

MA 126 - 8C CALCULUS II

November 19, 2015

Name (Print last name first):

Student Signature:

TEST IV

Closed book - Calculators and One Index Card are allowed!

PART I

Part I consists of 5 questions. Clearly write your answer (only) in the space provided after each question. Show your work to justify your answers. Very limited partial credit or none at all for this part of the test!

Each question is worth 8 points.

Question 1

Find the angle between the vectors $\mathbf{u} = \langle 1, 1, 1 \rangle$ and $\mathbf{v} = \langle 1, -1, 0 \rangle$. (Write your angle in degrees or radians!)

Answer:

Question 2

A constant force with vector representation $\mathbf{F} = 3\mathbf{i} + \mathbf{j} + 5\mathbf{k}$ moves an object along a straight line from the point $P(1, 1, 1)$ to the point $Q(3, 2, -1)$. Find the work done if the distance is measured in meters and the magnitude of the force is measured in newtons.

Answer:

Question 3

Find the symmetric equations of the line that is perpendicular to the plane $x - y - z = 2$ and passes through the point $(-1, 1, 0)$.

Answer:

Question 4

Find an equation of the plane containing both the point $P(2, -1, 3)$ and the vectors $\mathbf{u} = \langle 1, 0, 1 \rangle$ and $\mathbf{v} = \langle 0, 1, 1 \rangle$.

Answer:

Question 5

Find, if any, (the coordinates of) the point of intersection of the plane $2x + y - z = 2$ and the line given by the parametric equations

$$\ell := \begin{cases} x = 2 + t \\ y = 1 - t \\ z = -1 + t \end{cases}$$

Answer:

PART II

Each problem is worth 15 points.

Part II consists of 4 problems. You must show your work on this part of the test to get full credit. Displaying only the final answer (even if correct) without the relevant steps will not get full credit - no credit for unsubstantiated answers!

Problem 1

This problem has two separate questions (a) and (b). Answer each question.

(a) Find the area of the triangle with vertices $P(1, 0, 0)$, $Q(2, 1, 0)$ and $R(0, 0, 2)$.

(b) Find the volume of the box generated by the vectors $\mathbf{a} = \mathbf{i} + \mathbf{j} + \mathbf{k}$, $\mathbf{b} = \mathbf{j} - \mathbf{k}$ and $\mathbf{c} = -\mathbf{i} + \mathbf{j}$.

Problem 2

Consider the two lines given by the parametric equations

$$\ell_1 = \begin{cases} x = 2 + t \\ y = -1 - t \\ z = 1 + 2t \end{cases} \quad \text{and} \quad \ell_2 = \begin{cases} x = -1 - 2s \\ y = -1 + s \\ z = 2 - s \end{cases}$$

- (a) Determine whether they are parallel.
- (b) Determine whether they intersect. If they do intersect, find the point of intersection.
- (c) Determine whether they are skew.

Problem 3

Find the parametric equations of the line of intersection of the planes

$$x + y - 2z = 1 \quad \text{and} \quad x - y - z = 2.$$

SCRATCH PAPER

(Scratch paper will not be graded!)

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