6.2 Equations of Lines in Three-Space Worksheet

This document was composed and formatted by Annie Bernatchez.

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1) Write a vector equation for a line given each direction vector $\vec{m}$ and point P_0.

a) $\vec{m} = [2, -3, 5]$, $P_0(8, -11, 2)$	b) $\vec{m} = [-3, 4, 7]$, $P_0(7, -1, 4)$

2) Write the vector equation of the line that passes through each pair of points.

a) $A(4, -3, 1)$, $B(2, -3, 7)$	b) $A(5, 6, -1)$, $B(0, -3, 2)$

3) Write the parametric equations for each vector equation.

a) $[x, y, z] = [0, 4, -7] + t[3, -4, 1]$	b) $[x, y, z] = [7, 5, -4] + t[-2, 1, 3]$

4) Write a vector equation for each line, given the parametric equations.

a) $\ell : \begin{cases} x = 4 + 3t \\ y = 7 - 2t \\ z = 1 + t \end{cases}$	b) $\ell : \begin{cases} x = 4t \\ y = 5 - 9t \\ z = -3 \end{cases}$

5) Write a vector equation and the parametric equations of a line going through the points $A(7, 8, -3)$ and $B(-2, 3, 5)$.

6) Determine the vector equation of a line through $P_0(-1, -7, 7)$ and perpendicular to $[x, y, z] = [1, -7, 3] + t[4, -1, 2]$.

7) Determine which points are on the line $[x, y, z] = [3, 1, -4] + t[2, 0, 5]$.

a) $(-5, 1, -24)$	b) $(19, 1, 37)$

8) State possible vector, parametric, and symmetric equations for each of the following lines:

a) the line passing through the point $P(-1, 2, 1)$ with direction vector $(3, -2, 1)$

b) the line passing through the points $A(-1, 1, 0)$ and $B(-1, 2, 1)$

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c) the line passing through the point $Q(1,\ 2,\ 4)$ and parallel to the z-axis

9) Determine the parametric equations of the line whose direction vector is perpendicular to the direction vectors of the two lines $\frac{x}{-4} = \frac{y+10}{-7} = \frac{z+2}{3}$ and $\frac{x-5}{3} = \frac{y-5}{2} = \frac{z+5}{4}$ and passes through the point $(2,\ -5,\ 0)$.

Answer Key

1. a) $[x,\ y,\ z] = [8,\ -11,\ 2] + t[2,\ -3,\ 5]$ b) $[x,\ y,\ z] = [7,\ -1,\ 4] + t[-3,\ 4,\ 7]$

2. a) $[x,\ y,\ z] = [4,\ -3,\ 1] + t[1,\ 0,\ -3]$ b) $[x,\ y,\ z] = [5,\ 6,\ -1] + t[-5,\ -9,\ 3]$

3. a) $\ell : \begin{cases} x = 3t \\ y = 4 - 4t \\ z = -7 + t \end{cases}$ b) $\ell : \begin{cases} x = 7 - 2t \\ y = 5 + t \\ z = -4 + 3t \end{cases}$

4. a) $[x,\ y,\ z] = [4,\ 7,\ 1] + t[3,\ -2,\ 1]$ b) $[x,\ y,\ z] = [0,\ 5,\ -3] + t[4,\ -9,\ 0]$

5. $[x,\ y,\ z] = [7,\ 8,\ -3] + t[9,\ 5,\ -8]$; $\ell : \begin{cases} x = 7 + 9t \\ y = 8 + 5t \\ z = -3 - 8t \end{cases}$

6. $[x,\ y,\ z] = [-1,\ -7,\ 7] + t[0,\ 2,\ 1]$

7. a) Yes b) No

8. a) $[x,\ y,\ z] = [-1,\ 2,\ 1] + t[3,\ -2,\ 1]$; $\ell : \begin{cases} x = -1 + 3t \\ y = 2 - 2t \\ z = 1 + t \end{cases}$; $\frac{x+1}{3} = \frac{y-2}{-2} = z - 1$

b) $[x,\ y,\ z] = [-1,\ 1,\ 0] + t[0,\ 1,\ 1]$; $\ell : \begin{cases} x = -1 \\ y = 1 + t \\ z = t \end{cases}$; $y - 1 = z,\ x = -1$

c) $[x,\ y,\ z] = [1,\ 2,\ 4] + t[0,\ 0,\ 1]$; $\ell : \begin{cases} x = 1 \\ y = 2 \\ z = 4 + t \end{cases}$; no symmetric equation for this line since two of the direction vector coordinates are zero

9. $\ell : \begin{cases} x = 2 - 34t \\ y = -5 + 25t \\ z = 13t \end{cases}$

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