Subtracting Vectors

Subtraction means add the opposite.

Change

- To characterize change you do subtraction.
- (Final condition) – (Initial condition)

- Example: You are driving 30 mph on Union Turnpike and the traffic light turns red. You slow down and stop at the light. You change your velocity and your momentum.

- Subtraction means add the opposite
- $V(A) – V(B) = V(A) + (-V(B))$

- - V(B) has the same magnitude but opposite direction as V(B)
- - V(B) is pointing 180 degrees away from the direction of V(B)
- With coordinates, $- V(B) = (-1) \times (V(B))$.

Example

- If V(B) is (2, 3), then – V(B) is (-1) x (2, 3) =
- (-2, -3). - V(B) has the same magnitude but
- opposite direction compared to V(B)

EXAMPLE

- V(A) = (1, 0); V(B) = (0, 1)
- V(A) – V(B) = V(A) + (-1) x V(B)
- (1, 0) – (0, 1) = (1, 0) + (0, -1) = (1, -1)
- Size by Pythagorean Thm: 1^2 + (-1)^2 = 2
- Size = sq root of 2 = 1.4
- Angle: Arctan (opp/adj) = arctan(-1/1) = 45 degree

Example

- V(A) = (2, 3); V(B) = (1, 5); - V(B) = (-1, 5)
- V(A) – V(B) = V(A) + (-1) x (V(B))
- (2, 3) + (-1, -5) = (1, -2)
- Magnitude: 1^2 + (-2)^2 = 1 + 4 = 5
- C^2 = 5, c = sq root 5
- Angle: arctan (-2/1) = - 63 degrees

Group Activity

- Subtract Vectors and then determine magnitude (Pythagorean Thm) and angle (arctan (opp/adj).
- 1. 7.0 m North – 3.5 m West
- 2. 8.0 m West – 8.25 m South
- 3. 3.0 m East – 5.0 m South
- 4. 500 m East – 200 m North

Group Activity

- Subtract vectors by adding the opposite. Determine size (Pythagorean Thm) and angle (arctan(opp/adj)).
- 1. V(A) = (10, 5) minus V(B) = (5, 10)
- 2. V(A) = (-3, 5) minus V(B) = (5, 3)
- 3. V(A) = (0, -5) minus V(B) = (-5, -10)
- 4. V(A) = (7, -3) minus V(B) = (2, -5)