Scalar and Vector Quantities

Answer Key

1. **Problem**: Joshua jogs 225 m North, then 340 m West, and then 450 m South. Find the magnitude and direction of the resultant displacement.

Solution: Let us first list down the given components. Let A = 225 m N, B= 340 m W, and C = 450 m S.

Path A	Path B	Path C
$A_x = 0\ m$ $A_y = 225\ m$	$B_x = -340\ m$ $B_x = 0\ m$	$C_x = 0\ m$ $C_x = -450\ m$

Using the components of adding vectors,

$$Rx = Ax + Bx + Cx = -340\ m$$

$$Ry = Ay + By + Cy = -225\ m$$

Finding the magnitude of R,

$$R = \sqrt{(-340\ m)^2 + (-225\ m)^2}$$
$$R = \sqrt{115600\ m^2 + 50625\ m^2}$$
$$R = \sqrt{166225\ m^2}$$
$$\boldsymbol{R = 408\ m}$$

For the direction of R,

$$\theta = tan^{-1}\left(\frac{R_y}{R_x}\right)$$

$$\theta = tan^{-1}\left(\frac{-225\ m}{-340\ m}\right)$$

θ = 33.5° South of West

2. **Problem**: Find the y-component and the magnitude of the vector when it is in the direction of 30º counterclockwise from the positive x-axis and its x-component of A is 10 m.

Solution: The vector makes a 30º angle from the +x axis, hence we can write its components as

Ax = A cos 30

Ay = A sin 30

where A is the magnitude of the vector. We know that Ax = 10 m, so,

A = Ax/cos 30

A = 10 m/cos 30

A = 11.5 m

To get Ay,

Ay = (11.5 m) sin 30

Ay = 5.75 m

3. **Problem**: Find the magnitude of vector A when **A = 34î + 6k̂**

Solution: To find the magnitude of A, we are going to use the formula:

$$A = \sqrt{(A_x)^2 + (A_y)^2 + (A_z)^2}$$

Substituting the values, we will get:

$$A = \sqrt{(34)^2 + (0)^2 + (6)^2}$$

A = 34.5

4. **Problem**: Find the magnitude of vector A when **A = -12î - 4ĵ - 3k̂**

   Solution: To find the magnitude of A, we are going to use the formula:

$$A = \sqrt{(A_x)^2 + (A_y)^2 + (A_z)^2}$$

Substituting the values, we will get:

$$A = \sqrt{(-12)^2 + (-4)^2 + (-3)^2}$$

A = 13

5. **Problem**: Find the magnitude of vector A when **A = 24î + 11ĵ**

   Solution: To find the magnitude of A, we are going to use the formula:

$$A = \sqrt{(A_x)^2 + (A_y)^2 + (A_z)^2}$$

Substituting the values, we will get:

$$A = \sqrt{(24)^2 + (11)^2 + (0)^2}$$

A = 26.4