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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 TF *(2 marks)* Determine whether the statement is true or false, and justify your answer.
If $\vec{u} \cdot \vec{v} = 0$, then either $\vec{u} = 0$ or $\vec{v} = 0$.

False Let $\vec{u} = (2,1)$, $\vec{v} = (-1,2)$ then $\vec{u} \cdot \vec{v} = 2(-1) + 1(2) = 0$ but $\vec{u} \neq 0$, $\vec{v} \neq 0$

Question 2. §3.2 #23d *(3 marks)* Find the cosine of the angle θ between $\vec{u}$ and $\vec{v}$.

$\vec{u} = (-2,2,3)$, $\vec{v} = (1,7,-4)$

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

$\vec{u} \cdot \vec{v} = -2(1) + 2(7) + 3(-4) = 0$

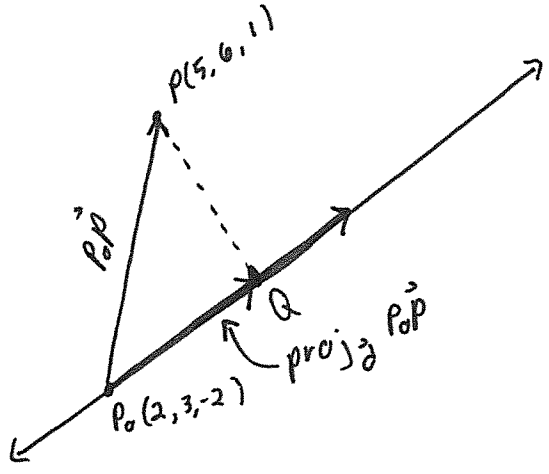
$0 = \|\vec{u}\|\|\vec{v}\|\cos\theta$

$\cos\theta = 0$

Question 3. 5.22a *(5 marks)* Find the point on the line which is closest to the point P.

$x = 2 - t, y = 3 + 2t, z = -2 + t$, and P(5, 6, 1)

$(x,y,z) = (2-t, 3+2t, -2+t) = \underbrace{(2,3,-2)}_{P_0} + t\,\underbrace{(-1,2,1)}_{\vec{d}}$ $\quad t \in \mathbb{R}$



$\vec{P_0P} = P - P_0$

$= (5,6,1) - (2,3,-2)$

$= (3,3,3)$

$\vec{P_0Q} = \text{proj}_{\vec{d}}\,\vec{P_0P}$

$Q - P_0 = \text{proj}_{\vec{d}}\,\vec{P_0P}$

$Q = P_0 + \text{proj}_{\vec{d}}\,\vec{P_0P}$

$= (2,3,-2) + \dfrac{(3,3,3)\cdot(-1,2,1)}{(-1,2,1)\cdot(-1,2,1)}(-1,2,1)$

$= (2,3,-2) + \dfrac{6}{6}(-1,2,1)$

$= (1,5,-1)$.