

# MULTIVARIABLE CALCULUS MATH 2D

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## Midterm Exam I with answers

### Problem 1.

Determine whether the given vectors are orthogonal, parallel, or neither.

a)  $\langle 3, 2, 1 \rangle$  and  $\langle -1, 0, 3 \rangle$

b)  $\langle 3, \sqrt{3}, 5 \rangle$  and  $\langle -1, -\frac{1}{\sqrt{3}}, -\frac{5}{3} \rangle$

c)  $\langle 3, 4, 3 \rangle$  and  $\langle -3, -2, 1 \rangle$

**Answers:**

a) orthogonal;

b) parallel;

c) neither.

### Problem 2.

Calculate the given quantity if

$$\bar{v} = \langle 3, 2, 1 \rangle, \bar{u} = \langle -2, 0, -1 \rangle, \bar{w} = \langle 2, 1, 1 \rangle$$

a)  $2\bar{v} + 2\bar{u} - \bar{w}$

b)  $|\bar{v} \times \bar{u}|$

c)  $\bar{v} \cdot (\bar{u} \times \bar{w})$

**Answers:**

a)  $\langle 0, 3, -1 \rangle$

b)  $\sqrt{21}$

c) 1

### Problem 3.

Find the equation of the plane through  $(1, 2, 3)$  that contains the line

$$x = 3t + 2, y = t - 3, z = -t - 1$$

**Answer:**  $9x - 11y + 16z = 35$

#### Problem 4.

Find the distance from the origin to the line

$$x = 3t + 2, \quad y = t - 1, \quad z = t + 2$$

**Answer:**  $\sqrt{\frac{50}{11}}$

#### Problem 5.

Reduce the equation to one of the standard forms, classify the surface:

$$x^2 - 2y^2 - 2x - 4y + z - 15 = 0$$

**Answer:**  $\frac{(x-1)^2}{a^2} - \frac{(y+1)^2}{b^2} = -(z-14)$ , where  $a^2 = 1, b^2 = 1/2$ . It is a hyperbolic paraboloid.