Explore 3-1: Graphing Technology Lab Intersections of Graphs

Use a graphing calculator to solve each system of equations.
1. $2x + 4y = 36$
   $10y - 5x = 0$

**SOLUTION:**
Write each equation in the form $y = mx + b$.

$2x + 4y = 36$
$4y = -2x + 36$
$y = \frac{-2x + 36}{4}$
$y = \frac{-x}{2} + 9$

$10y - 5x = 0$
$10y = 5x$
$y = \frac{5x}{10}$
$y = \frac{x}{2}$

Enter $y = \frac{-x}{2} + 9$ as Y1 and $y = \frac{x}{2}$ as Y2. Then graph the lines.

**KEYSTROKES:**

Find the intersection of the lines.

**KEYSTROKES:**

The solution is $(9, 4.5)$.

**ANSWER:**
(9, 4.5)

2. $2y - 3x = 7$
   $5x = 4y - 12$

**SOLUTION:**
Write each equation in the form $y = mx + b$.

$2y - 3x = 7$
$2y = 3x + 7$
$y = \frac{3x + 7}{2}$

$5x = 4y - 12$
$4y = 5x + 12$
$y = \frac{5x + 12}{4}$

Enter $y = \frac{3x + 7}{2}$ as Y1 and $y = \frac{5x + 12}{4}$ as Y2. Then graph the lines.

**KEYSTROKES:**

Find the intersection of the lines.

**KEYSTROKES:**

The solution is $(-2, 0.5)$.

**ANSWER:**
$(-2, 0.5)$
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3. $4x - 2y = 16$
   $7x + 3y = 15$

   **SOLUTION:**
   Write each equation in the form $y = mx + b$.
   
   $4x - 2y = 16$
   $7x + 3y = 15$

   $-2y = -4x + 16$
   $3y = -7x + 15$

   $y = 2x - 8$
   $y = -\frac{7x}{3} + 5$

   Enter $y = 2x - 8$ as Y1 and $y = -\frac{7x}{3} + 5$ as Y2.
   Then graph the lines.
   **KEYSTROKES:** $Y = 2 \left[ X,T,0,n \right] - 8$
   ENTER $(-) 7 \left[ X,T,0,n \right] + 3 + 5$

   Find the intersection of the lines.
   **KEYSTROKES:** 2nd [CALC] 5 ENTER
   ENTER ENTER

   The solution is $(3, -2)$.

   **ANSWER:** $(3, -2)$

4. $2x + 4y = 4$
   $x + 3y = 13$

   **SOLUTION:**
   Write each equation in the form $y = mx + b$.
   
   $2x + 4y = 4$
   $x + 3y = 13$

   $4y = -2x + 4$
   $3y = -x + 13$

   $y = -\frac{x}{2} + 1$
   $y = -\frac{-x + 13}{3}$

   Enter $y = -\frac{x}{2} + 1$ as Y1 and $y = -\frac{-x + 13}{3}$ as Y2.
   Then graph the lines.
   **KEYSTROKES:** $Y = (-) \left[ X,T,0,n \right] + 2 + 1$
   ENTER
   $(-) \left[ X,T,0,n \right] + 1 3 ) + 3$

   Find the intersection of the lines.
   **KEYSTROKES:** 2nd [CALC] 5 ENTER
   ENTER ENTER

   The solution is $(-20, 11)$.

   **ANSWER:** $(-20, 11)$
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5. \(5x + y = 13\)
   \(3x = 15 - 3y\)

**SOLUTION:**
Write each equation in the form \(y = mx + b\).

\[5x + y = 13 \quad 3x = 15 - 3y\]
\[y = -5x + 13 \quad 3y = -3x + 15\]
\[y = -x + 5\]

Enter \(y = -5x + 13\) as Y1 and \(y = -x + 5\) as Y2.
Then graph the lines.
**KEYSTROKES:**
\[Y = (-) 5 \frac{X,T,0,n}{3} + 1\]
3 ENTER (-) \[X,T,0,n\] + 5

Find the intersection of the lines.
**KEYSTROKES:**
2nd [CALC] 5 ENTER
ENTER ENTER

![Graph showing the intersection of lines](image)

The solution is (2, 3).

**ANSWER:**
(2, 3)

6. \(4y - 5 = 20 - 3x\)
   \(4x - 7y + 16 = 0\)

**SOLUTION:**
Write each equation in the form \(y = mx + b\).

\[4y - 5 = 20 - 3x\]
\[4x - 7y + 16 = 0\]
\[4y = 3x + 25\]
\[7y = 4x + 16\]
\[y = \frac{-3x + 25}{4}\]
\[y = \frac{4x + 16}{7}\]

Enter \(y = \frac{-3x + 25}{4}\) as Y1 and \(y = \frac{4x + 16}{7}\) as Y2.
Then graph the lines.
**KEYSTROKES:**
\[Y = (\quad -3) \frac{X,T,0,n}{4} + 1\]
3 ENTER
\[Y = \frac{4x + 16}{7}\]
7

Find the intersection of the lines.
**KEYSTROKES:**
2nd [CALC] 5 ENTER
ENTER ENTER

![Graph showing the intersection of lines](image)

The solution is (3, 4).

**ANSWER:**
(3, 4)
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7. \[ \frac{1}{4}x + y = \frac{11}{4} \]
\[ x - \frac{1}{2}y = 2 \]

**SOLUTION:**
Write each equation in the form \( y = mx + b \).

- \[ \frac{1}{4}x + y = \frac{11}{4} \]
  \[ y = \frac{-x + 11}{4} \]
- \[ x - \frac{1}{2}y = 2 \]
  \[ y = \frac{-x + 11}{2} \]

Enter \( y = \frac{-x + 11}{4} \) as Y1 and \( y = 2x - 4 \) as Y2. Then graph the lines.

**KEYSTROKES:**
\[ Y = \begin{pmatrix} \text{(-)} & X,T,0,n & + \end{pmatrix} \]
\[ \begin{pmatrix} 1 & 1 & + & 4 & \text{ENTER} & 2 & X,T,0,n & - & 4 \end{pmatrix} \]

Find the intersection of the lines.

**KEYSTROKES:**
2nd [CALC] 5 ENTER

The solution is (3, 2).

**ANSWER:**
(3, 2)

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8. \[ 3x + 2y = -3 \]
\[ x + \frac{1}{3}y = -4 \]

**SOLUTION:**
Write each equation in the form \( y = mx + b \).

- \[ 3x + 2y = -3 \]
  \[ y = \frac{-3x - 3}{2} \]
- \[ x + \frac{1}{3}y = -4 \]
  \[ y = \frac{-3x - 4}{3} \]

Enter \( y = \frac{-3x - 3}{2} \) as Y1 and \( y = \frac{-3x - 4}{3} \) as Y2. Then graph the lines.

**KEYSTROKES:**
\[ Y = \begin{pmatrix} \text{(-)} & 3 & X,T,0,n & - & 3 & \end{pmatrix} \]
\[ \begin{pmatrix} 2 & \text{ENTER} & \text{(-)} & 3 & X,T,0,n & - & 1 & 2 \end{pmatrix} \]

Find the intersection of the lines.

**KEYSTROKES:**
2nd [CALC] 5 ENTER

The solution is (−7, 9).

**ANSWER:**
(−7, 9)
9. \(3x - 6y = 6\)  
   \(2x - 4y = 4\)

**SOLUTION:**
Write each equation in the form \(y = mx + b\).
\[
\begin{align*}
3x - 6y &= 6 \\
2x - 4y &= 4 \\
-6y &= -3x + 6 \\
-4y &= -2x + 4 \\
y &= \frac{x}{2} - 1 \\
y &= \frac{x}{2} - 1
\end{align*}
\]
Since both the equations are \(y = \frac{x}{2} - 1\), the system has infinitely many solutions.

**ANSWER:**
infinity

10. \(6x + 8y = -16\)
   \(3x + 4y = 12\)

**SOLUTION:**
Write each equation in the form \(y = mx + b\).
\[
\begin{align*}
6x + 8y &= -16 \\
3x + 4y &= 12 \\
8y &= -6x - 16 \\
4y &= -3x + 12 \\
y &= -\frac{3}{4}x - 2 \\
y &= \frac{3}{4}x - 3
\end{align*}
\]
Enter \(y = -\frac{3}{4}x - 2\) as Y1 and \(y = \frac{3}{4}x + 3\) as Y2.
Then graph the lines.

**KEYSTROKES:** \(Y = \) \(-\) \(3 \) \([X,T,\theta,n]\) \(÷\) \(4\)

\(-\) \(2\) \(ENTER\) \(-\) \(3 \) \([X,T,\theta,n]\) \(÷\) \(4\) \(\) \(+\) \(3\)

GRAPH

Since the graphs are parallel, the system has no solution.

**ANSWER:**
no solution