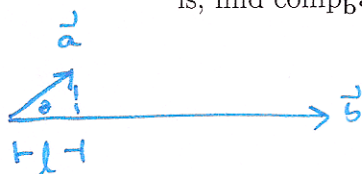


**Instructions:** Each question is worth 2 points. You get one point for taking this quiz.

1. (a) Let  $\mathbf{a} = (-1, 1, 0)$  and  $\mathbf{b} = (2, 1, 1)$ . Find the *scalar* component of  $\mathbf{a}$  onto  $\mathbf{b}$ ; that is, find  $\text{comp}_{\mathbf{b}} \mathbf{a}$ .



$$\therefore \text{comp}_{\mathbf{b}} \mathbf{a} = \frac{\mathbf{a} \cdot \mathbf{b}}{\|\mathbf{b}\|} = \frac{(-1)(2) + (1)(1) + (0)(1)}{\sqrt{2^2 + 1^2 + 1^2}} = \frac{-2+1}{\sqrt{6}} = \frac{-1}{\sqrt{6}} = \frac{-\sqrt{6}}{6}$$

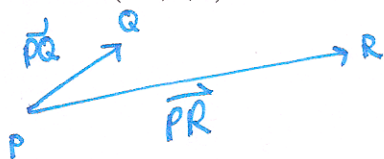
$$l = \text{comp}_{\mathbf{b}} \mathbf{a} = \|\mathbf{a}\| \cos \theta = \frac{\mathbf{a} \cdot \mathbf{b}}{\|\mathbf{b}\|}$$

- (b) Use your answer to (a), to find the *vector* component of  $\mathbf{a}$  onto  $\mathbf{b}$ ; that is, find  $\text{proj}_{\mathbf{b}} \mathbf{a}$ .

$$\text{proj}_{\mathbf{b}} \mathbf{a} = \frac{\mathbf{a} \cdot \mathbf{b}}{\|\mathbf{b}\|^2} \cdot \mathbf{b} = \frac{\mathbf{a} \cdot \mathbf{b}}{\|\mathbf{b}\|} \frac{\mathbf{b}}{\|\mathbf{b}\|}$$

$$= \frac{-1}{(\sqrt{6})^2} (2, 1, 1) = -\frac{1}{6} (2, 1, 1) = \left( -\frac{1}{3}, -\frac{1}{6}, -\frac{1}{6} \right)$$

2. Find a vector perpendicular to the plane that passes through the points  $P(1, 1, 1)$ ,  $Q(2, 3, 1)$ , and  $R(-1, 0, 2)$ .



Find  $\overrightarrow{PQ} \times \overrightarrow{PR}$

$$\overrightarrow{PQ} = (2, 2, 0) = (1, 2, 0)$$

$$\overrightarrow{PR} = (-2, -1, 1) = (-2, -1, 1)$$

$$\therefore \overrightarrow{PQ} \times \overrightarrow{PR} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 0 \\ -2 & -1 & 1 \end{vmatrix} = [2(1) - 0] \hat{i} - [(1)(1) - 0] \hat{j} + [1(-1) - 2(-2)] \hat{k} = 2\hat{i} - 1\hat{j} + 3\hat{k} = (2, -1, 3)$$

OR any non-zero scalar multiple ...