Math253 Multivariable Calculus

First Midterm Exam

Colorado Mesa University · 2025 Fall

NAME: _____

1. Let P be the point $(4,-7,4)$.

   (a) How far is the point P from the origin?

   (b) How far is the point P from the xz-plane?

   (c) How far is the point P from the y-axis?

   (d) What are the spherical coordinates of the point P?

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2. Let $\boldsymbol{u}$ be the vector $\langle 4, -7, 4 \rangle$ and $\boldsymbol{v}$ be the vector $\langle 8, 8, -6 \rangle$.

   (a) What is $\hat{\boldsymbol{u}}$, the unit vector in the direction of $\boldsymbol{u}$?

   (b) What is the measure of the angle between $\boldsymbol{u}$ and $\boldsymbol{v}$?

   (c) What the projection of $\boldsymbol{v}$ onto $\boldsymbol{u}$ expressed explicitly in terms of its components?

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3. Let P be the point $(4,-7,4)$ and Q be the point $(-4,3,2)$.

   (a) How far is the point P from the point Q?

   (b) What is a parameterization or vector equation of the line that passes through P and Q?

   (c) What is the shortest distance from the origin to the line that passes through P and Q?

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4. Let P be the point $(4,-7,4)$, and Q be the point $(-4,3,2)$, and R be the point $(1,4,-4)$.

   (a) What is the area of the triangle with vertices located at P and Q and R?

   (b) What is an equation for the plane that contains P and Q and R? Express the equation in the form $Ax + By + Cz = D$ for constants A, B, C, and D that don't share a common divisor.

   (c) What is a parameterization of the line along which the plane that contains P and Q and R intersects the xy-plane?

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