Name ____ Date ____________________

Introduction to Simultaneous Equations

Darnell and Hector ride their bikes at constant speeds. Darnell leaves Hector's house to bike home. He can bike the 8 miles in 32 minutes. Five minutes after Darnell leaves, Hector realizes that Darnell left his phone. Hector rides to catch up. He can ride to Darnell's house in 24 minutes. Assuming they bike the same path, will Hector catch up to Darnell before he gets home?

a. Write the linear equation that represents Darnell's constant speed.

b. Write the linear equation that represents Hector's constant speed. Make sure to take into account that Hector left after Darnell.

c. Write the system of linear equations that represents this situation.

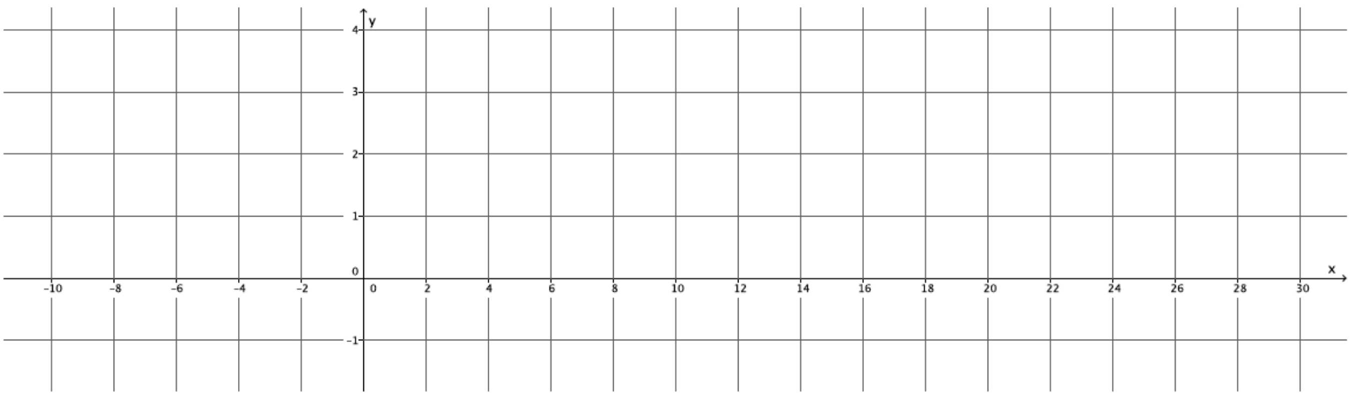
1. Jeremy and Gerardo run at constant speeds. Jeremy can run 1 mile in 8 minutes and Gerardo can run 3 miles in 33 minutes. Jeremy started running 10 minutes after Gerardo. Assuming they run the same path, when will Jeremy catch up to Gerardo?

   a. Write the linear equation that represents Jeremy's constant speed.

   b. Write the linear equation that represents Gerardo's constant speed. Make sure to include in your equation the extra time that Gerardo was able to run.

   c. Write the system of linear equations that represents this situation.

   d. Sketch the graphs of the two equations.

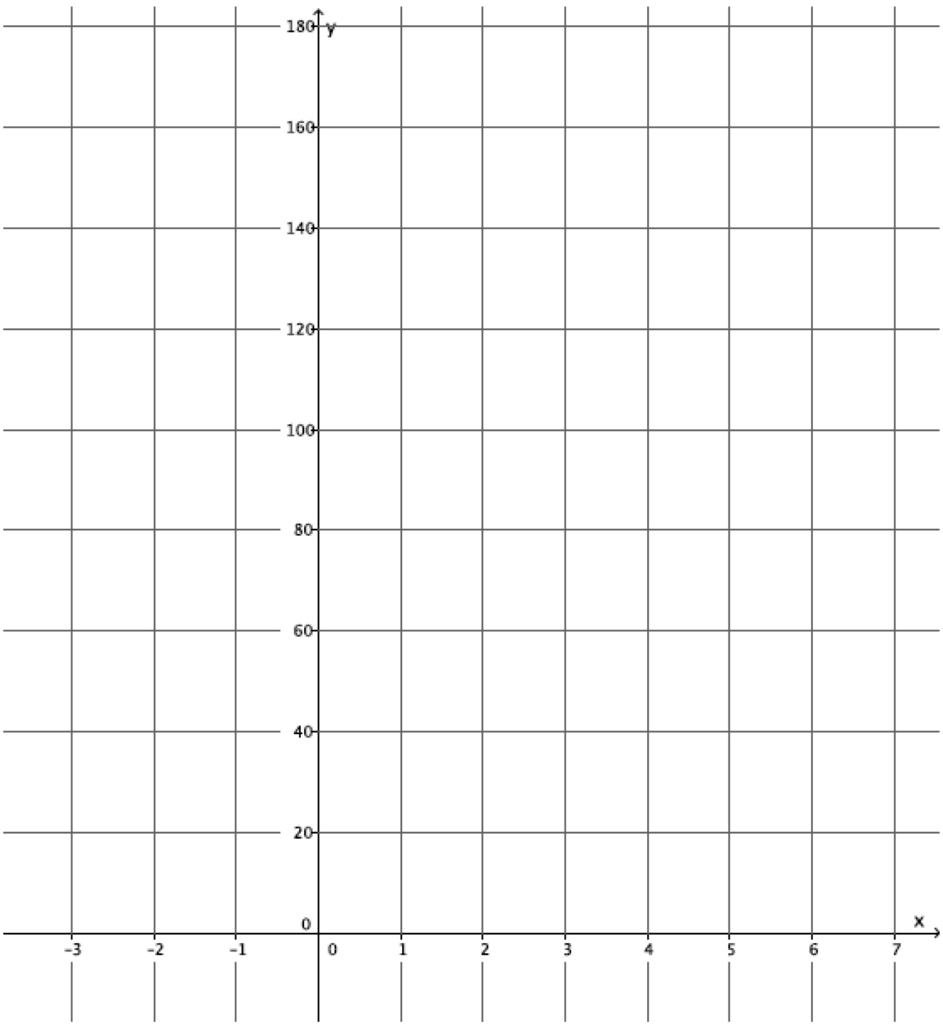


   e. Will Jeremy ever catch up to Gerardo? If so, approximately when?

   f. At approximately what point do the graphs of the lines intersect?

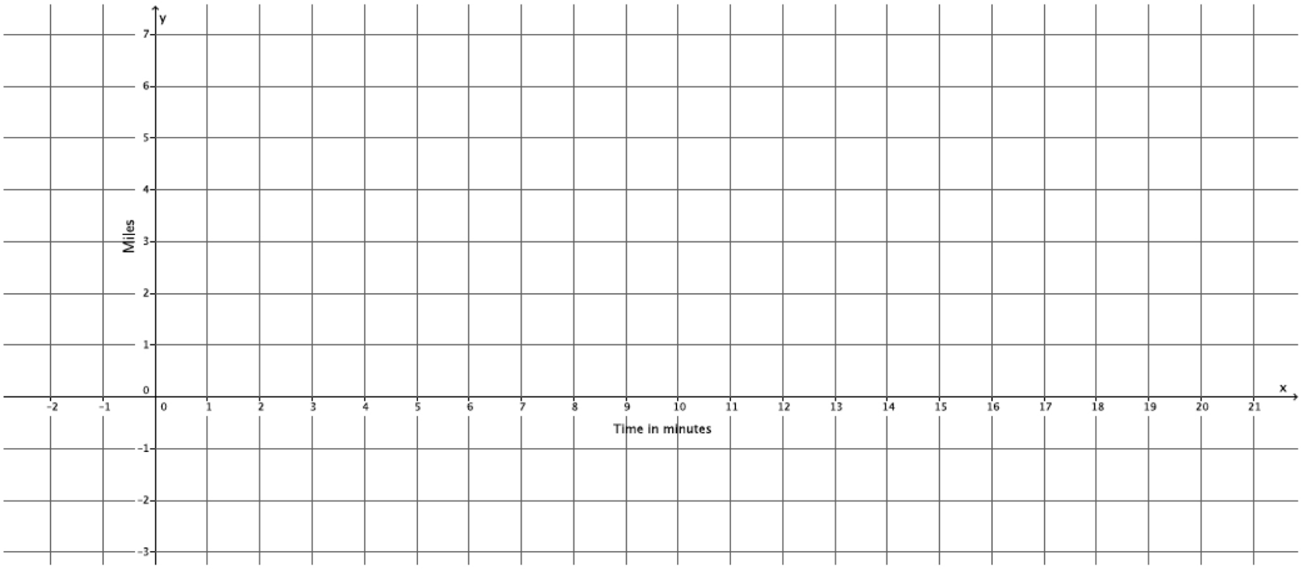
2. Two cars drive from town A to town B at constant speeds. The blue car travels 25 miles per hour and the red car travels 60 miles per hour. The blue car leaves at $9:30$ a.m., and the red car leaves at noon. The distance between the two towns is 150 miles.

a. Who will get there first? Write and graph the system of linear equations that represents this situation.



b. At approximately what point do the graphs of the lines intersect?

d. Sketch the graphs of the two equations.



e. Will Hector catch up to Darnell before he gets home? If so, approximately when?

f. At approximately what point do the graphs of the lines intersect?

Darnell and Hector ride their bikes at constant speeds. Darnell leaves Hector's house to bike home. He can bike the 8 miles in 32 minutes. Five minutes after Darnell leaves, Hector realizes that Darnell left his phone. Hector rides to catch up. He can ride to Darnell's house in 24 minutes. Assuming they bike the same path, will Hector catch up to Darnell before he gets home?

a. **Write the linear equation that represents Darnell's constant speed.**

Darnell's average speed over 32 minutes is $\frac{1}{4}$ miles per minute. If y represents the distance he bikes in x minutes, then the linear equations is $y = \frac{1}{4}x$.

b. **Write the linear equation that represents Hector's constant speed. Make sure to take into account that Hector left after Darnell.**

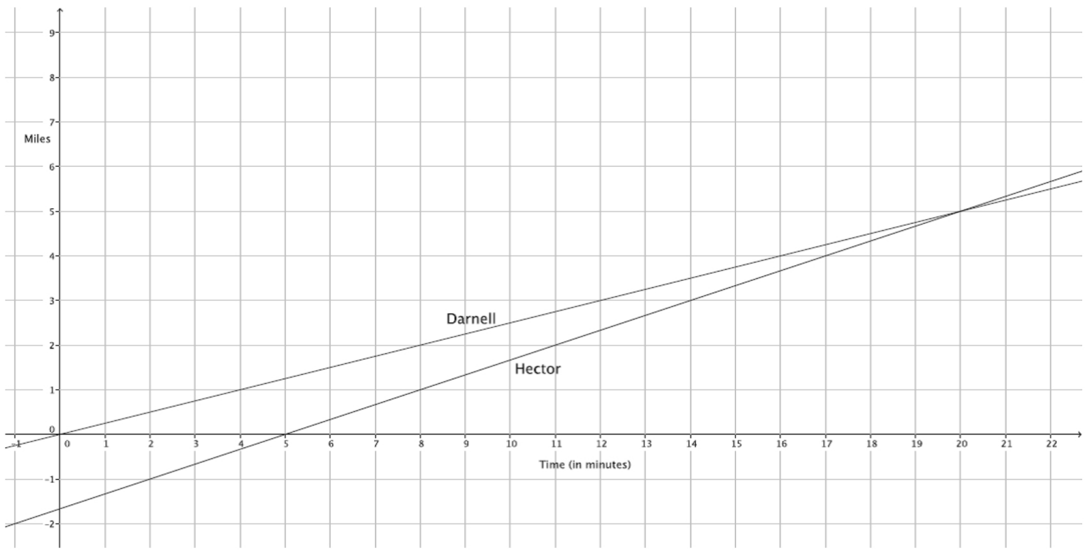
Hector's average speed over 24 minutes is $\frac{1}{3}$ miles per minute. If y represents the distance he bikes in x minutes, then the linear equation is $y = \frac{1}{3}x$. To account for the extra time Darnell has to bike, we write the equation

$$y = \frac{1}{3}(x-5)$$
$$y = \frac{1}{3}x - \frac{5}{3}.$$

c. **Write the system of linear equations that represents this situation.**

$$\begin{cases} y = \frac{1}{4}x \\ y = \frac{1}{3}x - \frac{5}{3} \end{cases}$$

d. **Sketch the graphs of the two equations.**



e. **Will Hector catch up to Darnell before he gets home? If so, approximately when?**

Hector will catch up 20 minutes after Darnell left his house (or 15 minutes of biking by Hector) or approximately 5 miles.

f. **At approximately what point do the graphs of the lines intersect?**

The lines intersect at approximately $(20, 5)$.

1. **Jeremy and Gerardo run at constant speeds. Jeremy can run 1 mile in 8 minutes and Gerardo can run 3 miles in 33 minutes. Jeremy started running 10 minutes after Gerardo. Assuming they run the same path, when will Jeremy catch up to Gerardo?**

a. **Write the linear equation that represents Jeremy's constant speed.**

Jeremy's average speed over 8 minutes is $\frac{1}{8}$ miles per minute. If y represents the distance he runs in x minutes, then we have $\frac{y}{x} = \frac{1}{8}$ and the linear equation $y = \frac{1}{8}x$.

b. **Write the linear equation that represents Gerardo's constant speed. Make sure to include in your equation the extra time that Gerardo was able to run.**

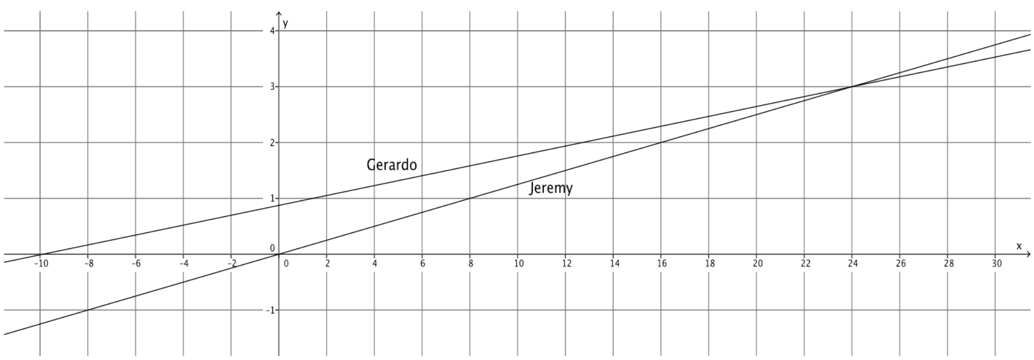
Gerardo's average speed over 33 minutes is $\frac{3}{33}$ miles per minute, which is the same as $\frac{1}{11}$ miles per minute. If y represents the distance he runs in x minutes, then we have $\frac{y}{x} = \frac{1}{11}$ and the linear equation $y = \frac{1}{11}x$. To account for the extra time that Gerardo gets to run, we write the equation

$$y = \frac{1}{11}(x + 10)$$
$$y = \frac{1}{11}x + \frac{10}{11}$$

c. **Write the system of linear equations that represents this situation.**

$$\begin{cases} y = \frac{1}{8}x \\ y = \frac{1}{11}x + \frac{10}{11} \end{cases}$$

d. **Sketch the graphs of the two equations.**



e. **Will Jeremy ever catch up to Gerardo? If so, approximately when?**

Yes, Jeremy will catch up to Gerardo after about 24 minutes or about 3 miles.

f. **At approximately what point do the graphs of the lines intersect?**

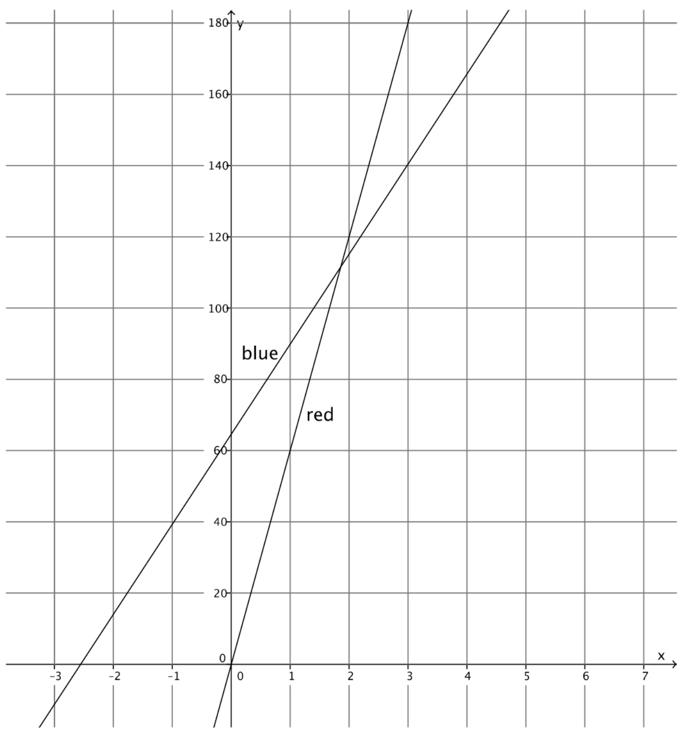
The lines intersect at approximately $(24, 3)$.

2. **Two cars drive from town A to town B at constant speeds. The blue car travels 25 miles per hour and the red car travels 60 miles per hour. The blue car leaves at $9:30$ a.m., and the red car leaves at noon. The distance between the two towns is 150 miles.**

a. **Who will get there first? Write and graph the system of linear equations that represents this situation.**

The linear equation that represents the motion of the blue car is $y = 25(x + 2.5)$, which is the same as $y = 25x + 62.5$. The linear equation that represents the motion of the red car is $y = 60x$. The system of linear equations that represents this situation is

$$\begin{cases} y = 25x + 62.5 \\ y = 60x \end{cases}.$$



The red car will get to town B first.

b. **At approximately what point do the graphs of the lines intersect?**

The lines intersect at approximately $(1.8, 110)$.