$\boxed{11D}$ #2a

scalar multiplication

$$2\begin{pmatrix}x\\y\end{pmatrix} - 3\begin{pmatrix}y\\x\end{pmatrix} = 5\begin{pmatrix}1\\-2\end{pmatrix}$$

$$\begin{pmatrix}2x-3y\\2y-3x\end{pmatrix} = \begin{pmatrix}5\\-10\end{pmatrix}$$

$$\begin{cases}2x-3y = 5\\ 2y-3x = -10\end{cases} \rightarrow \begin{cases}\cancel{6x}-9y = 15\\ \cancel{-6x}+4y = -20\end{cases}$$

$$-5y = -5$$

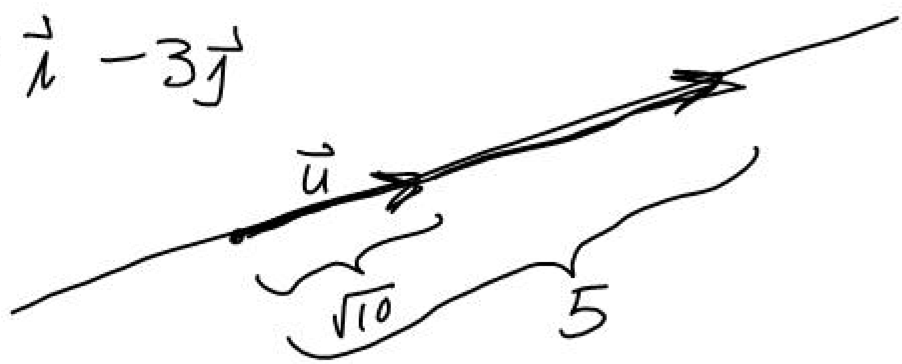
$$y = 1$$

$$2(1)-3x = -10$$

$$-3x = -12$$

$$x = 4$$

$\boxed{11E}$ #6 $\vec{u} = \vec{i} - 3\vec{j}$




$$|\vec{u}| = \sqrt{1^2+(-3)^2}$$

$$= \sqrt{10}$$

$$\vec{k} = 5\left(\frac{1}{\sqrt{10}}\vec{u}\right) = \frac{5}{\sqrt{10}}\vec{u} = \frac{5}{\sqrt{10}}\vec{i} - \frac{15}{\sqrt{10}}\vec{j}$$

$$= \frac{\sqrt{10}}{2}\vec{i} - \frac{3\sqrt{10}}{2}\vec{j}$$

#5. $\vec{u} = -4\vec{i} - 6\vec{j}$

$$|\vec{u}| = \sqrt{(-4)^2 + (-6)^2} = \sqrt{52} = 2\sqrt{13}$$

$$\vec{W} = \frac{1}{2}\vec{u} = -2\vec{i} - 3\vec{j}$$

$\boxed{11F}$ #2d $\vec{AB} = -4\vec{i} - 2\vec{j}$

$$\vec{AP} = 2\vec{PB} \qquad P(x, y)$$

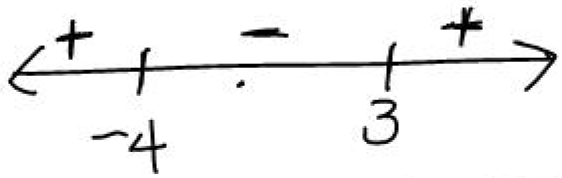
$$\begin{pmatrix} x-2 \\ y-6 \end{pmatrix} = 2\begin{pmatrix} -2-x \\ 4-y \end{pmatrix}$$

$$x - 2 = -4 - 2x \rightarrow 3x = -2 \rightarrow x = -\frac{2}{3}$$

$$y - 6 = 8 - 2y \rightarrow 3y = 14 \rightarrow y = \frac{14}{3}$$

$\boxed{11K}$ #4.

$$\cos\theta = \frac{\begin{pmatrix} a \\ a-4 \end{pmatrix} \cdot \begin{pmatrix} a-2 \\ 3 \end{pmatrix}}{\left|\begin{pmatrix} a \\ a-4 \end{pmatrix}\right| \left|\begin{pmatrix} a-2 \\ 3 \end{pmatrix}\right|} > 0$$




$$(a^2 - 2a) + (3a - 12) > 0$$

$$a^2 + a - 12 > 0$$

$$(a + 4)(a - 3) > 0$$

+ +

$\boxed{a < -4 \text{ or } a > 3}$

$\boxed{11G}$ #5.

$$\overrightarrow{AC} = \begin{pmatrix} -4 \\ -1 \\ 2 \end{pmatrix} \quad \overrightarrow{AD} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \quad \overrightarrow{CG} = \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$$

(b) <u>position vector for B</u> : $\overrightarrow{OB} = \overrightarrow{OA} + \overrightarrow{AB}$

$$= \begin{pmatrix} 4 \\ -1 \\ 3 \end{pmatrix} + \begin{pmatrix} -5 \\ -3 \\ -1 \end{pmatrix}$$

$$\overrightarrow{AB} = \overrightarrow{AC} + \overrightarrow{CB}$$

$$= \overrightarrow{AC} + \overrightarrow{DA}$$

$$= \underline{\overrightarrow{AC} - \overrightarrow{AD}} = \begin{pmatrix} -5 \\ -3 \\ -1 \end{pmatrix}$$

$$= \begin{pmatrix} -1 \\ -4 \\ 2 \end{pmatrix}$$

<u>position vector for E</u>

$$\overrightarrow{OE} = \overrightarrow{OA} + \overrightarrow{AE}$$

$$= \overrightarrow{OA} + \overrightarrow{CG} =$$

$$= \begin{pmatrix} 4 \\ -1 \\ 3 \end{pmatrix} + \begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix} = \begin{pmatrix} 5 \\ -3 \\ 4 \end{pmatrix}$$

$\boxed{11J}$ #3 $A(1,0,0)$ $E(1,0,1)$

$B(1,1,0)$ $F(1,1,1)$

$C(0,1,0)$ $G(0,1,1)$

$D(0,0,1)$

$$\overrightarrow{OF} - \begin{matrix}1\\1\\1\end{matrix} \qquad \overrightarrow{OG} = \begin{pmatrix}0\\1\\1\end{pmatrix}$$

$$\overrightarrow{OF}\cdot\overrightarrow{OG} = 2$$

$$\overrightarrow{AF} = \begin{pmatrix}0\\1\\1\end{pmatrix} \qquad \overrightarrow{BG} = \begin{pmatrix}-1\\0\\1\end{pmatrix}$$

$$\overrightarrow{AF}\cdot\overrightarrow{BG} = 1$$

# The Triple Scalar Product for $\vec{u}$, $\vec{v}$, and $\vec{w}$

$$\vec{u} \cdot (\vec{v} \times \vec{w})$$

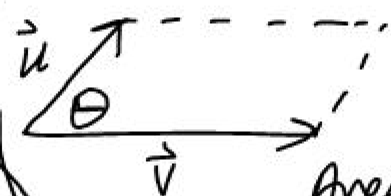
Ex. $\vec{u} = \begin{pmatrix} 2 \\ 1 \\ 1 \end{pmatrix}$, $\vec{v} = \begin{pmatrix} -1 \\ 2 \\ 3 \end{pmatrix}$, $\vec{w} = \begin{pmatrix} 3 \\ 4 \\ 2 \end{pmatrix}$

1. $\vec{u} \cdot (\vec{v} \times \vec{w}) = -15$
2. $\vec{u} \cdot (\vec{w} \times \vec{v}) = +15$
3. $\vec{v} \cdot (\vec{u} \times \vec{w}) = +15$
4. $\vec{v} \cdot (\vec{w} \times \vec{u}) = -15$
5. $\vec{w} \cdot (\vec{u} \times \vec{v}) = -15$
6. $\vec{w} \cdot (\vec{v} \times \vec{u}) = +15$

Volume of a parallelepiped

$$\left| \vec{u} \cdot (\vec{v} \times \vec{w}) \right|$$

Triangles + parallelograms




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

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

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

$\boxed{11\ M}$ #3.-5