Unit 10 · Vector

WORKSHEET

Full marks 30

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 30

1 Key words [3]

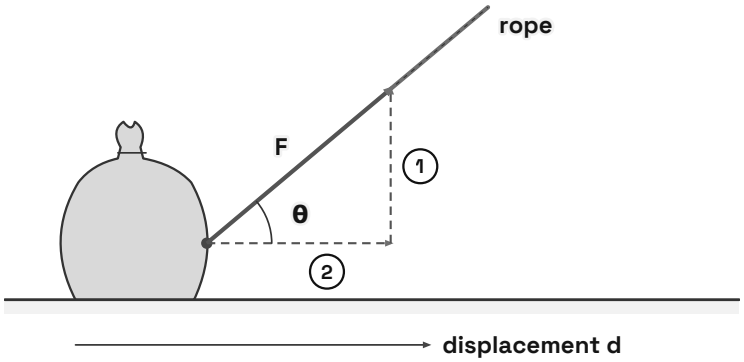
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

magnitude	**midpoint**	**parallel**	**perpendicular**	**position vector**	**scalar**	**scalar product**
triangle law						

The product $\vec{a} \cdot \vec{b} = |a|\,|b|\cos\theta$ is called the _____ (or dot product), and its answer is a _____, a number with no direction. Two vectors, neither of them zero, whose scalar product is 0 are _____. The vector from the origin O to a point A is the _____ of A. By the _____, $\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC}$. The point that divides AB in the ratio 1 : 1 is its _____.

2 Read the figure [1]

A sack is pulled along level ground by a rope at an angle θ to the ground, with a force F. The two parts of the pull are left blank: write them in.



1. _____ **2.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. If $|\vec{a}| = 2$, $|\vec{b}| = 5$ and the angle between them is 60°, what is $\vec{a} \cdot \vec{b}$? [1]

a. 10 **b.** 5

c. $5\sqrt{3}$ **d.** 2.5

ii. Which two vectors are perpendicular? [1]

a. $2\vec{i} + 3\vec{j}$ and $3\vec{i} - 2\vec{j}$

b. $2\vec{i} + 3\vec{j}$ and $4\vec{i} + 6\vec{j}$

c. $\vec{i} + 2\vec{j}$ and $2\vec{i} + \vec{j}$

d. $3\vec{i}$ and $-3\vec{i}$

iii. The position vectors of A and B are $4\vec{i} - 2\vec{j}$ and $-2\vec{i} + 6\vec{j}$. What is the position vector of the midpoint of AB? **[1]**

a. $\vec{i} + 2\vec{j}$
b. $2\vec{i} + 4\vec{j}$
c. $3\vec{i} - 4\vec{j}$
d. $-3\vec{i} + 4\vec{j}$

iv. In any triangle ABC, what is $\overrightarrow{AB} + \overrightarrow{BC} + \overrightarrow{CA}$? **[1]**

a. $\vec{0}$
b. $2\overrightarrow{AC}$
c. $\overrightarrow{AC}$
d. $\overrightarrow{CA}$

v. P divides the line segment from $A(0, 0)$ to $B(6, 9)$ internally in the ratio $1 : 2$. Where is P? **[1]**

a. $(2, 3)$
b. $(4, 6)$
c. $(3, 4.5)$
d. $(-6, -9)$

4 Very short answers **[3]**

Write very short answers to the following questions.

a. Write the formula for the angle θ between two vectors $\vec{a}$ and $\vec{b}$. **[1]**

b. The scalar product of two vectors is negative. What kind of angle is between them? **[1]**

c. Find $\vec{a} \cdot \vec{b}$ for $\vec{a} = 3\vec{i} - \vec{j}$ and $\vec{b} = 2\vec{i} + 5\vec{j}$. **[1]**

5 Short answers **[8]**

Write short answers to the following questions.

a. Find the mistake. For $A(1, 2)$ and $B(4, 6)$, Hari writes $\overrightarrow{AB} = \overrightarrow{OA} - \overrightarrow{OB} = (1 - 4, 2 - 6) = (-3, -4)$. What has he done wrong? Write the correct $\overrightarrow{AB}$. **[2]**

b. Work backwards. $|\vec{a}| = 4$, $\vec{a} \cdot \vec{b} = 6$ and the angle between $\vec{a}$ and $\vec{b}$ is $60°$. Find $|\vec{b}|$. **[2]**

c. $A(2, -3)$ and $B(3, 2)$ are the ends of the line segment AB. **[2]**

a. M divides AB internally in the ratio 2 : 3. Find the position vector of M.

b. N divides AB externally in the ratio 3 : 1. Find the position vector of N.

d. If $m{:}n = 1{:}1$, is there a point P that divides AB externally? Give a reason. **[2]**

6 Long answers **[8]**

Solve the following problems. Show your working.

a. The vertices of a triangle are $A(1, 2)$, $B(5, 4)$ and $C(3, 8)$. **[4]**

a. Write $\overrightarrow{BA}$ and $\overrightarrow{BC}$ as column vectors.

b. Find $\overrightarrow{BA} \cdot \overrightarrow{BC}$. What does it tell you about $\angle ABC$?

c. D is the midpoint of AC. Find the position vector of D.

d. Show that $BD = \frac{1}{2}AC$.

Science Playground, Katunje, Bhaktapur
https://science-playground.com/learn/grade-10-optional-math/vector

b. The position vectors of P and Q are $\vec{p} = 2\vec{i} + \vec{j}$ and $\vec{q} = \vec{i} - 3\vec{j}$. R divides PQ internally in the ratio 3 : 2. **[4]**

a. Write the formula for the position vector of a point that divides a line segment internally in the ratio m:n.

b. Find the position vector $\vec{r}$ of R.

c. Find $\angle POR$.

d. Find $\angle QOR$, and compare the two angles.

Answer: _____

7 Think [2]

Think, then answer.

Sita says: "If $\vec{a} \cdot \vec{b} = \vec{a} \cdot \vec{c}$, then $\vec{b} = \vec{c}$, because I can cancel $\vec{a}$ as in ordinary algebra." Is she right? Give an example.

_____

_____

_____

_____

_____

8 Activity: Measure an angle, then compute it (not marked)

On squared paper, draw each pair of vectors from one point O, one square a unit. Measure the angle between them with a protractor. Then work out $\vec{a} \cdot \vec{b}$, $\cos\theta$ and θ from the coordinates, and compare.

$\vec{a}$	$\vec{b}$	Angle measured	$\vec{a} \cdot \vec{b}$	$\cos\theta$	Angle worked out
(3, 1)	(1, 3)				
(4, 0)	(2, 2)				
(2, 3)	(−3, 2)				
(3, 1)	(−2, 2)				