Unit 10 · Vector

HARDER WORKSHEET

Full marks 26

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 26

1 Multiple choice [3]

Choose the correct option for each of the following questions.

i. $|\vec{a}| = 3$, $|\vec{b}| = 4$ and $|\vec{a} + \vec{b}| = 5$. What is $\vec{a} \cdot \vec{b}$? [1]

a. 0 **b.** 12

c. -12 **d.** 7

ii. For two vectors that are not zero, $\vec{a} \cdot \vec{b} = |\vec{a}|\,|\vec{b}|$. What can you say? [1]

a. They point in the same direction. **b.** They are perpendicular.

c. They point in opposite directions. **d.** They have the same length.

iii. $A(1, 1)$ and $B(4, 5)$. The point P is on AB produced, beyond B, with $BP = AB$. Where is P? [1]

a. $(7, 9)$ **b.** $(5.5, 7)$

c. $(2.5, 3)$ **d.** $(-2, -3)$

2 Short answers [13]

Write short answers to the following questions.

a. Where does the line segment from $A(-2, 6)$ to $B(6, -2)$ cross the X-axis, and in what ratio does that point divide AB? [3]

b. Show that if $(\vec{a} + \vec{b}) \cdot (\vec{a} - \vec{b}) = 0$, then $|\vec{a}| = |\vec{b}|$. What does this say about a parallelogram whose diagonals are perpendicular? [3]

c. A rope pulls a boat across a pond with a force $\vec{F} = 6\vec{i} + 8\vec{j}$ newtons while the boat moves $\vec{d} = 10\vec{i}$ meters. Find the work done, $W = \vec{F} \cdot \vec{d}$, and the part of the pull that does no work. **[2]**

d. $\vec{a} = 3\vec{i} + 4\vec{j}$ and $\vec{b} = \vec{i}$. For which number k is $|\vec{a} + k\vec{b}|$ least? Show that $\vec{a} + k\vec{b}$ is then perpendicular to $\vec{b}$. **[3]**

e. Make your own. Write two vectors, neither along an axis, that are perpendicular, one of them 5 units long. Check with the scalar product. **[2]**

3 Long answers **[8]**

Solve the following problems. Show your working.

a. $A(1, 1)$, $B(5, 3)$ and $C(3, 7)$ are three corners of a parallelogram $ABCD$. **[4]**

a. Find D.
b. Show that $ABCD$ is a rectangle.
c. Is it a square? Give a reason.
d. Show that its diagonals are perpendicular.

Answer:

b. Prove by the vector method that the diagonals of a rhombus are perpendicular to each other. **[4]**

4 Think **[2]**

Think, then answer.

Is the report possible? A student measures two forces of 4 N each and reports that their scalar product is 20. Could she be right? Give a reason.