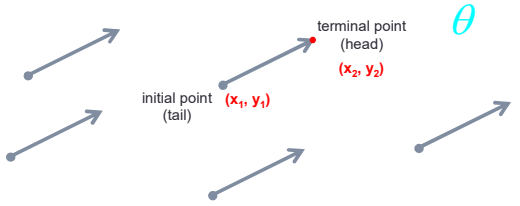
What is a vector?

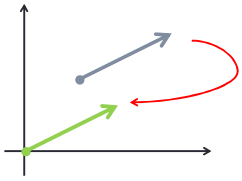
- A vector, $\vec{v}$ or $\boldsymbol{v}$ is a directed line segment that has both magnitude $\|\vec{v}\|$ (size/length) and direction (angle) θ.



2

a Vector in Standard Position …

- has its initial point (tail) at the origin.
(same magnitude and direction)



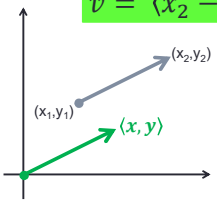
3

Component Form of a Vector …

- in standard form: $\vec{v} = \langle x, y \rangle$

$$\vec{v} = \langle x_2 - x_1, y_2 - y_1 \rangle$$

terminal point – initial point



4

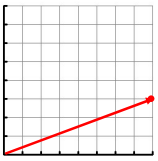
Example 1 … initial point: (-3, -4) terminal point: (5, -1)

a) Find component form.

$$\vec{v} = \langle 5-(-3), -1-(-4) \rangle$$

$$\vec{v} = \langle 8, 3 \rangle$$

b) Sketch in standard position.



5

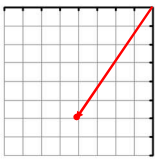
Example 2 … initial point: (3, 5) terminal point: (-1, -1)

a) Find component form.

$$\vec{v} = \langle -1-3, -1-5 \rangle$$

$$\vec{v} = \langle -4, -6 \rangle$$

b) Sketch in standard position.



6

Vector Operations

- Given $\vec{u} = \langle 2, -9 \rangle$ and $\vec{v} = \langle -6, 8 \rangle$.
- Find:

a) $\vec{u} + \vec{v} = \langle 2, -9 \rangle + \langle -6, 8 \rangle = \langle 2+(-6), -9+8 \rangle = \langle -4, -1 \rangle$

b) $\vec{v} - \vec{u} = \langle -6, 8 \rangle - \langle 2, -9 \rangle = \langle -6-2, 8-(-9) \rangle = \langle -8, 17 \rangle$

c) $-2\vec{u} - 3\vec{v} = -2\langle 2, -9 \rangle - 3\langle -6, 8 \rangle$
$= \langle -4, 18 \rangle + \langle 18, -24 \rangle = \langle 14, -6 \rangle$

d) $\vec{u} + \frac{1}{2}\vec{v} = \langle 2, -9 \rangle + \frac{1}{2}\langle -6, 8 \rangle = \langle 2, -9 \rangle + \langle -3, 4 \rangle = \langle -1, -5 \rangle$

8