QB365 Question Bank Software

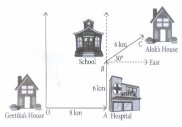
12th Maths CBSE Case Study Vector Algebra Questions For - 2024

12th Standard

Maths

SECTION-A 2 x 4 = 8

1) Geetika's house is situated at Shalimar Bagh at point 0, for going to Aloks house she first travels 8 km by bus in the East. Here at point A, a hospital is situated. From Hospital, Geetika takes an auto and goes 6 km in the North, here at point B school is situated. From school, she travels by bus to reach Aloks house which is at 30° East, 6 km from point B.



Based on the above information, answer the following questions.

(i) What is the vector distance between Geetikas house and school ?

(a) $8\hat{i}-6\hat{j}$ **(b)** $8\hat{i}+6\hat{j}$ **(c)** $8\hat{i}$ **(d)** $6\hat{j}$

(ii) How much distance Geetika travels to reach school?

(a) 14 km **(b) 15 km** **(c) 16 km** **(d) 17 km**

(iii) What is the vector distance from school to Alok's house ?

(a) $\sqrt{3}\hat{i}+\hat{j}$ **(b)** $3\sqrt{3}\hat{i}+3\hat{j}$ **(c)** $6\hat{i}$ **(d)** $6\hat{j}$

(iv) What is the vector distance from Geetikas house to Alok's house?

(a) $(8+3\sqrt{3})\hat{i}+9\hat{j}$ **(b)** $4\hat{i}+6\hat{j}$ **(c)** $15\hat{i}$ **(d)** $16\hat{j}$

(v) What is the total distance travelled by Geetika from her house to Alok's house?

(a) 19 km **(b) 20 km** **(c) 21 km** **(d) 22 km**

Answer : **(i) (b) :** We have, $\overrightarrow{OA}=8\hat{i}$ and $\overrightarrow{AB}=6\hat{j}$

$\therefore \overrightarrow{OB}=\overrightarrow{OA}+\overrightarrow{AB}=8\hat{i}+6\hat{j}$

(ii) (a) : To reach school Geetika travels

=(8+6) km=14km

(iii) (b): Vector distance from school to Alok's house

$=6\cos 30^{\circ}\hat{i}+6\sin 30^{\circ}\hat{j}$

$=6\times\frac{\sqrt{3}}{2}\hat{i}+6\times\frac{1}{2}\hat{j}=3\sqrt{3}\hat{i}+3\hat{j}$

(iv) (a): Vector distance from Geetika's house to

Alok'shouse $=8\hat{i}+6\hat{j}+3\sqrt{3}\hat{i}+3\hat{j}=(8+3\sqrt{3})\hat{i}+9\hat{j}$

(v) (b): Total distance travelled by Geetika from her house to Alok's house = (8 + 6 + 6) km = 20 km.

2) If two vectors are represented by the two sides of a triangle taken in order, then their sum is represented by the third side of the triangle taken in opposite order and this is known as triangle law of vector addition. lased on the above information, answer the following questions.

(i) If $\vec{p},\vec{q},\vec{r}$ are the vectors represented by the sides of a triangle taken in order, then $\vec{q}+\vec{r}$ =

(a) $\vec{p}$ **(b)** $2\vec{p}$ **(c)** $-\vec{p}$ **(d) None of these**

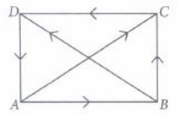
(ii) If ABCD is a parallelogram and AC and BD are its diagonals, then $\overrightarrow{AC}+\overrightarrow{BD}$ =

(a) $2\overrightarrow{DA}$ **(b)** $2\overrightarrow{AB}$ **(c)** $2\overrightarrow{BC}$ **(d)** $2\overrightarrow{BD}$

(iii) If ABCD is a parallelogram, where $\overrightarrow{AB}=2\vec{a}$ and $\overrightarrow{BC}=2\vec{b}$, then $\overrightarrow{AC}-\overrightarrow{BD}$ =

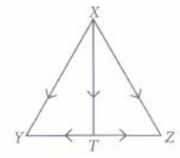
(a) $3\vec{a}$ **(b)** $4\vec{a}$ **(c)** $2\vec{b}$ **(d)** $4\vec{b}$

(iv) If ABCD is a quadrilateral whose diagonals are $\overrightarrow{AC}$ and $\overrightarrow{BD}$, then $\overrightarrow{BA}+\overrightarrow{CD}$ =



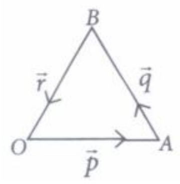
(a) $\overrightarrow{AC}+\overrightarrow{DB}$ **(b)** $\overrightarrow{AC}+\overrightarrow{BD}$ **(c)** $\overrightarrow{BC}+\overrightarrow{AD}$ **(d)** $\overrightarrow{BD}+\overrightarrow{CA}$

(v) If T is the mid point of side YZ of $\triangle$XYZ, then $\overrightarrow{XY}$ + $\overrightarrow{XZ}$ =



(a) $2\overrightarrow{YT}$ **(b)** $2\overrightarrow{XT}$ **(c)** $2\overrightarrow{TZ}$ **(d) None of these**

Answer : (i) (c) : Let OAB be a triangle such that



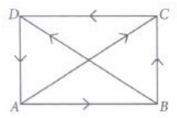
$\overrightarrow{AO}=-\vec{p}, \overrightarrow{AB}=\vec{q}, \overrightarrow{BO}=\vec{r}$

Now, $\vec{q}+\vec{r}=\overrightarrow{AB}+\overrightarrow{BO}$

$=\overrightarrow{AO}=-\vec{p}$

(ii) (c) : From triangle law of vector addition,

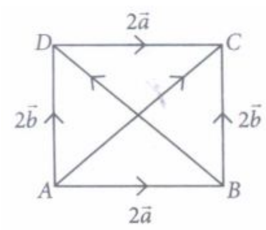
$\overrightarrow{AC}+\overrightarrow{BD}=\overrightarrow{AB}+\overrightarrow{BC}+\overrightarrow{BC}+\overrightarrow{CD}$



$=\overrightarrow{AB}+2\overrightarrow{BC}+\overrightarrow{CD}$

$=\overrightarrow{AB}+2\overrightarrow{BC}-\overrightarrow{AB}=2\overrightarrow{BC}$

(iii) (b) : In $\Delta ABC, \overrightarrow{AC}=2\vec{a}+2\vec{b}$



and in $\Delta ABD, 2\vec{b}=2\vec{a}+\overrightarrow{BD}$..(ii)

[By triangle law of addition]

Adding (i) and (ii), we have

$\overrightarrow{AC}+2\vec{b}=4\vec{a}+\overrightarrow{BD}+2\vec{b}$

$\Rightarrow \overrightarrow{AC}-\overrightarrow{BD}=4\vec{a}$

(iv) (d) : In $\Delta ABC, \overrightarrow{BA}+\overrightarrow{AC}=\overrightarrow{BC}$... (i)

[By triangle law]

In $\Delta BCD, \overrightarrow{BC}+\overrightarrow{CD}=\overrightarrow{BD}$ ..(i)

From (i) and (ii), $\overrightarrow{BA}+\overrightarrow{AC}=\overrightarrow{BD}-\overrightarrow{CD}$

$\Rightarrow \overrightarrow{BA}+\overrightarrow{CD}=\overrightarrow{BD}-\overrightarrow{AC}=\overrightarrow{BD}+\overrightarrow{CA}$

(v) (b): Since T is the mid point of YZ.

So, $\overrightarrow{YT}=\overrightarrow{TZ}$

Now, $\overrightarrow{XY}+\overrightarrow{XZ}=(\overrightarrow{XT}+\overrightarrow{TY})+(\overrightarrow{XT}+\overrightarrow{TZ})$

[By triangle law]

$=2\overrightarrow{XT}+\overrightarrow{TY}+\overrightarrow{TZ}=2\overrightarrow{XT} \quad [\because \overrightarrow{TY}=-\overrightarrow{YT}]$