Writing the Equation of a Line

In some real-world situations you can identify the rate of change, or slope, and an ordered pair. Then you can use the slope and ordered pair to model the situation with a linear equation.

Example 1:
World-wide carbon monoxide emissions are decreasing about 2.6 million metric tons each year. In 1991, carbon monoxide emissions were 79 million metric tons. Use a linear equation to model the relationship between carbon monoxide emissions and time. Let $x = 91$ corresponding to 1991.

Step 1 Use the data to write the slope and an ordered pair.
   Slope: -2.6; ordered pair: (91, 79)

Step 2 Find the y – intercept using the slope and the ordered pair.
   $y = a + bx$ (substitute (91, 79) for (x, y) and -2.6 for b)
   $79 = a - 2.6(91)$
   $79 = a - 236.6$

   What does a (or the y-intercept) equal?

Step 3 Substitue values for b (slope) and a (y-intercept) to write an equation.
   $y = a + bx$ (substitute -2.6 for b and 315.6 for a)
   $y = 315.6 - 2.6x$

The equation $y = 315.6 - 2.6x$ models the relationship between carbon monoxide emissions and time.

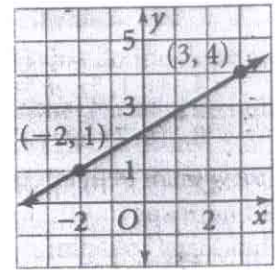1. a. Using the equation in Example 1, estimate the emissions for 1990.

   b. According to this model, what will the emissions be for 1999?

2. Write an equation of a line with the slope $\frac{2}{5}$ through the point (4, -3).

Example 2: Find an equation of the line in the graph.

Step 1 Use the coordinate of two points to find the slope of the line.

$$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

Step 2 Find the y – intercept.

$$y = a + bx$$

Step 3 Substitute values in $y = a + bx$.

Example 3:
Is the relationship shown by the data linear? If it is, write an equation.

Step 1 Find the rate of change for consecutive ordered pairs.

(-1, 4) to (3, 6)   (3, 6) to (5, 7)   (5, 7) to (9, 9)

x	y
−1	4
3	6
5	7
9	9

Is it linear? Explain.

Step 2 Find the y-intercept and write an equation.

$$y = a + bx$$

Write an equation of a line ($y = a + bx$) through the given point with the given slope.

1.) $(3, -5); b = 2$

2.) $(1, 2); b = -3$

3.) $(-6, 1); b = -\dfrac{3}{4}$

4.) $(3, 0); b = -1$

5.) $(3, 3); b = -\dfrac{1}{4}$

6.) $(5, -2); b = \dfrac{7}{2}$

Write an equation of a line through the given points.

1.) $(3, -3), (-3, 1)$

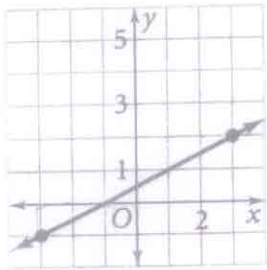2.) $(7, 3), (2, 2)$

3.) $(3, 5), (5, 3)$
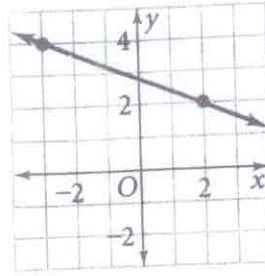
4.) $(-8, 2), (1, 3)$

5.) $(-0.5, 2), (-2, 1.5)$

6.) $(25, 100), (15, 120)$
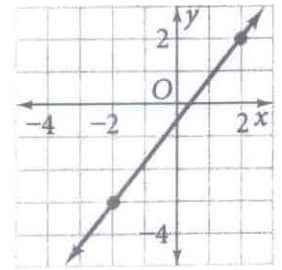
Write an equation of each line.

1.)

2.)

3.)

Tell whether the relationship shown by the data is linear. If it is, write an equation for the relationship.

1.)

x	y
−10	−7
0	−3
5	−1
20	5

2.)

x	y
−4	9
2	−3
5	−9
9	−17

3.)

x	y
1	7
2	8
3	10
4	13

4.)

x	y
−10	−5
−2	19
5	40
11	58

5.)

x	y
3	1
6	4
9	13
15	49

Critical Thinking:
A taxicab ride that is 2 miles long costs $7. One that is 9 miles long costs $24.50. Write an equation relating cost to length of ride.

What do the slope and y – intercept mean in this situation?

Determine whether each scatter plot shows *positive, negative,* or *no* correlation.