Very short answer questions

1. Each part is worth 1 mark. Please write your answers in the boxes.
   (a) Let \( \vec{u} = (1, 0, 1) \) and \( \vec{v} = (1, 1, 2) \), and \( \vec{w} = (3, 0, 0) \). Find \( \vec{u} \cdot (\vec{v} + \vec{w}) \).

\[
\langle 1, 0, 1 \rangle \cdot (\langle 1, 1, 2 \rangle + \langle 3, 0, 0 \rangle) = \langle 1, 0, 1 \rangle \cdot \langle 4, 1, 2 \rangle = 4 + 2 = 6
\]

Answer: 6

(b) Does the plane \( 3x + 2y - z = 8 \) contain the point \( P = (2, 3, 4) \)?

\[
3 \cdot 2 + 2 \cdot 3 - 4 = 6 + 6 - 4 = 8
\]

Answer: Yes

Short answer questions — you must show your work

2. Each part is worth 2 marks.
   (a) Find the equation of the plane normal to the vector \( \vec{n} = (2, 1, 1) \) passing through the point \( P = (5, 0, 3) \).

\[
2x + y + z = d
\]

\[
2 \cdot 5 + 0 + 3 = d \Rightarrow d = 13
\]

Answer: \( 2x + y + z = 13 \)

(b) Let \( f(x, y) = \cos(x + y) \sin(x - y) \). Find the first partial derivatives of \( f \).

\[
\frac{\partial f}{\partial x} = - \sin(x + y) \sin(x - y) + \cos(x + y) \cos(x - y)
\]

\[
\frac{\partial f}{\partial y} = - \sin(x + y) \sin(x - y) - \cos(x + y) \cos(x - y)
\]

Answer:
Long answer question — you must show your work

3. [4 marks] Draw the trace of the equation

\[ \frac{x^2}{4} - \frac{y^2}{9} + \frac{z^2}{16} = 0 \]

through the plane \( y = 3 \). Make sure to label the axes and intersections of the trace with the axes.

Setting \( y = 3 \) gives

\[ \frac{x^2}{4} - 1 + \frac{z^2}{16} = 0 \]

\[ \frac{x^2}{4} + \frac{z^2}{16} = 1 \]