

$$A(1, -3, 5)$$

$$B(-2, 4, -6)$$

$$C(-7, 1, 0)$$

$$a. \vec{P} = \vec{AB} = \begin{pmatrix} -2 - 1 \\ 4 + 3 \\ -6 - 5 \end{pmatrix} = \begin{pmatrix} -3 \\ 7 \\ -11 \end{pmatrix}$$

$$\vec{CB} = \begin{pmatrix} -2 + 7 \\ 4 - 1 \\ -6 - 0 \end{pmatrix} = \begin{pmatrix} 5 \\ 3 \\ -6 \end{pmatrix}$$

$$\vec{Q} = \vec{BC} = \begin{pmatrix} -7 + 2 \\ 1 - 4 \\ 0 + 6 \end{pmatrix} = \begin{pmatrix} -5 \\ -3 \\ 6 \end{pmatrix}$$

$$b. |\vec{Q}| = \sqrt{25 + 9 + 36} = \sqrt{70}$$

$$c. \vec{Q} = \frac{1}{\sqrt{70}} \begin{pmatrix} -5 \\ -3 \\ 6 \end{pmatrix}$$

$$d. \vec{P} \cdot \vec{Q} = -3 \cdot -5 + 7 \cdot -3 + (-11) \cdot 6 \\ = 15 + (-21) + (-66) \\ = -72$$

$$e. \vec{N} = \vec{CB} \times \vec{AB} = \begin{pmatrix} 5 \\ 3 \\ -6 \end{pmatrix} \times \begin{pmatrix} -3 \\ 7 \\ -11 \end{pmatrix} = \begin{pmatrix} -33 + 42 \\ 18 + 55 \\ 35 + 9 \end{pmatrix} \\ = \begin{pmatrix} 9 \\ 73 \\ 44 \end{pmatrix}$$

$$M_1 = \begin{pmatrix} 2 & -4 \end{pmatrix}$$

$$M_2 = \begin{pmatrix} -1 & 3 \\ 2 & -1 \end{pmatrix}$$

$$\begin{aligned} M_1 \cdot M_2 &= \begin{pmatrix} 2 & -4 \end{pmatrix} \begin{pmatrix} -1 & 3 \\ 2 & -1 \end{pmatrix} = \begin{pmatrix} -2 + (-8) & 6 + 4 \end{pmatrix} \\ &= \begin{pmatrix} -10 & 10 \end{pmatrix} \end{aligned}$$

$$\begin{aligned} M_2 \cdot M_2 &= \begin{pmatrix} -1 & 3 \\ 2 & -1 \end{pmatrix} \begin{pmatrix} -1 & 3 \\ 2 & -1 \end{pmatrix} = \begin{pmatrix} 1 + 6 & -3 + (-3) \\ -2 + (-2) & 6 + 1 \end{pmatrix} \\ &= \begin{pmatrix} 7 & -6 \\ -4 & 7 \end{pmatrix} \end{aligned}$$