

**VECTORS--** Component form of a vector:  $\langle x, y \rangle$  OR  $\langle v_x, v_y \rangle$  OR  $\langle \vec{x}, \vec{y} \rangle$

$r = \|v\|$  magnitude = length of hypotenuse or resultant vector

Formula for magnitude:  $x^2 + y^2 = r^2 = \|v\|^2$

$\theta =$  direction angle = angle from x-coor to resultant vector

Formula for direction angle:  $\tan^{-1}\left(\frac{v_y}{v_x}\right) = \theta$

How to find x-coordinate:  $x = r \cos\theta$  or  $\|v\| \cos\theta$  How to find y-coordinate:  $y = r \sin\theta$  or  $\|v\| \sin\theta$

Dot product of 2 vectors:  $v \cdot w = v_x w_x + v_y w_y$

Scalar multiplication:  $k \langle x, y \rangle = \langle kx, ky \rangle$

Linear combination:  $v_x i + v_y j$

Add/subtract vectors:

$$v_x \pm w_x \quad v_y \pm w_y$$

Angle between 2 vectors:  $\cos^{-1}\left(\frac{v \cdot w}{\|v\| \|w\|}\right) = \theta$

Parallel vectors:  $\frac{v_y}{v_x} = \frac{w_y}{w_x}$

Orthogonal or Perpendicular vectors:  $v \cdot w = 0$

or  $\frac{v_y}{v_x} \neq \frac{w_y}{w_x}$  are reciprocal and opp. signs

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**RECTANGULAR COORDINATES--** Ordered pair for rectangular coordinate:  $(x, y)$

$h =$  hypotenuse = longest side of right triangle

Formula for hypotenuse:  $a^2 + b^2 = c^2$   $c = \text{hyp}$   $x^2 + y^2 = h^2$

$\theta =$  reference angle = angle that is acute + one side is  $x$ -axis

Formula for reference angle:  $\tan^{-1}\left(\frac{y}{x}\right) = \theta$

How to find  $x$ -coordinate:  $x = h \cos \theta$

How to find  $y$ -coordinate:  $y = h \sin \theta$

Changing rectangular coordinates to polar coordinates: find  $r$  &  $\theta$

$$r = \sqrt{x^2 + y^2} \quad \theta = \tan^{-1}\left(\frac{y}{x}\right)$$

Changing rectangular equations to polar equations:

substitute  $x^2 + y^2$  with  $r^2$

substitute  $x$  with  $r \cos \theta$

substitute  $y$  with  $r \sin \theta$

then solve for  $r$

**RECTANGULAR COORDINATES--** Ordered pair for rectangular coordinate:

$h =$  \_\_\_\_\_ =

Formula for hypotenuse:

$\theta =$  \_\_\_\_\_ =

Formula for reference angle:

How to find  $x$ -coordinate:

How to find  $y$ -coordinate:

Changing rectangular coordinates to polar coordinates:

Changing rectangular equations to polar equations: