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Quiz 7

This quiz is graded out of 10 marks. No books, 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. Let $\mathbf{u} = (3,2,-1)$, $\mathbf{v} = (3,-3,-3)$, $\mathbf{w} = (2,-2,-3)$.

a. *(3 marks)* Find the scalar triple product of **u**, **v**, **w**.

b. *(1 mark)* Find the volume of the parallelepiped with sides **u**, **v**, **w**.

a) $\vec{u} \cdot (\vec{v} \times \vec{w}) = \begin{vmatrix} 3 & 2 & -1 \\ 3 & -3 & -3 \\ 2 & -2 & -3 \end{vmatrix} = 3(-1)^{1+1}\begin{vmatrix} -3 & -3 \\ -2 & -3 \end{vmatrix} + 2(-1)^{2+1}\begin{vmatrix} 3 & -3 \\ 2 & -3 \end{vmatrix} + -1(-1)^{3+1}\begin{vmatrix} 3 & -3 \\ 2 & -2 \end{vmatrix}$

$= 3[9-6] + 2(-1)[-9+6]$

$= 9 + 6 = 15$

b) the volume is 15.

Question 2. *(4 marks)* Find the area of the parallelogram determined by $\mathbf{x} = (2,-3,3)$ and $\mathbf{y} = (-2,2,-3)$.

$\vec{x} \times \vec{y} = \left(\begin{vmatrix} -3 & 2 \\ 3 & -3 \end{vmatrix}, -\begin{vmatrix} 2 & -2 \\ 3 & -3 \end{vmatrix}, \begin{vmatrix} 2 & -2 \\ -3 & 2 \end{vmatrix}\right) = (3, 0, -2)$

$2 \quad -2$
$-3 \quad 2$
$3 \quad -3$

area $= \|\vec{x} \times \vec{y}\| = \sqrt{3^2 + 0^2 + (-2)^2} = \sqrt{13}$

Question 3. *(2 marks)* Find a vector **v** that is orthogonal to the vector $\mathbf{u} = (1,-6,-2)$.

Let $\vec{v} = (x_1, x_2, x_3)$

$0 = \vec{v} \cdot \vec{u} = (x_1, x_2, x_3) \cdot (1, -6, -2)$

$0 = x_1 - 6x_2 - 2x_3$

Let $x_1 = 1$, $x_2 = 1$

$0 = 1 - 6(1) - 2x_3$

$2x_3 = -5$

$x_3 = \frac{-5}{2}$

$\therefore (1, 1, \frac{-5}{2})$