

1.(1 pt) Find a unit vector with positive first coordinate that is orthogonal to the plane through the points $P = (0, 4, -2)$, $Q = (4, 8, 2)$, and $R = (4, 8, 3)$.

(_____ , _____ , _____)

2.(1 pt) A bicycle pedal is pushed straight downwards by a foot with a 29 Newton force. The shaft of the pedal is 20 cm long. If the shaft is $\pi/5$ radians past horizontal, what is the magnitude of the torque about the point where the shaft is attached to the bicycle? _____ Nm

3.(1 pt) Enter T or F depending on whether the statement is true or false. (You must enter T or F - True and False will not work.)

- ___ 1. Two lines either intersect or are parallel.
- ___ 2. Two lines parallel to a third line are parallel.
- ___ 3. Two planes perpendicular to a line are parallel.
- ___ 4. Two lines perpendicular to a plane are parallel
- ___ 5. Two lines parallel to a plane are parallel.
- ___ 6. Two lines perpendicular to a third line are parallel.
- ___ 7. Two planes either intersect or are parallel.
- ___ 8. Two planes parallel to a third plane are parallel.
- ___ 9. Two planes perpendicular to a third plane are parallel.
- ___ 10. A plane and a line either intersect or are parallel.
- ___ 11. Two planes parallel to a line are parallel.

4.(1 pt) Find a vector equation for the line through the point $P = (5, 4, -5)$ and parallel to the vector $\mathbf{v} = (-2, -1, -4)$.

Assume $\mathbf{r}(0) = 5\mathbf{i} + 4\mathbf{j} - 5\mathbf{k}$ and that \mathbf{v} is the velocity vector of the line.

$\mathbf{r}(t) = \underline{\hspace{1cm}} \mathbf{i} + \underline{\hspace{1cm}} \mathbf{j} + \underline{\hspace{1cm}} \mathbf{k}$

5.(1 pt) Find a vector equation for the line through the point $P = (2, -1, 2)$ and parallel to the vector $\mathbf{v} = (-5, 3, 5)$.

Assume $\mathbf{r}(0) = 2\mathbf{i} - 1\mathbf{j} + 2\mathbf{k}$ and that \mathbf{v} is the velocity vector of the line..

$\mathbf{r}(t) = \underline{\hspace{1cm}} \mathbf{i} + \underline{\hspace{1cm}} \mathbf{j} + \underline{\hspace{1cm}} \mathbf{k}$

Rewrite this in terms of the parametric equations for the line.

$x = \underline{\hspace{1cm}}$

$y = \underline{\hspace{1cm}}$

$z = \underline{\hspace{1cm}}$

6.(1 pt) Given a the vector equation $\mathbf{r}(t) = (4 + 4t)\mathbf{i} + (-1 + 1t)\mathbf{j} + (3 + 1t)\mathbf{k}$, rewrite this in terms of the parametric equations for the line.

$x(t) = \underline{\hspace{1cm}}$

$y(t) = \underline{\hspace{1cm}}$

$z(t) = \underline{\hspace{1cm}}$

7.(1 pt) Given a the vector equation $\mathbf{r}(t) = (2 + -1t)\mathbf{i} + (1 + -3t)\mathbf{j} + (-1 + -2t)\mathbf{k}$, rewrite this in terms of the symmetric equations for the line.

(quotient involving x) _____

(quotient involving y) = _____

(quotient involving z) = _____

8.(1 pt) Consider the planes $3x + 5y + 3z = 1$ and $3x + 3z = 0$.

(A) Find the unique point P on the y-axis which is on both planes. (_____ , _____ , _____)

(B) Find a unit vector \mathbf{u} with positive first coordinate that is parallel to both planes.

_____ \mathbf{i} + _____ \mathbf{j} + _____ \mathbf{k}

(C) Use parts (A) and (B) to find a vector equation for the line of intersection of the two planes, $\mathbf{r}(t) =$

_____ \mathbf{i} + _____ \mathbf{j} + _____ \mathbf{k}

9.(1 pt) (A) Find the parametric equations for the line through the point $P = (-5, -4, -5)$ that is perpendicular to the plane $-1x - 2y + 4z = 1$.

Use "t" as your variable, $t = 0$ should correspond to P, and the velocity vector of the line should be the same as the standard normal vector of the plane.

$x = \underline{\hspace{1cm}}$

$y = \underline{\hspace{1cm}}$

$z = \underline{\hspace{1cm}}$

(B) At what point Q does this line intersect the yz-plane?

$Q = (\underline{\hspace{1cm}} , \underline{\hspace{1cm}} , \underline{\hspace{1cm}})$

10.(1 pt) Consider the two lines

$L_1 : x = -2t, y = 1 + 2t, z = 3t$

$L_2 : x = -7 + 3s, y = 1 + 4s, z = 5 + 1s$

Find the point of intersection of the two lines.

$P = (\underline{\hspace{1cm}} , \underline{\hspace{1cm}} , \underline{\hspace{1cm}})$

11.(1 pt) Find an equation of the plane through the point $(-2, -5, 0)$ and perpendicular to the vector $(3, 5, 5)$. Do this problem in the standard way or WebWork may not recognize a correct answer.

_____ x + _____ y + _____ $z = \underline{\hspace{1cm}}$

12.(1 pt) Find an equation of the plane through the point $(3, 1, -3)$ and parallel to the plane $3x - 1y + 1z = 0$. Do this problem in the standard way or WebWork may not recognize a correct answer.

_____ x + _____ y + _____ $z = \underline{\hspace{1cm}}$

13.(1 pt) Find the point P where the line $x = 1 + t, y = 2t, z = -3t$ intersects the plane $x + y - z = 5$.

$P = (\underline{\hspace{1cm}} , \underline{\hspace{1cm}} , \underline{\hspace{1cm}})$

14.(1 pt) Find the angle in radians between the planes $-1x + z = 1$ and $5y + z = 1$.

15.(1 pt) Find the distance from the point $(5, 2, 2)$ to the line $x = 0, y = 2 + 5t, z = 2 + 5t$.

16.(1 pt) Find the distance from the point $(-5, 5, -1)$ to the plane $-4x - 5y - 3z = -2$.

17.(1 pt) Match the surfaces with the appropriate descriptions.

- 1. $z = y^2 - 2x^2$
- 2. $z = 2x^2 + 3y^2$
- 3. $z = 4$
- 4. $z = 2x + 3y$
- 5. $x^2 + y^2 = 5$
- 6. $z = x^2$
- 7. $x^2 + 2y^2 + 3z^2 = 1$

- A. hyperbolic paraboloid
- B. elliptic paraboloid
- C. circular cylinder

- D. nonhorizontal plane
- E. horizontal plane
- F. parabolic cylinder
- G. ellipsoid

18.(1 pt) A million years ago, an alien species built a vertical tower on a horizontal plane. When they returned they discovered that the ground had tilted so that measurements of 3 points on the ground gave coordinates of $(0, 0, 0)$, $(1, 2, 0)$, and $(0, 1, 3)$. By what angle does the tower now deviate from the vertical?

_____ radians.