

## Exponents, Radicals, Logarithms, Scientific Notation

### Conjugates

- Use the conjugate whenever there is a radical or a square root (or complex number) in the denominator ( $(x - \sqrt{y}) \Rightarrow$  the conjugate is  $(x + \sqrt{y})$ )
- Multiply the conjugate by the numerator and denominator to remove the radical (or complex number) out of the denominator

### % Interest Equation

- Total = initial  $\cdot (1 + \text{rate})^{\text{time}}$  (rate is a decimal, time is in years, + means increase)

## Quadratic Equations

### Quadratic Formula

- $x_1, x_2 = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
- Use the Quadratic formula when it's difficult to factor equation

### Discriminant

- The discriminant is the equation,  $b^2 - 4ac$  (this is taken from the formula under the square root in the quadratic formula)
- If  $b^2 - 4ac > 0$ , there are 2 real solutions.
- If  $b^2 - 4ac = 0$ , there is 1 real solution.
- If  $b^2 - 4ac < 0$ , there are no real solutions.

### Perfect Squares

- $x^2 + 2Ax + A^2 = (x + A)^2 = 0$

## Probability

Probability an event will occur from multiple selections

- Probability = Total number of combinations where the scenario WILL occur / Total number of combinations
- Count the values for the numerator and denominator

## Matrices

- The determinant of a  $2 \times 2$  matrix is defined as  $D = ad - bc$  for a  $2 \times 2$  matrix

## Angles

Rectangular coordinates:  $(x, y)$ , Polar coordinates:  $(r, \theta)$

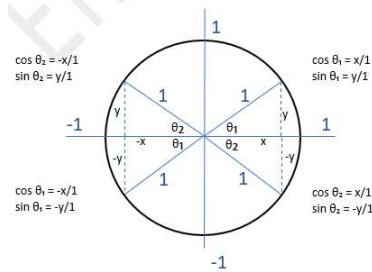
- Equations to convert from rectangular to polar coordinate:  $R = \sqrt{x^2 + y^2}$ ,  $\theta = \tan^{-1}(y/x)$
- Equations to convert from polar to rectangular coordinates:  $x = r \cos \theta$ ,  $y = r \sin \theta$

## Trigonometry

- $\csc \theta = 1 / \sin \theta$
- $\sec \theta = 1 / \cos \theta$
- $\cot \theta = 1 / \tan \theta$

### Unit Circle

- When given a value for cos, sin, or tan, recall there are certain angle ranges where the result is positive or negative
- The radius of the unit circle = 1
- The sign of cos, sin, and tan can be found by drawing the angle on the circle and then use the signs as referenced by the axis at  $90^\circ$ ,  $180^\circ$ ,  $270^\circ$ , and  $360^\circ$



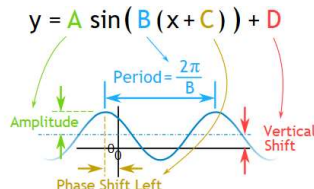
### Properties of all triangles (not just right triangles)

- Pythagorean Identity:  $\cos^2 \theta + \sin^2 \theta = 1$
- Law of Cosines:  $c^2 = a^2 + b^2 - 2ab \cos C$  (a, b, c are sides, C is an angle)
- Law of Sines:  $A / \sin A = b / \sin B = c / \sin C$  (a, b, c are sides, A, B, C are angles)

### Graphing Trigonometry Equations

$$y = A \sin(B(x - C)) + D$$

- A = amplitude
- (A > 0 opens up, A < 0 opens down)
- D = shift up & down
- (D > 0 shift up, D < 0 shift down)



## Similar Triangles

### Determine triangle type

- 2 side length must be greater than 3rd side to make a triangle
- $a^2 + b^2 = c^2 \Rightarrow$  right triangle
- $a^2 + b^2 > c^2 \Rightarrow$  obtuse triangle
- $a^2 + b^2 < c^2 \Rightarrow$  acute triangle

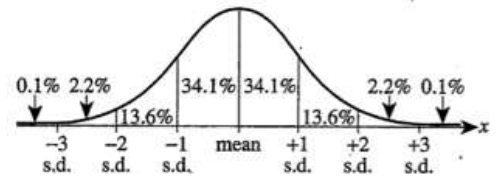
## Statistics

### Weighted Mean / Average

- Weighted average = factor  $a_1 \cdot b_1 / (b_1 + b_2) +$  factor  $a_2 \cdot b_2 / (b_1 + b_2)$

### Histograms

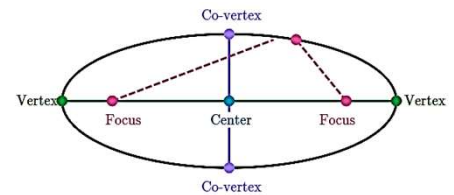
- A histogram (or probability density function) shows the mean and the standard deviation for a given set of data.
- Mean defines the average of the data (see mean below)
- Standard deviation ( $\sigma$ ) defines the spread of the data (see -3 sd, -2 sd, etc below)



## Ellipses

- The center is  $(h, k)$ ,  $2a$  is the transverse or horizontal diameter, and  $2b$  is the vertical diameter

$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$$



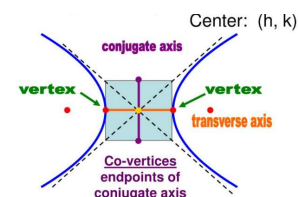
### Foci / Focus

- 2 points whose sum of distances from any point on the ellipse is always the same. They lie on the ellipse's major radius
- $f^2 = p^2 - q^2$  (f = foci, p = major radius or a in the ellipse above, q = minor radius or b in the ellipse above)

## Hyperbola

- The center is  $(h, k)$ ,  $2a$  is the transverse or horizontal diameter, and  $2b$  is the vertical diameter

$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$$



### Foci / Focus

- $b^2 = c^2 - a^2$