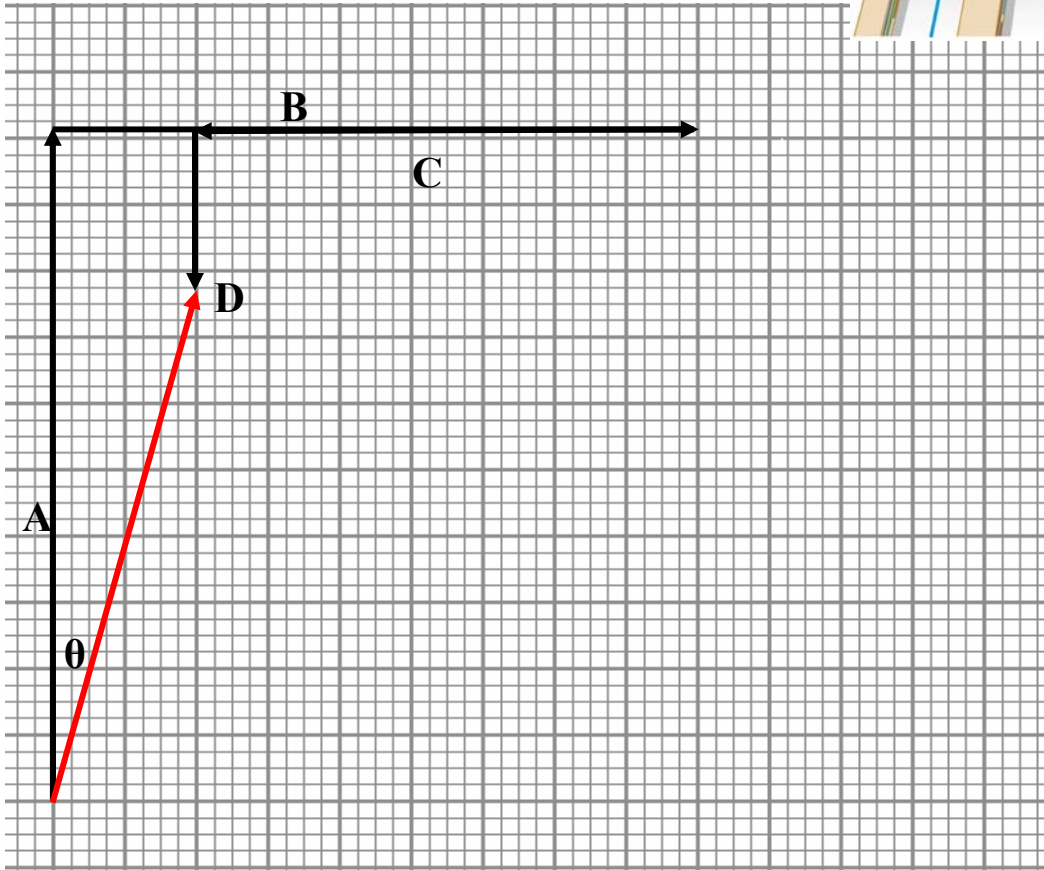
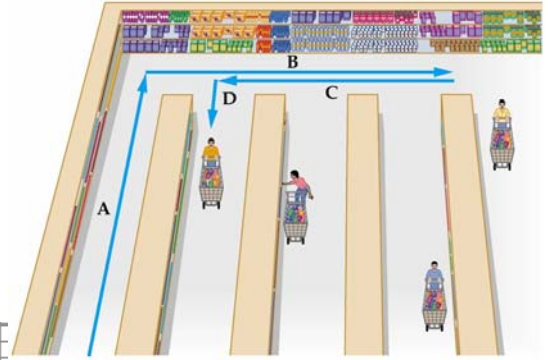


Physics 151 Class Exercise: Vectors - KEY

1. A shopper at the supermarket follows the path indicated by vectors A, B, C, and D in the figure. Given that the vectors have magnitudes $A = 51$ ft, $B = 45$ ft, $C = 35$ ft, and $D = 13$ ft, find the total displacement of the shopper using:

a) the graphical method



Scale:
5 ft = 1 big block

b) the component method of vector addition.

Vector	x-coord	y-coord
A	0 ft	51 ft
B	45 ft	0 ft
C	-35 ft	0 ft
D	0 ft	-13 ft
R	10 ft	38 ft

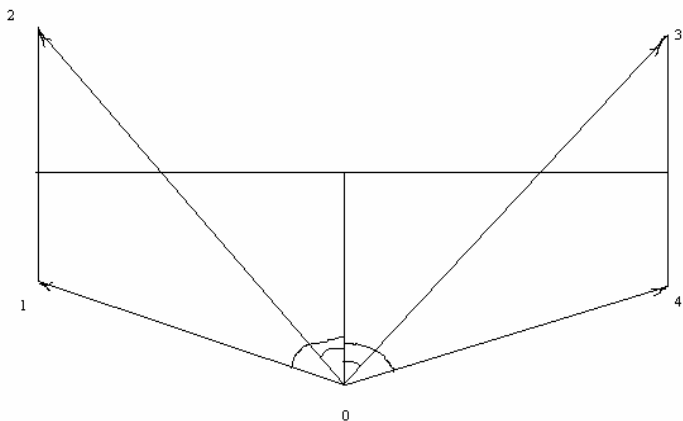
$$|R| = \sqrt{(10 \text{ ft})^2 + (38 \text{ ft})^2}$$

$$= \boxed{39 \text{ ft}}$$

$$\theta = \tan^{-1} \frac{10}{38} = 15^\circ$$

East of north (or 75° from x-axis)

2. A treasure map directs you to start at a palm tree and walk due north for 10.0 m. You are then to turn 90° and walk 15.0 m; then turn 90° again and walk 5.00 m. Give the distance from the palm tree, and the direction relative to north for each of the four possible locations of the treasure. (It is recommended that you draw a diagram illustrating the four solutions.)



Four possible locations of the treasure are shown on the picture. Let the origin of coordinate system be at the location of the palm tree (0), then possible coordinates of the treasure can be found as

$$x_1 = -15.0m, y_1 = 10.0m - 5.00m = 5.00m,$$

$$x_2 = -15.0m, y_2 = 10.0m + 5.00m = 15.0m,$$

$$x_3 = 15.0m, y_3 = 10.0m + 5.00m = 15.0m,$$

$$x_4 = 15.0m, y_4 = 10.0m - 5.00m = 5.00m$$

The distances from the palm tree to each of those locations are

$$d_{01} = \sqrt{x_1^2 + y_1^2} = \sqrt{(-15.0m)^2 + (5.00m)^2} = 15.8m,$$

$$d_{02} = \sqrt{x_2^2 + y_2^2} = \sqrt{(-15.0m)^2 + (15.0m)^2} = 21.2m,$$

$$d_{03} = \sqrt{x_3^2 + y_3^2} = \sqrt{(15.0m)^2 + (15.0m)^2} = 21.2m,$$

$$d_{04} = \sqrt{x_4^2 + y_4^2} = \sqrt{(15.0m)^2 + (5.00m)^2} = 15.8m$$

Angles counting from the North for each are

$$\alpha_1 = \arctan(15.0/5.00) = 71.6^\circ,$$

$$\alpha_2 = \arctan(15.0/15.0) = 45.0^\circ,$$

$$\alpha_3 = \arctan(15.0/15.0) = 45.0^\circ,$$

$$\alpha_4 = \arctan(15.0/5.00) = 71.6^\circ$$

Answer:	15.8m, 71.6° W of N
Answer:	21.2m, 45.0° W of N
Answer:	21.2m, 45.0° E of N
Answer:	15.8m, 71.6° E of N