MCV4U - Unit 8 Test - Equations of Lines & Planes
Mark: /44

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. What is the vector equation of the line with parametric equations $x = 2t + 7,\ y = -3t + 2,\ t \in \mathbf{R}$?

a. $\overrightarrow{r} = (7,2) + s(2,-3),\ s \in \mathbf{R}$
b. $\overrightarrow{r} = (2,-3) + s(7,2),\ s \in \mathbf{R}$
c. $\overrightarrow{r} = (2,7) + s(-3,2),\ s \in \mathbf{R}$
d. none of the above

____ 2. Which three points are on the line *L*: $\overrightarrow{r} = (2,-5) + s(2,1),\ s \in \mathbf{R}$?

a. $P(2,-5),\ Q(2,1),\ R(0,-6)$
b. $Q(2,1),\ Q(6,-3),\ R(2,-5)$
c. $P(1,7),\ Q(2,-5),\ R(6,-3)$
d. $P(2,-5),\ Q(6,-3),\ R(0,-6)$

____ 3. Which of the following is a direction vector for the line $x = 2t - 1,\ y = -3t + 2,\ t \in \mathbf{R}$?

a. $\overrightarrow{m} = (4,-6)$
b. $\overrightarrow{m} = \left(\frac{2}{3},-1\right)$
c. $\overrightarrow{m} = (-2,3)$
d. all of the above

____ 4. Determine which line is perpendicular to the line $2x - 3y + 17 = 0$.

a. $\overrightarrow{r} = (2,-3) + s(3,-2),\ s \in \mathbf{R}$
b. $\overrightarrow{r} = (1,2) + s(3,2),\ s \in \mathbf{R}$
c. $\overrightarrow{r} = (1,7) + s(2,-3),\ s \in \mathbf{R}$
d. $\overrightarrow{r} = s(3,2),\ s \in \mathbf{R}$

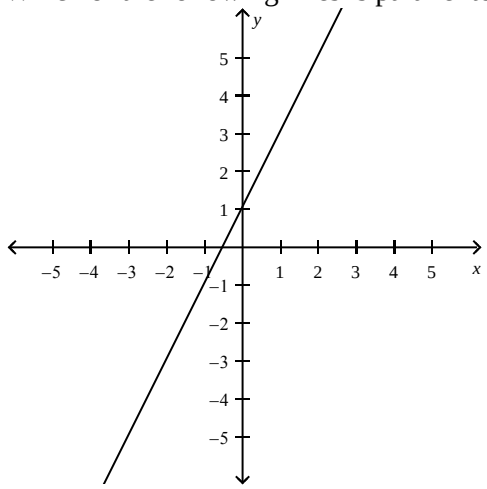
____ 5. Which value of k will make the lines $\overrightarrow{r} = (1,2) + s(2,3),\ s \in \mathbf{R}$ and $12x + ky = 0$ parallel?

a. 18
b. -8
c. 8
d. -18

____ 6. Which of the following equations determines a line with normal vector $\overrightarrow{n} = (4,3)$ going through the point $P(1,-1)$?

a. $4x + 3y - 1 = 0$
b. $4x + 3y + 1 = 0$
c. $3x + 4y - 1 = 0$
d. $3x + 4y + 1 = 0$

____ 7. Which of the following lines is parallel to the line shown below?



a. $2x + y + 3 = 0$
b. $2x - y - 2 = 0$
c. $x + 2y - 4 = 0$
d. $x - 2y - 4 = 0$

____ 8. Which of the following is the parametric equation of the line with symmetric equation $\frac{x+3}{3} = \frac{y+2}{2} = \frac{z-1}{2}$?

a. $x = 3t - 3,\ y = 2t - 2,\ z = 2t + 1,\ t \in \mathbf{R}$
b. $x = 3t + 3,\ y = 2t + 2,\ z = 2t - 1,\ t \in \mathbf{R}$
c. $x = 3t - 3,\ y = 2t - 2,\ z = t + 2,\ t \in \mathbf{R}$
d. none of the above

____ 9. What value of *k* will place the point $P(k, 2k, k-2)$ on the line $\overrightarrow{r} = (-3, 2, 9) + s(3, 2, -4),\ s \in \mathbf{R}$?

a. 3
b. 4
c. 2
d. 1

____ 10. Which of the following is not an equation for the line passing through the points $P(1, 4, -3)$ and $Q(3, 2, 1)$?

a. $\overrightarrow{r} = (1, 4, -3) + s(2, -2, 4),\ s \in \mathbf{R}$
b. $x = -t + 3,\ y = t + 2,\ z = -2t + 1,\ t \in \mathbf{R}$
c. $\frac{x-3}{2} = \frac{y-2}{-2} = \frac{z+1}{4}$
d. $\overrightarrow{r} = (3, 2, 1) + s(1, -1, 2),\ s \in \mathbf{R}$

____ 11. Determine the value of *k* that makes the lines $\frac{x+2}{4} = \frac{y+1}{5} = \frac{z-3}{3}$ and $\overrightarrow{r} = (1, 3, 6) + s(-2k, 2, k),\ s \in \mathbf{R}$, perpendicular.

a. 1
b. 3
c. −3
d. none of the above

____ 12. Which of the following determines a plane?

a. a line and a point not on the line
b. two intersecting lines
c. two parallel, non-coincident lines
d. all of the above

____ 13. Which of the following is not a plane?

a. $\overrightarrow{r} = (1,3,4) + s(2,-1,2) + t(1,1,1),\ s,t \in \mathbf{R}$

b. $\overrightarrow{r} = (2,4,2) + s(1,-2,3) + t(3,2,2),\ s,t \in \mathbf{R}$

c. $\overrightarrow{r} = (3,2,3) + s(4,-4,2) + t(-2,2,-1),\ s,t \in \mathbf{R}$

d. $\overrightarrow{r} = (-2,1,4) + s(2,2,-1) + t(2,2,1),\ s,t \in \mathbf{R}$

____ 14. A plane is defined by the equation $3x - 2z = 4y + 1$. Which of the following is the normal vector of this plane?

a. $\overrightarrow{n} = (3,-2,4)$

b. $\overrightarrow{n} = (3,4,-2)$

c. $\overrightarrow{n} = (3,2,4)$

d. $\overrightarrow{n} = (3,-4,-2)$

____ 15. On which of the following planes could the point $P(2,3,-4)$ lie?

a. $x = 3$

b. $y = 3$

c. $z = 3$

d. none of the above

____ 16. Which of the following is the *x*-intercept of the plane $2x - 4z + 1 = 0$?

a. $P(2,0,-4)$

b. $P(0,0,0)$

c. $P\left(-\frac{1}{2},0,0\right)$

d. $P\left(0,0,\frac{1}{4}\right)$

____ 17. Which of the following best describes the intersection of the three planes π_1: $x = 2$, π_2: $y = 6$, and π_3: $z = -3$?

a. $\overrightarrow{v} = (2,0,-3) + s(0,6,0),\ s \in \mathbf{R}$

b. $P(2,6,-3)$

c. There is no intersection.

d. none of the above

____ 18. Which of the following would describe the sketch of the expression $xy + 2y - 3x - 6 = 0$?

a. the planes $x = -2$ and $y = 3$

b. the planes $x = 3$ and $y = -2$

c. the planes $x = 6$ and $y = 2$

d. the planes $x = 3$ and $y = 6$

____ 19. Which of the following planes is the equation for the plane with an *x*-intercept at $P(2,0,0)$, a *y*-intercept at $Q(0,-3,0)$, and is parallel to the *z*-axis?

a. $3x - 2y - 6 = 0$

b. $2x - 3y + z - 6 = 0$

c. $3y - 2z - 6 = 0$

d. $z = -6$

____ 20. Which three points are on the plane $2x - 7y + 3z - 5 = 0$?

a. $P(1,0,1)$, $Q(3,1,2)$, and $R(4,3,6)$

b. $P(1,0,1)$, $Q(2,2,3)$, and $R(3,1,2)$

c. $P(3,1,2)$, $Q(4,3,6)$, and $R(5,0,-2)$

d. $P(4,3,6)$, $Q(0,0,0)$, and $R(3,1,2)$

Full Solutions: Show all applicable work for the following questions.

1. Calculate the acute angle that is formed by the intersection of the planes with equations $2x+3y-z+9=0$ and $x+2y+4=0$. [3]

2. Determine the x-intercept of the plane with equation

$$[x,y,z]=[1,8,6]+s[1,-12,-12]+t[2,4,-3].$$ **[4]**

3. Determine the parametric equations of the line whose direction vector is perpendicular to the direction vectors of the two lines

$$\frac{x-5}{3}=\frac{y-5}{2}=\frac{z+5}{4} \quad \text{and} \quad \frac{x}{-4}=\frac{y+10}{-7}=\frac{z+2}{3}$$

and passes through the point $(2,-5,0)$. **[4]**

4. A plane is determined by a normal $\vec{n}=(2,5,3)$ and contains the point P(-1,-4,7). Determine a Cartesian equation for this plane using two different methods. [5]

5. A line segment with endpoints P (1,2) and Q (3,6) is the hypotenuse of a right triangle. The third vertex, R, lies on the line with Cartesian equation $-x+2y-1=0$. Determine the coordinates of R. [4]

6. Explain why the line $\vec{r}=(4,9,-3)+t(1,-4,2)$ and the point $(8,-7,5)$ do not determine a plane? **[2]**

7. Explain why the plane with Cartesian equation $2x+5z-3=0$ never intersects the y-axis. [2]