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Quiz 7

This quiz is graded out of 10 marks. No books, calculators, notes or cell phones are allowed. You must show all your work, the correct answer is worth 1 mark the remaining marks are given for the work. If you need more space for your answer use the back of the page.

Question 1. §3.2 #23d *(5 marks)* Find the cosine of the angle θ between $\mathbf{u} = (-2, 2, 3)$ and $\mathbf{v} = (1, 7, -4)$.

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

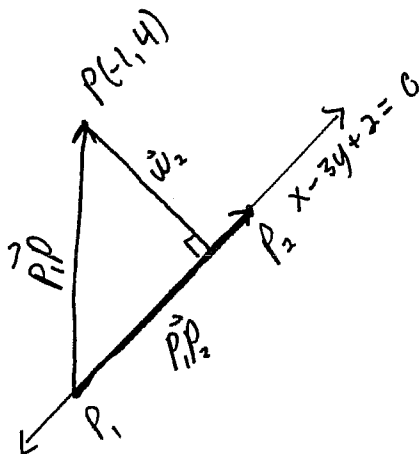$$\cos\theta = \frac{\vec{u} \cdot \vec{v}}{\|\vec{u}\|\|\vec{v}\|}$$

$$= \frac{(-2, 2, 3) \cdot (1, 7, -4)}{\sqrt{(-2)^2 + 2^2 + 3^2}\sqrt{1^2 + 7^2 + (-4)^2}}$$

$$= \frac{-2(1) + 2(7) + 3(-4)}{\sqrt{17}\sqrt{66}}$$

$$= \frac{0}{\sqrt{17}\sqrt{66}} = 0$$

Question 2. §3.3 #30 *(5 marks)* Find the distance between the point and the line. *YOU MUST use projections to solve this problem*

$(-1, 4); \; x - 3y + 2 = 0$

Let $y = 0$

$x - 3(0) + 2 = 0$

$x = -2$

$P_1 (-2, 0)$

Let $y = 1$

$x - 3(1) + 2 = 0$

$x = 1$ $P_2 (1, 1)$

$\vec{P_1 P_2} = P_2 - P_1 = (1, 1) - (-2, 0) = (3, 1)$

$\vec{P_1 P} = P - P_1 = (-1, 4) - (-2, 0) = (1, 4)$

$\vec{w_2} = \vec{P_1 P} - \text{proj}_{\vec{P_1 P_2}} \vec{P_1 P}$

$= (1, 4) - \frac{\vec{P_1 P_2} \cdot \vec{P_1 P}}{\vec{P_1 P_2} \cdot \vec{P_1 P_2}} \vec{P_1 P_2}$

$= (1, 4) - \frac{(3, 1) \cdot (1, 4)}{(3, 1) \cdot (3, 1)} (3, 1)$

$= (1, 4) - \frac{3 + 4}{9 + 1} (3, 1)$

$= (1, 4) - \left(\frac{21}{10}, \frac{7}{10}\right)$

$= \left(\frac{-11}{10}, \frac{33}{10}\right)$

$d = \|\vec{w_2}\|$

$= \sqrt{\left(\frac{-11}{10}\right)^2 + \left(\frac{33}{10}\right)^2}$

$= \sqrt{\frac{11^2 + 33^2}{10^2}}$

$= \sqrt{\frac{121 + 9(121)}{10}}$

$= \frac{\sqrt{10(121)}}{10}$

$= \frac{11}{\sqrt{10}}$