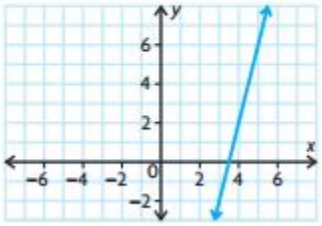
# 8.2 Cartesian and Symmetric Equations of Lines

These problems taken from the Nelson text: Pg. 443 – 444

6. Determine the Cartesian equation for the line with a normal vector of $(4, 5)$, passing through the point $A(-1, 5)$.
7. A line passes through the points $A(-3, 5)$ and $B(-2, 4)$. Determine the Cartesian equation of this line.
8. A line is perpendicular to the line $2x - 4y + 7 = 0$ and that passes through the point $P(7, 2)$. Determine the equation of this line in Cartesian form.
9. A line has parametric equations $x = 3 - t, y = -2 - 4t, t \in \mathbf{R}$.
   a. Sketch this line.
   b. Determine a Cartesian equation for this line.
10. For each pair of lines, determine the size of the acute angle, to the nearest degree, that is created by the intersection of the lines.
    a. $(x, y) = (3, 6) + t(2, -5)$ and $(x, y) = (-3, 4) - t(-4, -1)$
    b. $x = 2 - 5t, y = 3 + 4t$ and $x = -1 + t, y = 2 - 6t$
    c. $y = 0.5x + 6$ and $y = -0.75x - 1$

Answers

**6.** $4x + 5y - 21 = 0$
**7.** $x + y - 2 = 0$
**8.** $2x + y - 16 = 0$
**9.** **a.**




**b.** $4x - y - 14 = 0$

**10.** **a.** 82°
**b.** 42°
**c.** 63°

## 8.3 Lines in 3 – Space

These Problems taken from the Nelson text: Pg. 449 – 450

1. State the coordinates of a point on each of the given lines.
   a. $\vec{r} = (-3, 1, 8) + s(-1, 1, 9), s \in \mathbf{R}$
   b. $\frac{x-1}{2} = \frac{y+1}{1} = \frac{z-3}{-1}$
   c. $x = -2 + 3t, y = 1 + (-4t), z = 3 - t, t \in \mathbf{R}$
2. State a direction vector for each line in question 1, making certain that the components for each are integers.
4. A line passes through the points $A(-1, 5, -4)$ and $B(2, 5, -4)$.
   a. Write a vector equation for the line containing these points.
   b. Write parametric equations corresponding to the vector equation you wrote in part a.
   c. Explain why there are no symmetric equations for this line.
5. State where 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 $B(-1, 2, 1)$
   c. the line passing through the point $B(-2, 3, 0)$ and parallel to the line passing through the points $M(-2, -2, 1)$ and $N(-2, 4, 7)$

Answers

**1.** **a.** $(-3, 1, 8)$
**b.** $(1, -1, 3)$
**c.** $(-2, 1, 3)$

**2.** **a.** $(-1, 1, 9)$
**b.** $(2, 1, -1)$
**c.** $(3, -4, -1)$

**4.** **a.** $\vec{r} = (-1, 5, -4) + t(1, 0, 0), t \in \mathbf{R}$
**b.** $x = -1 + t, y = 5, z = -4, t \in \mathbf{R}$
**c.** Since two of the coordinates in the direction vector are zero, a symmetric equation cannot exist.

**5.** **a.** $\vec{r} = (-1, 2, 1) + t(3, -2, 1), t \in \mathbf{R}$;
$x = -1 + 3t, y = 2 - 2t,$
$z = 1 + t, t \in \mathbf{R}$;
$\frac{x+1}{3} = \frac{y-2}{-2} = \frac{z-1}{1}$

**b.** $\vec{r} = (-1, 1, 0) + t(0, 1, 1), t \in \mathbf{R}$;
$x = -1, y = 1 + t, z = t, t \in \mathbf{R}$;
$\frac{y-1}{1} = \frac{z}{1}, x = -1$

**c.** $\vec{r} = (-2, 3, 0) + t(0, 1, 1), t \in \mathbf{R}$;
$x = -2, y = 3 + t, z = t, t \in \mathbf{R}$;
$\frac{y-3}{1} = \frac{z}{1}, x = -2$