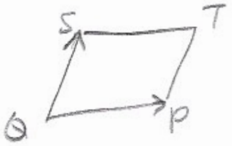
[2][a]



$$\overrightarrow{QP} = -\overrightarrow{PQ} = \underline{\langle -4,-3,2\rangle}_{2\frac{1}{2}}$$

$$\overrightarrow{QS} = \langle 0,2,-1\rangle$$

$$\overrightarrow{QP}\times\overrightarrow{QS} = \underline{\left|\begin{matrix} \vec{\imath} & \vec{\jmath} & \vec{k} \\ -4 & -3 & 2 \\ 0 & 2 & -1 \end{matrix}\right| \begin{matrix} \vec{\imath} & \vec{\jmath} \\ -4 & -3 \\ 0 & 2 \end{matrix}}_{5} = \begin{matrix} 3\vec{\imath} \quad -8\vec{k} \\ -4\vec{\imath} - 4\vec{\jmath} \end{matrix} = \underline{\langle -1,-4,-8\rangle}_{7\frac{1}{2}}$$

$$\langle -1,-4,-8\rangle \cdot \langle -4,-3,2\rangle = \underline{4+12-16}_{1} = 0$$

$$\langle -1,-4,-8\rangle \cdot \langle 0,2,-1\rangle = \underline{0-8+8}_{1} = 0$$

$$\|\overrightarrow{QP}\times\overrightarrow{QS}\| = \underline{\sqrt{(-1)^2+(-4)^2+(-8)^2} = \sqrt{1+16+64}}_{5} = \sqrt{81} = \underline{9}_{2}$$

[b] $\overrightarrow{QS}\cdot\overrightarrow{QP} = \langle 0,2,-1\rangle \cdot \langle -4,-3,2\rangle = \underline{0-6-2}_{5} = -8 \underline{< 0}_{3}$

$\underline{\text{OBTUSE}}_{3}$

[c] $\underset{3}{\underline{\cancel{12}^{4}}} \cdot \underset{3}{\underline{\frac{1}{\cancel{9}_{3}}}}\,\underline{\langle -1,-4,-8\rangle}_{5} = \underline{\left\langle -\frac{4}{3}, -\frac{16}{3}, -\frac{32}{3}\right\rangle \text{ OR } \left\langle \frac{4}{3}, \frac{16}{3}, \frac{32}{3}\right\rangle}_{3}$

[d] RADIUS $= \|\overrightarrow{QS}\| = \underline{\sqrt{0^2+2^2+(-1)^2} = \sqrt{0+4+1}}_{5} = \underline{\sqrt{5}}_{2}$

$$\underline{(x+2)^2+(y-3)^2+(z-1)^2 = 5}_{6}$$

$$\underline{(x+2)^2+(0-3)^2+(z-1)^2 = 5}_{5}$$

$$\underline{(x+2)^2+(z-1)^2 = -4}_{2} \quad \underline{\text{NO XZ-TRACE}}_{3}$$

[e] $\overrightarrow{QR} = \langle -6-2, -2-3, 5-1\rangle = \underline{\langle -4,-5,4\rangle}_{2}$

$$\underline{|(\overrightarrow{QP}\times\overrightarrow{QS})\cdot\overrightarrow{QR}|}_{5} = |\langle -1,-4,-8\rangle \cdot \langle -4,-5,4\rangle|$$

$$= \underline{|4+20-32|}_{5}$$

$$= |-8|$$

$$= \underline{8}_{1}$$

[3] [a] $\|\vec{w}\|^2 = \vec{w}\cdot\vec{w} = 6 \longrightarrow \underline{\|\vec{w}\| = \sqrt{6}}_{4}$

[b] $(\vec{w}+\vec{v})\times\vec{u} = (\vec{w}\times\vec{u}) + (\vec{v}\times\vec{u}) = -(\vec{u}\times\vec{w}) - (\vec{u}\times\vec{v})$

$= \underline{\langle -4, 1, 7\rangle - \langle 2, 0, -3\rangle}_{5} = \underline{\langle -6, 1, 10\rangle}_{2}$

[c] $(\vec{v}\times\vec{w})\cdot\vec{u} = \vec{u}\cdot(\vec{v}\times\vec{w}) = \underline{1} \quad 4$

[d] $2\vec{u}\times 2\vec{v} = 2(\vec{u}\times 2\vec{v}) = 2\cdot 2(\vec{u}\times\vec{v})$

$= \underline{4\langle 2, 0 -3\rangle}_{4}$

$= \underline{\langle 8, 0 -12\rangle}_{1}$

[4][a] $\overrightarrow{AB} = \langle -2-1, 1--1, 1-2 \rangle = \underline{\langle -3, 2, -1 \rangle}$ 2

$\overrightarrow{AC} = \langle -1-1, 2--1, -1-2 \rangle = \underline{\langle -2, 3, -3 \rangle}$ 2

$\vec{n} \perp \overrightarrow{AB}, \overrightarrow{AC} \longrightarrow$ LET $\vec{n} = \overrightarrow{AB} \times \overrightarrow{AC}$

$$= \underline{\left| \begin{array}{ccc|cc} \vec{i} & \vec{j} & \vec{k} & \vec{i} & \vec{j} \\ -3 & 2 & -1 & -3 & 2 \\ -2 & 3 & -3 & -2 & 3 \end{array} \right.}_{5}$$

$$= -6\vec{i} + 2\vec{j} - 9\vec{k} + 3\vec{i} - 9\vec{j} + 4\vec{k} = \underline{\langle -3, -7, -5 \rangle}_{7\frac{1}{2}}$$

$\langle -3, -7, -5 \rangle \cdot \langle -3, 2, -1 \rangle = \underline{9 - 14 + 5}_{1} = 0$

$\langle -3, -7, -5 \rangle \cdot \langle -2, 3, -3 \rangle = \underline{6 - 21 + 15}_{1} = 0$

USE $\vec{n} = \langle 3, 7, 5 \rangle$

$\underline{3(x-1) + 7(y+1) + 5(z-2) = 0}$ 6

$3x + 7y + 5z - 3 + 7 - 10 = 0$

$\underline{3x + 7y + 5z - 6 = 0}$ $1\frac{1}{2}$

[b] $\vec{d}_1 \parallel \vec{n} \rightarrow$ LET $\vec{d}_1 = \vec{n} = \underline{\langle 3,7,5 \rangle}$ 6

1 $\underline{x = -1} + \underline{3t}$ 1

1 $\underline{y = 2} + \underline{7t}$ 1

1 $\underline{z = -1} + \underline{5t}$ 1

[c] $\vec{d}_2 \parallel \vec{d}_1 , \vec{d}_2 \parallel \vec{n} \rightarrow$ LET $\vec{d}_2 = \vec{d}_1 = \vec{n} = \underline{\langle 3,7,5 \rangle}$ 6

$$\underline{\frac{x-1}{3} = \frac{y+1}{7} = \frac{z-2}{5}}$$ 6

[5] $\overrightarrow{AB} = \langle a-1, 1-2a-1, 2-2a-2 \rangle = \underline{\langle a-1, 2-2a, -2a \rangle}$ 2

$\overrightarrow{AC} = \langle -a-1, a-2-1, a+2-2 \rangle = \underline{\langle -a-1, a-1, a \rangle}$ 2

$\overrightarrow{AB} = k\overrightarrow{AC} \longrightarrow \underline{\langle a-1, 2-2a, -2a \rangle = k\langle -a-1, a-1, a \rangle}$ 5

$= \langle -ka-k, ka-k, ka \rangle$

① $a-1 = -ka-k$

② $2-2a = ka-k$

③ $\underline{-2a = ka}$ 3 $\longrightarrow 0 = ka+2a$

$0 = (k+2)a$

3 $\underline{k+2=0}$ or $\underline{a=0}$ 3

$k=-2$

$\downarrow$ $\qquad\qquad$ $\downarrow$

① $\underline{a-1 = 2a+2}$ 3 $\qquad$ ① $-1 = -k$

$\underline{-3 = a}$ 3 $\qquad$ $k = 1$

② $2-2a = -2a+2$ $\qquad$ ② $2 = -1$

✓ $\qquad$ x

$\underline{a = -3}$ 1