVISION
  Unlike, addition or subtraction, there is no need to find the common denominators. However, in order to divide fractions, its necessary to find the reciprocal of the dividend (Flipping the numerator and the denominator) and multiply the fractions.

$\frac{2}{6} \div \frac{4}{5} =$
Flip the
$\frac{2}{6} \times \frac{5}{4} = \frac{10}{24}$
reduced form of the answer: $\frac{5}{12}$

TRIGONOMETRY

Basic Trig Functions

- sin(x)
- cos(x)
- tan(x)
- sec(x)
- csc(x)
- cot(x)

Basic Trig Identities

Quotient Identity

$tan(x) = \frac{sin(x)}{cos(x)}$
$cot(x) = \frac{cos(x)}{sin(x)}$

Reciprocal Identity

- $csc(x) = \frac{1}{sin(x)}$
- $sec(x) = \frac{1}{cos(x)}$
- $cot(x) = \frac{1}{tan(x)}$
- $sin(x) = \frac{1}{csc(x)}$
- $cos(x) = \frac{1}{sec(x)}$
- $tan(x) = \frac{1}{cot(x)}$

Pythagorean Identity

- $sin^2(x) + cos^2(x) = 1$
- $sin^2(x) = 1 - cos^2(x)$
- $cos^2(x) = 1 - sin^2(x)$
- $tan^2(x) + 1 = sec^2(x)$
- $sec^2(x) - 1 = tan^2(x)$

Double Angle Trig

- $sin(2\theta) = 2sin(\theta)cos(\theta)$
- $cos(2\theta) = cos^2(\theta) - sin^2(\theta)$
- $cos(2\theta) = 2cos^2(\theta) - 1$

DERIVATIVES

Definition of a Derivative

$$\lim_{h\to 0} \frac{f(x+h) - f(x)}{h} \tag{1}$$

Derivative tells us the change of the function.
For instance if f(x) tells us the position of an object, then its derivative (written as $f'(x) or \frac{d}{dx}f(x)$) tells us the speed. **Derivative Properties** Sometimes memorizing these derivatives properties will help you in the later calculus.

Caution

Carefully read the direction of the problem as it may ask you to solve using the definition of a derivatives. Even with the correct answer it may hurt your score.

Constant Rule

$$\frac{d}{dx}c = 0 \tag{2}$$

where c is any real number
A derivative of any constant is equal to 0.

Derivative of a single variable

$$\frac{d}{dx}x = 1 \tag{3}$$

where x is a variable to the first power

Power Rule

$$\frac{d}{dx}x^n = nx^{n-1} \tag{4}$$

where n is a real number

Product Rule

$$\frac{d}{dx}(f(x) \times g(x)) = (\frac{d}{dx}f(x))g(x) + f(x)(\frac{d}{dx}g(x)) \tag{5}$$

Quotient Rule

$$\frac{d}{dx}((f(x) \div g(x)) = \frac{(\frac{d}{dx}f(x))g(x) - f(x)\frac{d}{dx}g(x)}{(g(x)^2)} \tag{6}$$

Trigonometry Derivatives

- $\frac{d}{dx}sin(x) = cos(x)$
- $\frac{d}{dx}cos(x) = -sin(x)$
- $\frac{d}{dx}tan(x) = sec^2(x)$
- $\frac{d}{dx}sec(x) = sec(x)tan(x)$
- $\frac{d}{dx}csc(x) = -csc(x)cot(x)$
- $\frac{d}{dx}cot(x) = -csc^2(x)$
- **advice** trigonometry functions that start with the letter 'C' have a negative sign on its their derivative.

Application of Derivatives

- **Critical Points**: x=c is a critical point of a function if $f'(c) = 0$ or $f'(c) =$ DNE
- **Maximum Minimum**: since the derivatives tells us if the slope of the graph is increasing or decreasing we can find the use it to find the highest or/and lowest points
- **Tangent Lines**

$$y = f(a) + f'(a)(x - a) \tag{7}$$

based on the points (a, f(a))