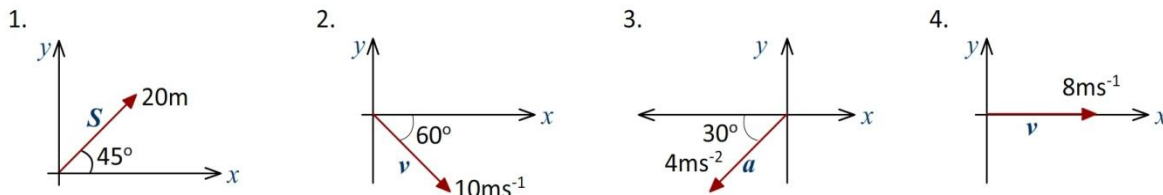


Objective : Understand resolution of vectors, addition & subtraction using components of vectors, addition and subtraction using parallelogram law of addition of vectors

1. Find the rectangular components of the given vectors and write them in their component form



2. Identify unit vectors and null vectors from the following.

(a) $3\hat{i} + 3\hat{j}$

(b) $3\hat{i} - 2\hat{j}$

(c) $1\hat{i} + 1\hat{j}$

(d) $0.6\hat{i} - 0.8\hat{j}$

(e) $1\hat{i} - 1\hat{j}$

3. If $\mathbf{P} = 2\hat{i} + 3\hat{j} + 6\hat{k}$ and $\mathbf{Q} = \hat{i} - 4\hat{j} + 2\hat{k}$ then find $\mathbf{P} + \mathbf{Q}$.

4. If $\mathbf{P} = 4\hat{i} + 2\hat{j}$ and $\mathbf{Q} = -2\hat{i} + \hat{k}$ then find $|\mathbf{P} - \mathbf{Q}|$.

5. If $\mathbf{P} = \hat{i} + \hat{j} - \hat{k}$ and $\mathbf{Q} = \hat{i} - 2\hat{j} - \hat{k}$ then find the ratio of $|\mathbf{P} + \mathbf{Q}|$ to $|\mathbf{P} - \mathbf{Q}|$.

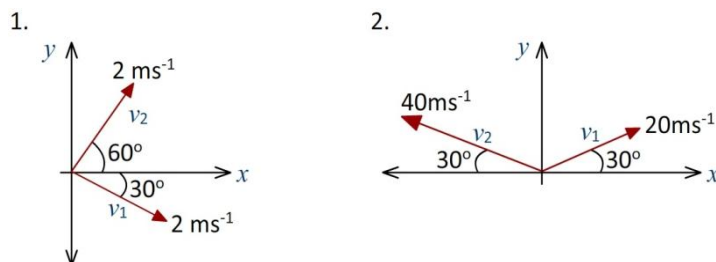
6. If $\mathbf{u} = \hat{i} + 2\hat{j} - 5\hat{k}$ then find a unit vector in the direction of $\mathbf{u}$.

7. If the magnitude of addition of two vectors is equal to the magnitude of subtraction of the vectors then what is the angle between the vectors?

8. Can a vector having non-zero components have a zero magnitude?

9. Can a vector having non-zero magnitude have a non-zero components?

10. In the following cases find the magnitude of resultant using parallelogram law and verify the result using the component method of addition



11. Two vectors of magnitudes 5 units and 6 units are mutually perpendicular to each other. Find the magnitude of the resultant of addition of these vectors.
12. Two vectors each of magnitude 3 units are inclined at an angle of 60° with respect to each other find (a) the magnitude of sum of these two vectors (b) the magnitude of difference of these two vectors.
13. Two vectors have magnitude 5 units and 10 units. Find the maximum and the minimum possible magnitude of resultant of addition of these two vectors.
14. Can two vectors of equal magnitude add up to give null vector as resultant?
15. Can two vectors of unequal magnitude add up to give null vector as resultant?
16. Can the magnitude of resultant of addition of two vectors be equal to the sum of magnitudes of the initial vectors?
17. Can the magnitude of resultant of addition of two vectors be less than the sum of magnitudes of the initial vectors?
18. Can the magnitude of resultant of addition of two vectors be greater than the sum of magnitudes of the initial vectors?
19. What is the minimum number of vectors of unequal magnitudes that can be added to give a null vector as a resultant?
20. If the magnitude of addition of two vectors is equal to the magnitude of subtraction of the vectors then what is the angle between the vectors?

Values of sine and cosine for a few angles for reference

$\cos(30^\circ) = \sqrt{3}/2$	$\sin(30^\circ) = 1/2$	$\cos(60^\circ) = 1/2$	$\sin(60^\circ) = \sqrt{3}/2$
$\cos(120^\circ) = -1/2$	$\sin(120^\circ) = \sqrt{3}/2$	$\sin(90^\circ) = 1$	$\cos(90^\circ) = 0$
$\cos(37^\circ) = 4/5$	$\sin(37^\circ) = 3/5$		

Answers

1. (a) $S = 10\sqrt{2}\hat{i} + 10\sqrt{2}\hat{j}$
(b) $\mathbf{v} = 5\hat{i} - 5\sqrt{3}\hat{j}$
(c) $\mathbf{a} = -2\hat{i} - 2\sqrt{3}\hat{j}$
(d) $\mathbf{v} = 8\hat{i}$
2. (a) Not a unit vector , Not a null vector
(b) Not a unit vector , Not a null vector
(c) Not a unit vector , Not a null vector
(d) Unit vector , Not a null vector
(e) Not a unit vector , Not a null vector
3. $\mathbf{R} = 3\hat{i} - \hat{j} + 8\hat{k}$
4. $\sqrt{41}$
5. 1:1
6. $\hat{\mathbf{R}} = \frac{\hat{i} + 2\hat{j} - 5\hat{k}}{\sqrt{30}}$
7. 90°
8. No
9. No
10. (a) $|v_{\text{res}}| = 4$
(b) $|v_{\text{res}}| = 20\sqrt{3}$
11. $\sqrt{61}$
12. (a) $3\sqrt{3}$ (b) 3
13. 15, 5
14. Yes, when $\theta = 180^\circ$

- 15. No
- 16. Yes, when $\theta = 0^\circ$
- 17. Yes, when $\theta > 0^\circ$
- 18. No
- 19. 3
- 20. 45°