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Quiz 11

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.

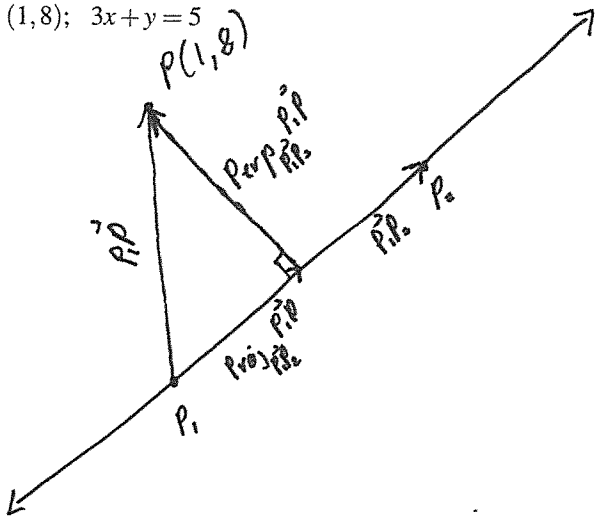
Question 1. §3.4 #5 *(2 marks)* Use the given equation of a line to find a point on the line and a vector parallel to the line.

$\vec{x} = (3-5t, -6-t) = (3,-6) + t(-5,-1) = P_0 + t\vec{d}$

where $P_0 = (3,-6)$ and $\vec{d} = (-5,-1)$

Question 2. §3.3 #32 *(4 marks)* Using projections find the distance between the point and the line.

$(1,8)$; $3x+y=5$



Lets find 2 points on the line

Let $x=1 \rightarrow 3(1)+y=5 \Leftrightarrow y=2 \therefore P_1(1,2)$

Let $x=2 \rightarrow 3(2)+y=5 \Leftrightarrow y=-1 \therefore P_2(2,-1)$

$\vec{P_1P} = P - P_1 = (1,8)-(1,2) = (0,6)$

$\vec{P_1P_2} = P_2 - P_1 = (2,-1)-(1,2) = (1,-3)$

$$\text{perp}_{\vec{P_1P_2}} \vec{P_1P} = \vec{P_1P} - \text{proj}_{\vec{P_1P_2}} \vec{P_1P}$$

$$= (0,6) - \frac{\vec{P_1P}\cdot\vec{P_1P_2}}{\vec{P_1P_2}\cdot\vec{P_1P_2}}\vec{P_1P_2}$$

$$= (0,6) - \frac{(0,6)\cdot(1,-3)}{(1,-3)\cdot(1,-3)}(1,-3)$$

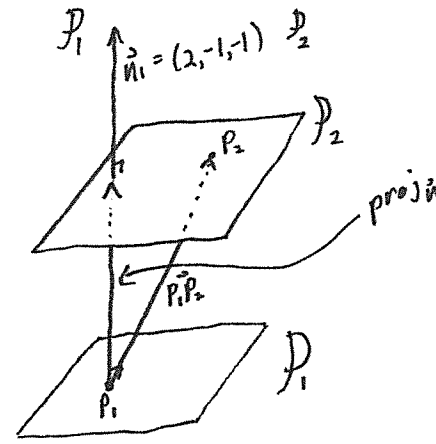
$$= (0,6) - \frac{-18}{10}(1,-3)$$

$$= (0,6) + \frac{9}{5}(1,-3) = \left(\frac{9}{5}, \frac{3}{5}\right) = \frac{3}{5}(3,1)$$

$$d = \|\text{perp}_{\vec{P_1P_2}} \vec{P_1P}\| = \left\|\frac{3}{5}(3,1)\right\| = \frac{3}{5}\sqrt{3^2+1^2} = \frac{3}{5}\sqrt{10}$$

Question 3. §3.3 #37 *(4 marks)* Find the distance between the given parallel planes.

$2x-y-z=5$ and $-4x+2y+2z=12$



$\vec{P_1P_2} = P_2 - P_1 = (0,6,0) - (0,0,-5) = (0,6,5)$

$$\text{proj}_{\vec{n}_1} \vec{P_1P_2} = \frac{\vec{P_1P_2}\cdot\vec{n}_1}{\vec{n}_1\cdot\vec{n}_1}\vec{n}_1$$

$$= \frac{(0,6,5)\cdot(2,-1,-1)}{(2,-1,-1)\cdot(2,-1,-1)}(2,-1,-1)$$

$$= \frac{-11}{4+1+1}(2,-1,-1)$$

$$= \frac{-11}{6}(2,-1,-1)$$

Lets find a point on P_1: Let $x=y=0$

$2(0)-0-z=5$, $z=-5$, $P_1(0,0,-5)$

Lets find a point on P_2: Let $x=z=0$

$-4(0)+2y+2(0)=12$, $y=6$, $P_2(0,6,0)$

$$d = \|\text{proj}_{\vec{n}_1} \vec{P_1P_2}\| = \left\|\frac{-11}{6}(2,-1,-1)\right\| = \frac{11}{6}\|(2,-1,-1)\| = \frac{11}{6}\sqrt{2^2+(-1)^2+(-1)^2}$$

$$= \frac{11\sqrt{6}}{6}$$