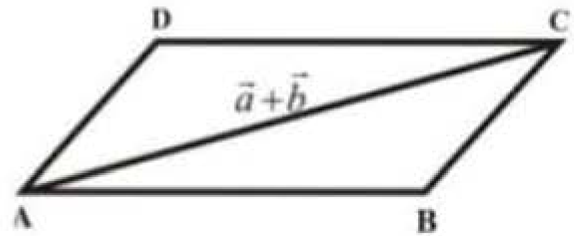
) Find the area of parallelogram whose adjecent sides are 2i - 4j + 5k and i - 2j - 3k. Also find unit vector parallel to its diagonal.

$\vec{a} = 2i - 4j + 5k \qquad \vec{b} = i - 2j - 3k$

$$\vec{a} \times \vec{b} = \begin{vmatrix} i & j & k \\ 2 & -4 & 5 \\ 1 & -2 & -3 \end{vmatrix} = i\{12+10\} - j\{-6-5\} + k\{-4+4\} = 22i + 11j$$

$$|\vec{a} \times \vec{b}| = \sqrt{(22)^2 + (11)^2 + 0} = \sqrt{242+121+0} = \sqrt{363}$$



Area of parallelogram ABCD $= |\vec{a} \times \vec{b}| = \sqrt{363}$ *sq.units*

Diagonal $\overrightarrow{AC} = \vec{a} + \vec{b}$

$= 2i - 4j + 5k + i - 2j - 3k$

$\overrightarrow{AC} = 3i - 6j + 2k$

$$|\overrightarrow{AC}| = \sqrt{3^2 + (-6)^2 + 2^2} = \sqrt{9+36+4} = \sqrt{49} = 7$$

Unit vector along $\overrightarrow{AC}$, $\qquad \hat{\overrightarrow{AC}} = \dfrac{\overrightarrow{AC}}{|\overrightarrow{AC}|} = \dfrac{3i - 6j + 2k}{7}$

Unit vector parallel to $\overrightarrow{AC}$ = Unit vector along $\overrightarrow{AC} = \dfrac{3i - 6j + 2k}{7}$