$\boxed{11\ G}$ #2c, d

$$2(\vec{a}-\vec{b})-3\vec{c}$$

$$2\left[\begin{pmatrix}+2\\3\\-1\end{pmatrix}-\begin{pmatrix}-1\\2\\-2\end{pmatrix}\right]-3\begin{pmatrix}0\\1\\3\end{pmatrix}$$

$$2\begin{pmatrix}3\\1\\1\end{pmatrix}-3\begin{pmatrix}0\\1\\3\end{pmatrix}$$

scalar multiplication

$$\begin{pmatrix}6\\2\\2\end{pmatrix}-\begin{pmatrix}0\\3\\9\end{pmatrix}=\begin{pmatrix}6\\-1\\-7\end{pmatrix}$$

(d) $$\frac{1}{2}\left[\begin{pmatrix}2\\3\\-1\end{pmatrix}-3\begin{pmatrix}-1\\2\\-2\end{pmatrix}\right]=\frac{1}{2}\begin{pmatrix}5\\-3\\5\end{pmatrix}=\begin{pmatrix}5/2\\-3/2\\5/2\end{pmatrix}$$

$\boxed{11H}$ **#5** $\vec{r} = (1+k)\vec{i} - k\vec{j} + 2\vec{k}$

$$\vec{r} = \begin{pmatrix} 1 \\ 0 \\ 2 \end{pmatrix} + k\begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}$$

(a) $\begin{pmatrix} 1 \\ 0 \\ 2 \end{pmatrix}, \begin{pmatrix} 2 \\ -1 \\ 2 \end{pmatrix}, \begin{pmatrix} 0 \\ 1 \\ 2 \end{pmatrix}, \ldots$

(b) $\left|\begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}\right| = \sqrt{2} \leftarrow \quad (2\sqrt{2})\sqrt{2} = 4$

$$2\sqrt{2}\begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix} = \underline{\underline{\begin{pmatrix} 2\sqrt{2} \\ -2\sqrt{2} \\ 0 \end{pmatrix}}}$$

$\boxed{11H}$ **#3** $\dfrac{x+1}{3} = \dfrac{y-0}{3/2} = \dfrac{z-1}{1}$

dir. vector : $\begin{pmatrix} 3 \\ 3/2 \\ 1 \end{pmatrix}$ point : $(-1, 0, 1)$

$\boxed{11A}$ #4 (a) $\lambda = 0 \quad (1, 1, -1)$

$\lambda = 1 \quad (0, 1, 2)$

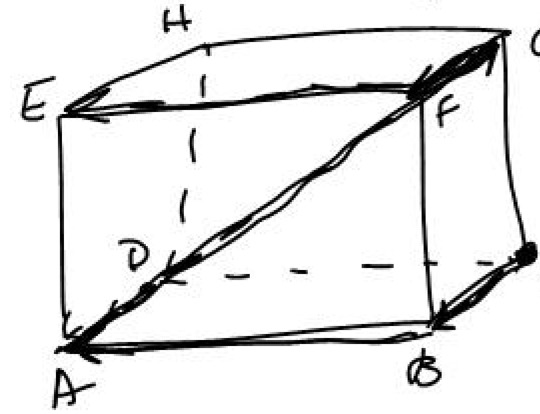
$\lambda = 2 \quad (-1, 1, 5)$

(b) $y = 1$ for all points on the line.

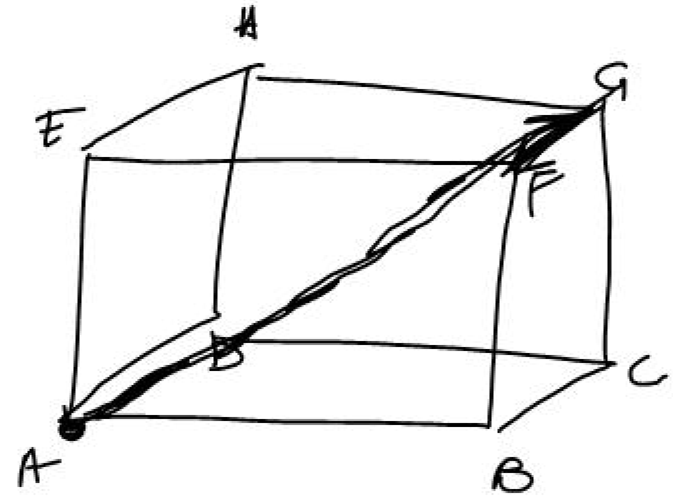
(c) $\vec{r} = \begin{pmatrix} 0 \\ 3 \\ 2 \end{pmatrix} + \mu \begin{pmatrix} -1 \\ 0 \\ 3 \end{pmatrix}$

$\boxed{11B}$ #3. (a)(iii) $\overrightarrow{CE} = -\vec{v} - \vec{u} + \vec{w} - \vec{v} - \vec{u}$

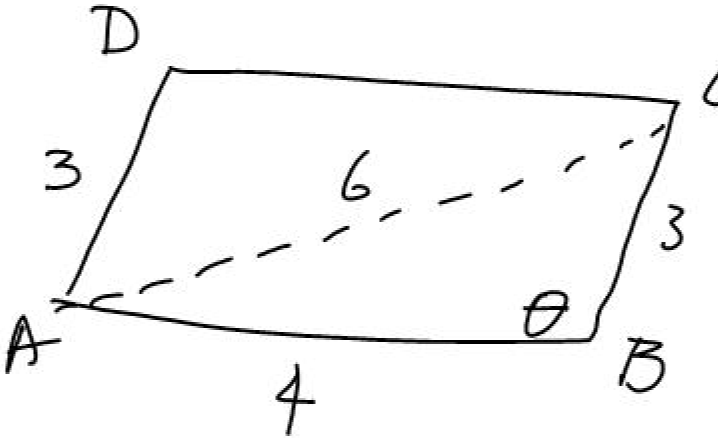
$= \vec{w} - 2\vec{u} - 2\vec{v}$



(iv) $\overrightarrow{AF} = \vec{w} - \vec{v}$

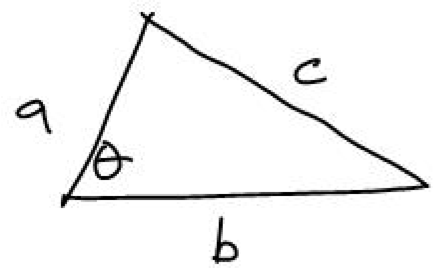


(b)(i)



$$\cos\theta = \frac{3^2+4^2-6^2}{2(3)(4)} = 117^\circ$$

The Cosine Rule

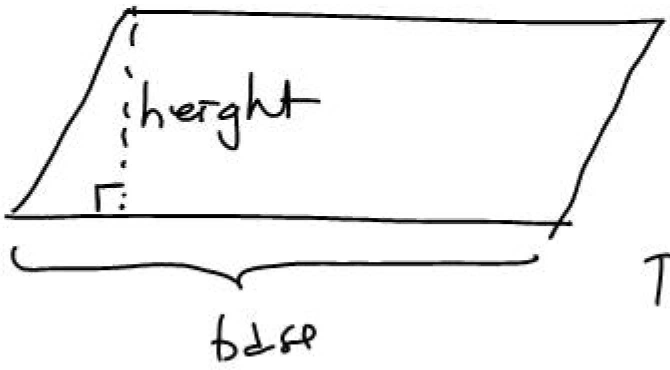


SAS case $c^2 = a^2+b^2-2ab\cos\theta$

SSS case $\cos\theta = \frac{a^2+b^2-c^2}{2(a)(b)}$

The area of a parallelogram

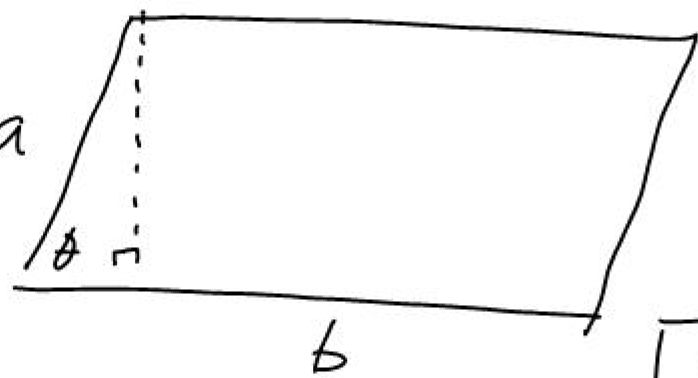
(i)



$$\boxed{A = bh}$$

Triangle: $A = \frac{1}{2}bh$

(ii)



$$\sin\theta = \frac{h}{a}$$

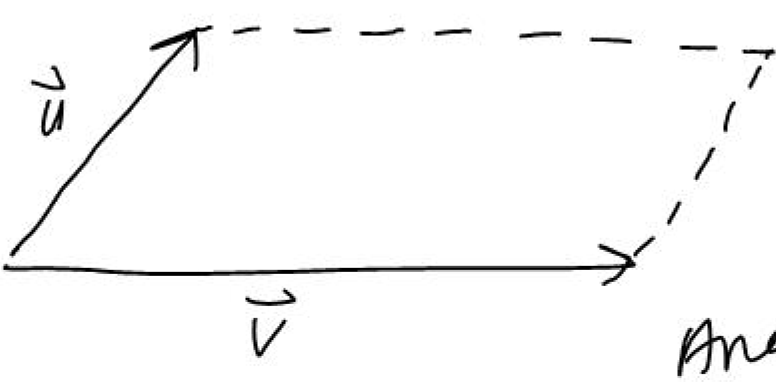
$$h = a\sin\theta$$

$$\boxed{\text{Area} = ab\sin\theta}$$

Triangle: $A = \frac{1}{2}ab\sin\theta$

angle between a and b

(iii)

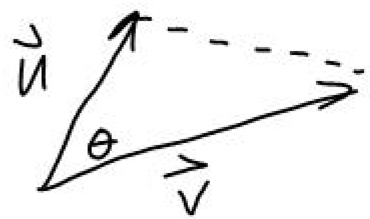


$$\text{Area} = |\vec{u} \times \vec{v}|$$

Triangle: $\text{Area} = \frac{1}{2}|\vec{u} \times \vec{v}|$

EX $\vec{u} = \vec{i} + \vec{j} + \vec{k}$

$\vec{v} = 2\vec{i} - 3\vec{k}$



Find the area of the Δ with sides $\vec{u}$ and $\vec{v}$.

$(-3\vec{i}+2\vec{j}) \quad -(2\vec{k} - 3\vec{j})$

$$\vec{u} \times \vec{v} = \det \begin{pmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & 1 & 1 \\ 2 & 0 & -3 \end{pmatrix} \begin{matrix} \vec{i} & \vec{j} \\ 1 & 1 \\ 2 & 0 \end{matrix} = -3\vec{i} + 5\vec{j} - 2\vec{k}$$

$$\text{Area} = \frac{1}{2}\sqrt{(-3)^2 + 5^2 + (-2)^2} = \underline{3.08}$$

Alternate Area Calculation

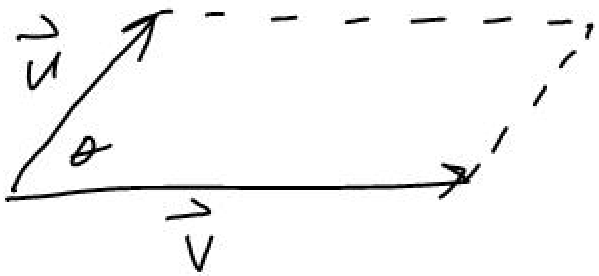
$$\text{Area} = \frac{1}{2}|\vec{u}||\vec{v}| \sin\theta$$

$$= \frac{1}{2}|\vec{u}||\vec{v}| \sin\left(\cos^{-1}\left(\frac{\vec{u}\cdot\vec{v}}{|\vec{u}||\vec{v}|}\right)\right)$$

$$= \frac{1}{2}\sqrt{3\cdot 13} \; \sin\left(\cos^{-1}\left(\frac{-1}{\sqrt{3\cdot 13}}\right)\right)$$

- $|\vec{u} \times \vec{v}| = |\vec{u}|\,|\vec{v}| \sin\theta$

$\uparrow$ angle between $\vec{u}$ and $\vec{v}$



- $\vec{u} \cdot \vec{v} = |\vec{u}|\,|\vec{v}| \cos\theta$

$$\cos\theta = \frac{\vec{u} \cdot \vec{v}}{|\vec{u}|\,|\vec{v}|}$$

$\boxed{11C}$ #3a $\quad \overrightarrow{AB} = \begin{pmatrix} 1 \\ 2 \\ 2 \end{pmatrix}$

"terminal − initial"

Unit Vectors − vectors that are 1 unit long

- Find the unit vector in the direction of $3\vec{i} - 2\vec{j} + \vec{k}$.

$$|3\vec{i} - 2\vec{j} + \vec{k}| = \sqrt{14}$$

$$\frac{1}{\sqrt{14}}(3\vec{i} - 2\vec{j} + \vec{k}) = \underbrace{\left(\frac{3}{\sqrt{14}}\vec{i} - \frac{2}{\sqrt{14}}\vec{j} + \frac{1}{\sqrt{14}}\vec{k}\right)}_{\text{unit vector}}$$

A unit vector in the direction of $\vec{u}$ is

$$\left(\frac{1}{|\vec{u}|}\right)\vec{u}$$

$\boxed{11F}$ *1.b $\overrightarrow{AB} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$

$$\overrightarrow{AC} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$$

$$\overrightarrow{AD} = \begin{pmatrix} -1 \\ -4 \end{pmatrix}$$

(i) $\overrightarrow{BD} = \overrightarrow{AD} - \overrightarrow{AB} = \begin{pmatrix} -1 \\ -4 \end{pmatrix} - \begin{pmatrix} 3 \\ 1 \end{pmatrix} = \begin{pmatrix} -4 \\ -5 \end{pmatrix}$

$$= \overrightarrow{AD} + \overrightarrow{BA}$$