VECTORS - a directed line segment

2 Components
1) direction
2) magnitude (length)

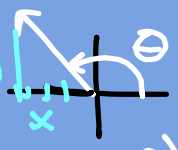
$\vec{v}$ $\mathbf{v}$

$|v|$ or $\|v\|$

initial pt

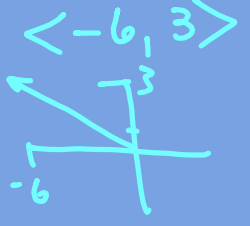
terminal pt.

Form 1: $|v| =$ $\theta =$ (r, θ)



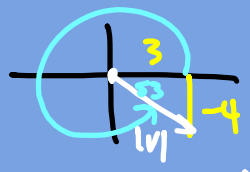
Form 2: Component Form

$\langle x, y \rangle$ $\langle -6, 3 \rangle$



Find magnitude + direction

$\langle 3, -4 \rangle$



$|v|^2 = 3^2 + (-4)^2$

$|v|^2 = 9 + 16$

$|v|^2 = 25$

$|v| = 5$

$\tan\theta = \frac{4}{-3}$

$\tan^{-1}(4/3) = 53°$

$\theta = 307°$

$|v| = 5 \quad \theta = 307°$

Find component form.

$|v| = 8 \quad \theta = 227°$

$x = |v| \cos\theta$

$y = |v| \sin\theta$

$x = 8 \cos 227° = -5.46$

$y = 8 \sin 227° = -5.85$

$\langle -5.46, -5.85 \rangle$

Parallel Vectors

Vectors has same slope $\left(\frac{y}{x}\right)$

$\langle x, y \rangle$ $m = \frac{y}{x}$

Δx Δy

$\langle 2, -3 \rangle$ $\langle -10, 15 \rangle$

$m = \frac{-3}{2}$ $m = \frac{15}{-10} = -3/2$

Yes, Parallel

Orthogonal (Perpendicular) Vectors

Orthogonal if dot product $= 0$

Dot product

$\langle x_1, y_1 \rangle \cdot \langle x_2, y_2 \rangle$

$= (x_1 \cdot x_2) + (y_1 \cdot y_2)$

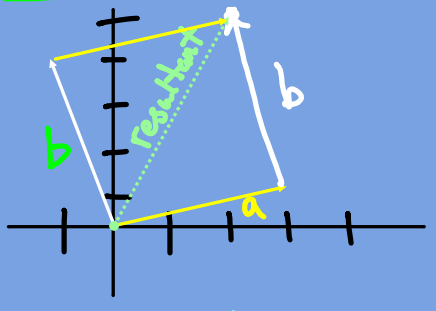
$\langle 2, -3 \rangle \cdot \langle 6, 4 \rangle$

$2 \cdot 6 + -3 \cdot 4$

$12 + -12 = 0$ ← Orthogonal!

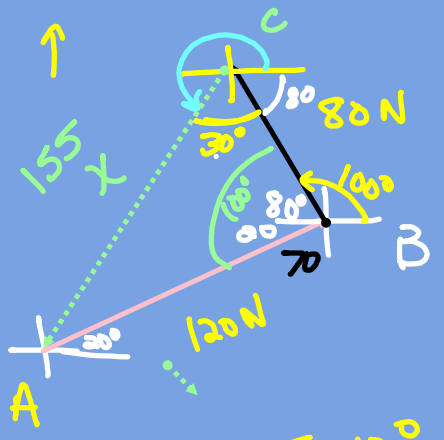
April 9, 2025

Adding Vectors = Head-to-tail



resultant = sum of vectors

120 N force acting at 20°
80 N force acting at 100°
What is the magnitude + direction of:
resultant force ↑ from start to end
3rd force that produces equilibrium. ↑ end to start



A

$X^2 = 120^2 + 80^2 - 2(120)(80)\cos 100°$

$X = 155$ N

$\frac{\sin A}{80} = \frac{\sin 100° \cdot 80}{155}$

$A = 50°$

155 N @ 70°

$\frac{\sin C}{120} = \frac{\sin 100°}{155}$

$C = 30°$

$360° - 110° = 250°$

155 N @ 250°