5 marks

1. (a) Describe the equation of the plane which contains the points $A = (0, 0, 1)$, $B = (1, 1, 3)$ and $C = (1, -3, 1)$ in the form $ax + y + cz + d = 0$. Note that we ask that the coefficient next to y is 1.

Answer:

5 marks

(b) What angle does the plane from (a) form with the plane given by the equation $x - y = 0$? You may leave your answer in the form $\theta = \cos^{-1}(\cdot)$.

Answer:

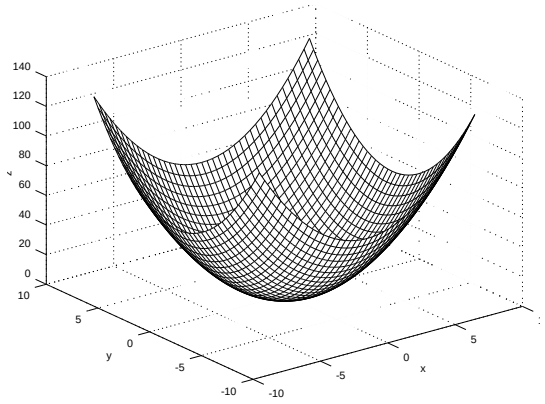
5 marks

(c) The lines $\vec{l_1}$ and $\vec{l_2}$ are described by the equations $\vec{l_1}(t) = \langle 0, -2, 1\rangle + t\langle 1, 2, 1\rangle$ and $\vec{l_2}(s) = \langle 2, 2, 3\rangle + s\langle 1, -1, 2\rangle$. Give the equation of the line which has as a basepoint the intersection of $\vec{l_1}$ and $\vec{l_2}$ and is orthogonal to the plane spanned by $\vec{l_1}$ and $\vec{l_2}$.

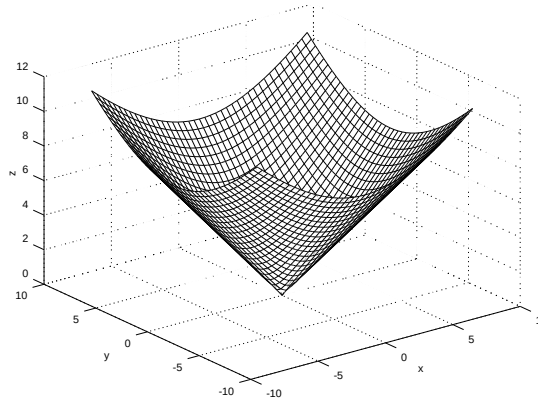
Answer:

5 marks

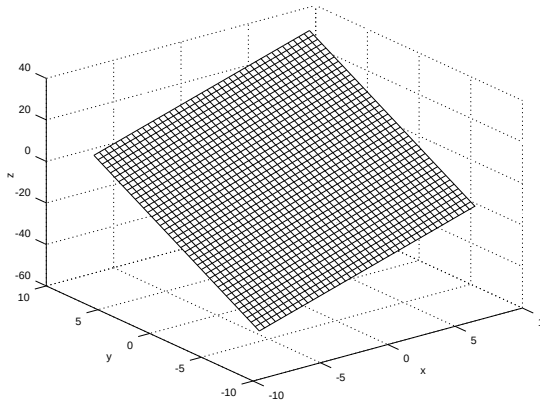
(d) Match the surfaces with the equations below. There is one equation which does not correspond to any surface.



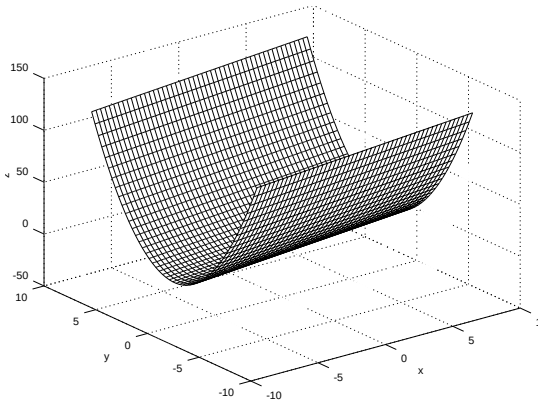
Answer:



Answer:



Answer:



Answer:

(A) $z^2 = x^2 + y^2$, (B) $z = x + 2y^2$, (C) $x^2 + y^2 + z^2 = 1$,

(D) $z = x^2 + y^2$, (E) $2x + 3y - z = 4$.

2 marks

(e) (Bonus marks) Let $\vec{u} \neq \vec{0}$ be a fixed vector. Describe the set of vectors $\vec{v}$ which satisfy

$$||\vec{u} + \vec{v}|| = ||\vec{u}|| + ||\vec{v}||.$$

Answer:

This page has been left blank for your rough work and calculations.