Unit 2 · Vectors

WORKSHEET

Full marks 32

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 32

1 Key words [2.5]

Match each kind of vector in Column A with what is true of it in Column B. One description in Column B is not needed. Each match carries 0.5 mark.

Column A		Column B
1. unit vector	☐	**a.** has zero magnitude
2. null vector	☐	**b.** act along the same line or parallel lines
3. negative of a vector	☐	**c.** lie in the same plane
4. collinear vectors	☐	**d.** has the same magnitude and the same direction as another
5. coplanar vectors	☐	**e.** has the same magnitude and the opposite direction
		f. has a magnitude of 1 and shows a direction only

2 True or false [3]

Write ✓ for a true statement and ✗ for a false one. Correct the false ones.

i. Electric current has a direction, but it is a scalar. ☐

ii. Two forces of 5 N and 3 N can have a resultant of 9 N. ☐

iii. The dot product of two perpendicular vectors is zero. ☐

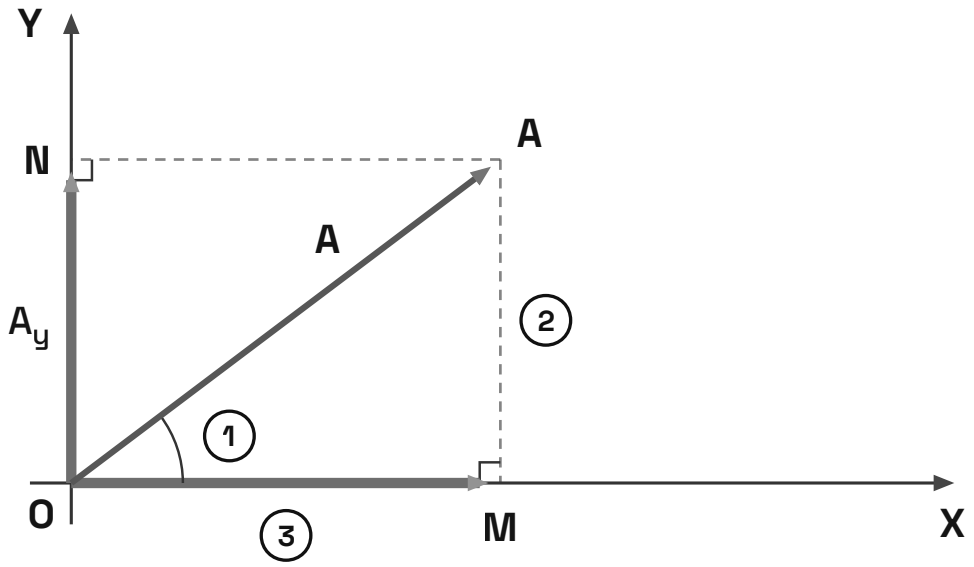
iv. $\vec{A} \times \vec{B} = \vec{B} \times \vec{A}$ ☐

v. The scalar product of two vectors is a vector. ☐

vi. The magnitude of $\vec{A} \times \vec{B}$ is the area of the parallelogram with sides $\vec{A}$ and $\vec{B}$. ☐

3 Label the diagram [1.5]

The diagram shows a vector $\vec{A}$ resolved into rectangular components. Write the quantity that belongs in place of 1 to 3. Each carries 0.5 mark.



1. _____ **2.** _____

3. _____

4 Multiple choice [5]

Choose the correct option for each of the following questions.

i. Which of these is a scalar quantity? [1]

a. work **b.** force

c. displacement **d.** momentum

ii. Two forces of 6 N and 8 N act on a point at right angles. Their resultant is: [1]

a. 2 N **b.** 10 N

c. 14 N **d.** 48 N

iii. If $\vec{A} = 2\hat{i} + 3\hat{j}$ and $\vec{B} = 4\hat{i} - \hat{j}$, then $\vec{A} \cdot \vec{B}$ is: [1]

a. 11 **b.** 5

c. $8\hat{i} - 3\hat{j}$ **d.** 14

iv. $\hat{k} \times \hat{i}$ is equal to: [1]

a. $\hat{j}$ **b.** $-\hat{j}$

c. $\hat{k}$ **d.** zero

v. The angle between two vectors is 60°. The ratio $|\vec{A} \times \vec{B}| \ / \ (\vec{A} \cdot \vec{B})$ is: [1]

a. 1 **b.** $1/\sqrt{3}$

c. $\sqrt{3}$ **d.** 2

5 Short answers [6]

Write short answers to the following questions.

a. Can three vectors that do not lie in one plane add up to zero? Give a reason. [2]

b. Dawa pulls a loaded box along the floor with a rope. Why does pulling with the rope nearly level move the box more easily than pulling with it held steeply up? [2]

c. Show that the vectors $\vec{A} = 2\hat{\imath} - 3\hat{\jmath} + \hat{k}$ and $\vec{B} = \hat{\imath} + \hat{\jmath} + \hat{k}$ are perpendicular. [2]

6 Long answer [4]

Write a long answer to the following question.

Two vectors of magnitudes P and Q act at a point at an angle θ. Using $R = \sqrt{P^2 + Q^2 + 2PQ\cos\theta}$, show when their resultant is greatest and when it is least, and find these values. At what angle must two equal vectors of magnitude P act for their resultant to be $\sqrt{3}\,P$?

7 Numerical problems [7]

Solve the following problems. Show your working.

a. Pemba walks 400 m due east, then 300 m in a direction 60° north of east. Using components, find the magnitude and direction of his displacement. [4]

Answer: _____

b. A force $\vec{F} = (3\hat{i} + 4\hat{j})$ N moves a box through a displacement $\vec{s} = 5\hat{i}$ m. Find the work done, $W = \vec{F} \cdot \vec{s}$, and the angle between the force and the displacement. [3]

Answer: _____

8 Think [3]

Can three forces of 5 N, 6 N and 12 N, pulling on one ring, keep it at rest? Explain using the triangle law.

9 Activity: Three pulls on a ring

(not marked)

Tie three strings to a small metal ring and hook a spring balance to each. Three friends pull until the ring rests over a point marked on a sheet of paper. Draw the strings on the paper, measure each angle from a line you choose as the x-axis, and read each balance.

Pull	Reading (N)	Angle from x-axis	x-component (N)	y-component (N)
1				
2				
3				
Sum	—	—		

Are your two sums close to zero? Why might they not be exactly zero?