CASE BASED QUESTIONS-Chapter 10 Vectors

1	A monkey starts moving from a point A(0,0,0) to 5 meters away a point B in east direction then 6 meters in north direction to a point C and then climbs a tree of 10 meters to a point D. From above information answer the questions given below: (i) Find position vector of monkey. (ii) Find displace of monkey. (iii) Find unit vector of vector AD
2	Two toddlers are playing seesaw game in a garden. A student of XII class observing the positions of toddlers and finds the position of first toddler (3,4,2) and position of second toddler (5,6,0). From above information answer the questions given below: (i) Find position vector of midpoint of seesaw. (ii) Find distance between both toddlers (iii) Find position vector of point on seesaw which divides seesaw beam in 2:1 .
3.	Three birds are sitting on tree at positions A(4,6,8) , B (6, 7 ,7) , C(5,6, 9) .A student of class XII wants apply vector algebra concept to find different component of triangle. Solve the problem that he finds in following questions. (i) Find vector $\overrightarrow{AB}\ and\ \overrightarrow{AC}$. (ii) Find centroid of triangle. (iii) Find angle between vector $\overrightarrow{AB}\ and\ \overrightarrow{AC}$.
4.	. A student of class XII wants to find displace of a particle using the formula $$\vec{s} = \vec{u}t + \frac{1}{2}\vec{a}t^2$$ and $\vec{a} = \frac{\vec{F}}{m}$ where $\vec{u} = 2\hat{\imath}\ m/s\ and\ mass\ of\ particle\ is\ 2\ kg.$ Force on the particle are as (newton unit)

$$\overrightarrow{F_1} = 2\vec{\imath} + 3\vec{\jmath} - \vec{k} \ , \overrightarrow{F_1} = 2\vec{\imath} + 2\vec{\jmath} - 3\vec{k}$$

From the above informations solve the following questions
- (i)   Find net force on object.
- (ii)   Find acceleration of object .
- (iii) Find displacement in 2 second.

5.

There is a 9 meters tree in a field. Shape of field is in parallelogram whose two adjacent side are given $\vec{a} = 4\hat{\imath} - \hat{\jmath} + 3\hat{k} \ and \ \vec{b} = -2\hat{\imath} + \hat{\jmath} - 2\hat{k}$.
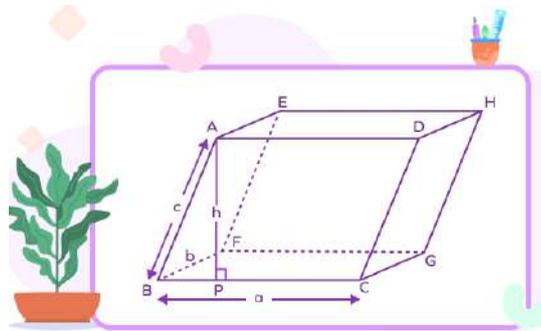

From above informations solve following questions
- (i)   Find area of field.
- (ii)   Find height in vector form.

6.   Three adjacent side of a parallelopiped are represented by three vectors as shown in figure
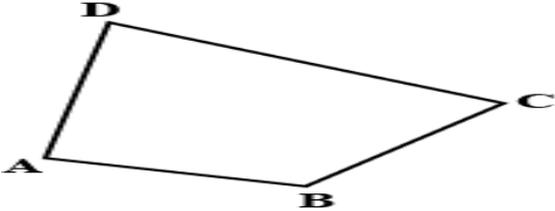

$$\vec{a} = \hat{\imath} + \hat{\jmath} + \hat{k} \ ,$$
$$\vec{b} = 2\hat{\imath} + 4\hat{\jmath} - \hat{k} \ ,$$
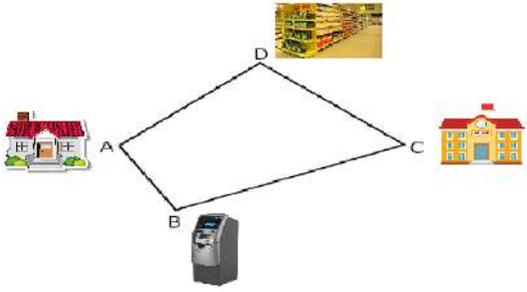$$and \ \vec{c} = \hat{\imath} + \hat{\jmath} + 3\hat{k}$$

From above information solve following questions
- (i)   Find $\vec{a} \times \vec{b}$
- (ii)   Find projection of $\vec{c} \ on \ \vec{a} \times \vec{b}$

	(iii) Find height h of parallelopiped.

7.	. A garden is in shape of quadrilateral. A student wants to finds its area by using
	  vector algebra. points are given as A(0,1,1), B(2,3,-2), C(22,19,-5),
	  and D(1,-2,1).
	
	From above information solve following questions
	    (i) Find $\overrightarrow{AC}$.
	    (ii) Find $\overrightarrow{BD}$.
	    (iii) Using this find area of quadrilateral.

8.	A student is observing the launch of Chandrayan- 3. He assumed a frame
	  Of reference that is x-axis, y-axis and z-axis . he finds the launching pad
	  A(5,10,0) in km units . The Chandranan 3 starts with net acceleration 5km/s^2
	  and he uses the formula $\vec{h} = 1/2\vec{a}t^2$.
	
	Solve the following questions.
	  (i) Find height of Chandrayan after 10 second.
	  (ii) Find position vector of Chandrayan- 3 in 10 second from.
	  (iii) What is angle of elevation by student if height of student neglected.

9.	.
	
	Tiranga point A(0,0,0) and Shivashakti point B(25,2,0)on moon are very important place for India's unity and integrity. If Pragyan Rover is at a instant to a point C(0,1/2.0).
	
	  From these information solve the following questions
	  (i) Find $\overrightarrow{AB}$.

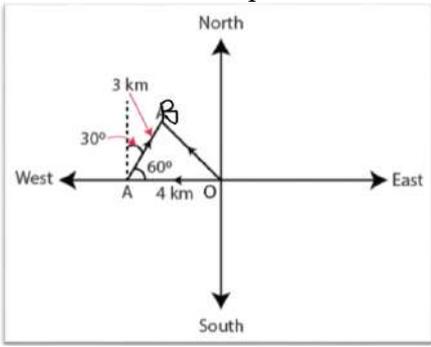|	
	(ii) Find $\overrightarrow{AC}$. (iii) Find area of triangle ABC .
10.	Ritika starts walking from his house to shopping mall. Instead of going to the mall directly, she first goes to a ATM, from there to her daughter's school and then reaches the mall. In the diagram, A(1,1,1),B(-2,4,1),C(-1,5,5) and D(2,2,2) are shown. From this information solve the following questions (i) Find distance between House A and ATM (B). (ii) Find distance between ATM (B) and school (C).
11	Anitha walks 4km towards west from her home and reaches her friend Geetu's house. Then together they walk 3km in a direction 30^0 east of north and reaches school . Based on the above information, answer the following questions.
	Find Anitha's displacement from her house to Geetu's house?
	Find Geetu's displacement from her house to school?
	Find Anitha's displacement from her house to school?

	ANSWERS
1.	**SOLUTION:** Let X axis in east direction Y axis in north direction and Z axis in above direction (i) $\overrightarrow{AD} = 5\hat{\imath} + 6\hat{\jmath} + 10\hat{k}$ (ii) $\left|\overrightarrow{AD}\right| = \sqrt{25 + 36 + 100} = \sqrt{161} \; meter$. (iii) $\widehat{AD} = \frac{5\hat{\imath}+6\hat{\jmath}+10\hat{k}}{\sqrt{161}}$.
2.	**Solutions:** (i) $4\hat{\imath} + 5\hat{\jmath} + \hat{k}$. (ii) $\sqrt{(2)^2 + (2)^2 + (-2)^2} = \sqrt{12} = 2\sqrt{3}$ units (iii) $\vec{r} = \frac{13\hat{\imath}+16\hat{\jmath}+2\hat{k}}{3}$.
3.	**SOLUTION :** (i) $\overrightarrow{AB} = 2\hat{\imath} + \hat{\jmath} - \hat{k}$, $\overrightarrow{AC} = \hat{\imath} + \hat{k}$. (ii) (5,19/3,8) . (iii) $\cos^{-1}\frac{1}{\sqrt{12}}$.
4.	SOLUTION: (i) $\vec{F} = \overrightarrow{F_1} + \overrightarrow{F_2} = 4\hat{\imath} + 5\hat{\jmath} - 4\hat{k}$ (ii) $\vec{a} = \frac{\vec{F}}{m} = 2\hat{\imath} + 5/2\hat{\jmath} - 2\hat{k}$ (iii) $\vec{s} = 8\hat{\imath} + 5\hat{\jmath} - 4\hat{k}$.
5.	SOLUTION: (i) Area= $\left|\vec{a} \times \vec{b}\right| = \left|-\hat{\imath} + 2\hat{\jmath} + 2\hat{k}\right| = 3$ (ii) $9\frac{(-\hat{\imath}+2\hat{\jmath}+2\hat{k})}{3}$
6.	SOLUTION: (i) $\vec{a} \times \vec{b} = -5\hat{\imath} + 3\hat{\jmath} + 2\hat{k}$ (ii) Projection $=(\hat{\imath} + \hat{\jmath} + 3\hat{k}).\frac{-5\hat{\imath}+3\hat{\jmath}+2\hat{k}}{\sqrt{38}} = \frac{4}{\sqrt{38}}$. (iii) Height$= \frac{4}{\sqrt{38}}$
7.	**SOLUTION:** (i) $\overrightarrow{AC} = 22\hat{\imath} + 18\hat{\jmath} - 6\hat{k}$ (ii) $\overrightarrow{BD} = -\hat{I} - 5\hat{J} + 3\hat{K}$ (iii) AREA$=\frac{1}{2}\left|\overrightarrow{AC} \times \overrightarrow{BD}\right| = \frac{1}{2}\sqrt{12940}$
8.	**SOLUTION:** (i) $\vec{h} = \frac{1}{2}5 \times 10^2 \; \hat{k}$ or h= 250 km. (ii) $\vec{r} = (5\hat{\imath} + 10\hat{\jmath}) + 250\hat{k}$

	(iii) $\theta = \tan^{-1} 10\sqrt{5}$
9.	**Solution:** (i) $\overrightarrow{AB} = 25\hat{\imath} + 2\hat{\jmath}$ (ii) $\overrightarrow{AC} = 1/2\hat{\jmath}$. (iii) $Area = 25/2\hat{k}$.
10.	**Solution:** (i) $32\sqrt{2}$. (ii) $32\sqrt{2}$.
11	It is given that Let O be the position of Anitha's house and B be the position of i Geetu's house nd final positions of the girl, respectively. Then, the girl's position can be shown as **Solution:** It is given that Let O and B be the initial and final positions of the girl, respectively. Then, the Anitha's position can be shown as
(i)	$\overrightarrow{OA} = -4\hat{\imath}$
(ii)	$\overrightarrow{AB} = |AB|\cos60^0\,\hat{\imath} + |AB|\sin 60^0\,\hat{\jmath}$ $= \frac{3}{2}\hat{\imath} + \frac{3\sqrt{3}}{2}\hat{\jmath}$
(iii)	$\overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB}$ $= \frac{-5}{2}\hat{\imath} + \frac{3\sqrt{3}}{2}\hat{\jmath}$