

APPLICATIONS

1. A water tank is being filled by pumps at a constant rate. The volume of water in the tank V , in gallons, is given by the equation:

$$V(t) = 65t + 280, \text{ where } t \text{ is the time, in minutes, the pump has been on}$$

- (a) At what rate, in gallons per minute, is the water being pumped into the tank?

65

- (b) How many gallons of water were in the tank when the pumps were turned on?

280

- (c) What is the volume in the tank after two hours of the pumps running?

$$V(t) = 65(120) + 280$$

$$7800 + 280$$

$$V(t) = 8,080$$

- (d) The pumps will turn off when the volume in the tank hits 10,000 gallons. To the nearest minute, after how long does this happen?

$$10,000 = 65t + 280$$

$$\frac{9720}{65} = \frac{65t}{65}$$

$$149.538 = t$$

$$t = 150 \text{ min}$$

2. A solar lease customer built up an excess of 6,500 kilowatt hours (kwh) during the summer using his solar panels. When he turned his electric heat on, the excess began to be used up at a rate of 50 kilowatt hours per day.

(a) If E represents the excess left and d represents the number of days since the heat has been turned on, write an equation for E in terms of d .

$$E = -50d + 6500$$

(b) How much of the excess will be left after one month (use a month length of 30 days)?

$$\begin{aligned} E &= -50(30) + 6500 \\ E &= -1500 + 6500 \\ E &= 5000 \end{aligned}$$

(c) If the heat will need to be turned on for 5 months, will the excess be enough to last through this time period? Justify your answer.

$$E = -50(150) + 6500$$

$$E = -7500 + 6500$$

$$E = -1000 \text{ kwh}$$

3. As Evin is driving her car, she notices that after 1 hour her gas tank has 7.25 gallons left and after 4 hours of driving, it has 3.5 gallons of gas left in it.

(a) Represent this information as two coordinate pairs in the form (h, g) , where h is the number of hours driven and g is the gallons of gas left.

$$(1, 7.25)$$

$$(4, 3.5)$$

(b) Find the slope between these two points. Using proper units, interpret this slope.

$$m = \frac{7.25 - 3.5}{1 - 4} = \frac{+3.75}{-3} =$$

$$\boxed{-1.25 \text{ g/hr}}$$

(c) Assuming the relationship between h and g is linear, find an equation for g in terms of h .

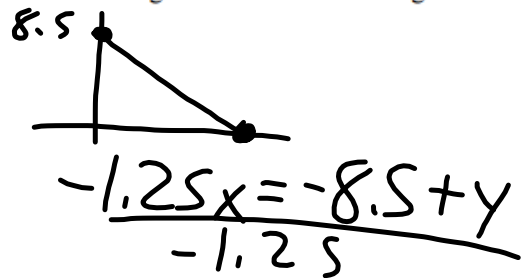
$$\boxed{g = -1.25h + 8.5}$$

$$y - \overset{+7.25}{\cancel{7.25}} = -1.25(x - 1) \overset{+7.25}{\cancel{+7.25}}$$

$$y = -1.25x + 1.25 + 7.25$$

$$y = -1.25x + \underline{8.50}$$

(d) According to this equation, after how many hours of driving would Evin run out of gas?



$$x = 6.8 \text{ hrs}$$

$$6 \text{ hrs } 48 \text{ min.}$$

4. The population of Champaign, Illinois is given for three years in the table below:

$$\begin{aligned} t &= 0 \\ t &= 10 \\ t &= 42 \end{aligned}$$

Year	Population
1970	163,488
1980	168,392
2012	203,276

- (a) Using 1970 as $t=0$, create a linear model from the first two data points in this table to predict the population, p , as a function of the number of years since 1970, t .

$$\frac{168392 - 163488}{10 - 0} = \frac{4904}{10}$$

$$m = 490.4$$

$$p = 490.4t + 163488$$

- (b) If this model is used to predict the population of Champaign in the year 2012, will the model overestimate or underestimate the actual population? Explain.

$$p = 490.4(42) + 163488$$

$$184,084.8$$

Bell Ringer:

The formula for converting degrees Fahrenheit (F) to degrees Celsius (C) is

$$C = \frac{5}{9}(F - 32)^\circ$$

Find the equivalent Celsius temperature when the temperature is 77°F .

$$C = \frac{5}{9}(77 - 32)$$

$$C = \frac{5}{9}(45)$$

$$C = \frac{5 \cdot 5}{1 \cdot 1}$$

$$C = 25^\circ$$

Convert 12 cups to quarts.

$$\begin{array}{l} 2c - 1qt \\ 2qt - 1qt \\ 4c - 1qt \\ \quad \quad 3qt \end{array}$$

Convert 14 pints to gallons.

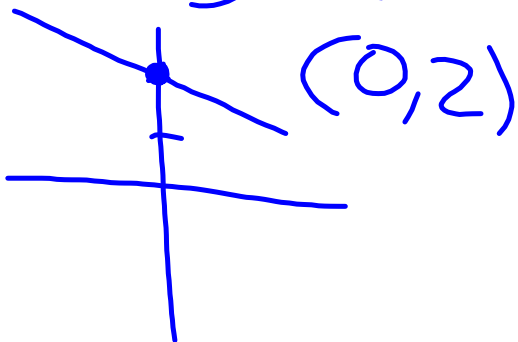
$$\begin{array}{l} 2pt - 1qt \\ 4qt - 1g \\ 7 \rightarrow 1\frac{3}{4} \text{ or } 1.75 \end{array}$$

QUIZ CORRECTIONS:

1) $x + 3y = 6$

$$\frac{3y = -x + 6}{3}$$

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



2) $4x - 5y = 40$

$$\frac{4x = 5y + 40}{4}$$

$$x = \frac{5}{4}y + 10$$

Ans. Choice 1 \rightarrow 10

3) $0, -3$

1) $y = \frac{12 - 6x}{4}$

~~$\frac{12}{4} = 3$~~

2) $27 + 3y = 6x$

~~$y = 2x - 9$~~

3) $6y + x = 18$

~~$y = -\frac{1}{6}x + 3$~~

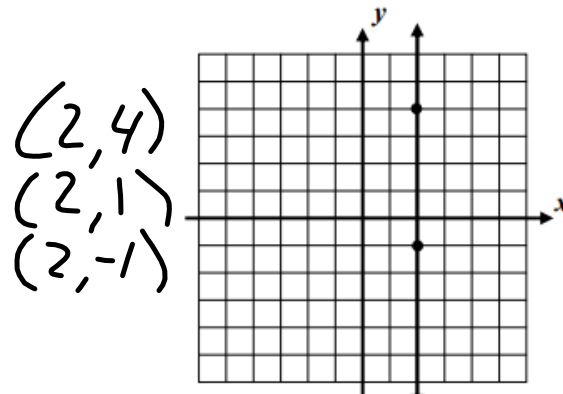
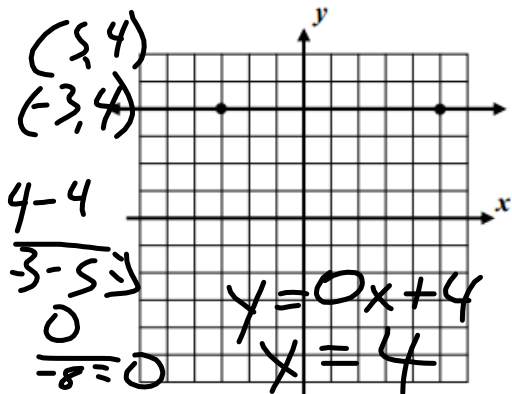
4) $y + 3 = 6x$
 $y = 6x - 3$

STRANGE LINES – VERTICAL AND HORIZONTAL
COMMON CORE ALGEBRA I



Although they don't fit the classic linear model, it is important to understand how we write equations for **horizontal and vertical lines**. The first exercise will illustrate the idea. Never forget, though, that when we create an **equation** for a curve, it simply **describes what all points on the curve share in common**.

Exercise #1: Shown below are a horizontal line and a vertical line.



HORIZONTAL LINE

Write down two coordinate points:

What do they share in common?

y-value

What is this line's equation?

y = 4

VERTICAL LINE

Write down two coordinate points:

What do they share in common?

x-value

What is this line's equation?

x = 2

Equations of horizontal lines and vertical lines are so simple that students will often get them confused later, because they don't really seem like typical linear equations (because they aren't).

HORIZONTAL AND VERTICAL LINES**Horizontal Line:** $y = \text{constant}$ **Vertical Line:** $x = \text{constant}$

(Constants can be determined by using any point the line passes through)

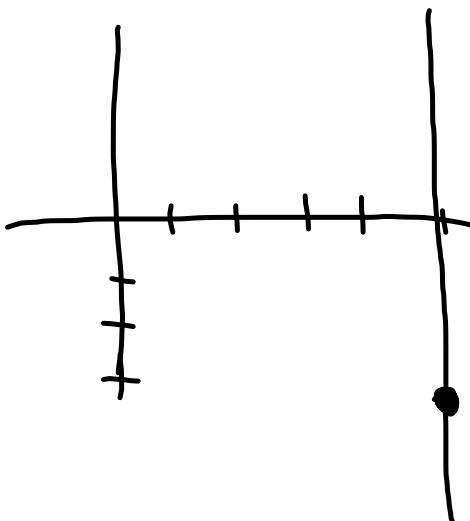
Exercise #2: Which of the following equations represents a vertical line that passes through the point $(5, -3)$?

(1) $y = -3$

(3) $y = -3x + 5$

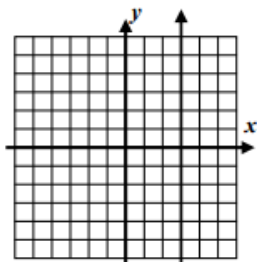
(2) $x = 5$

(4) $y = 5x - 3$

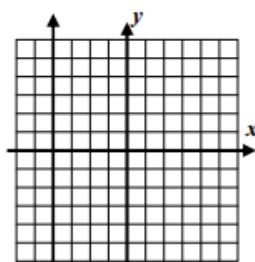


Exercise #3: For each of the following, give the equation of the line shown or described.

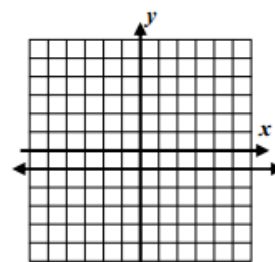
(a)

EQUATION: $X = 3$

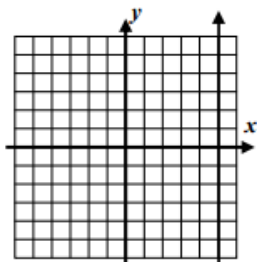
(b)

EQUATION: $X = -4$

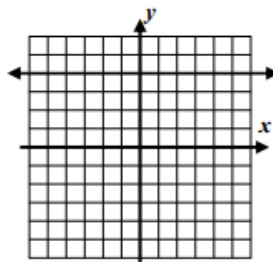
(c)

EQUATION: $Y = -1$

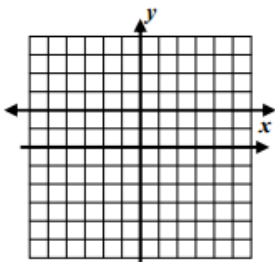
(d)

EQUATION: $X = 5$

(e)

EQUATION: $Y = 4$

(f)

EQUATION: $Y = 2$

(g) The equation of a vertical line passing through the point $(-4, 5)$.

$$X = -4$$

(h) The equation of a horizontal line passing through the point $(3, 2)$.

$$Y = 2$$

Exercise #4: Sketch the region bounded by the three lines whose equations are given below. Label each with its equation. Find the area of the triangular region enclosed by the lines. You may want to use your calculator to create a table of values of the first line or simply use facts about the slope and y-intercept.

$y = 2x - 4$

$x = -1$

$y = 2$

$A_{\triangle} = \frac{1}{2}bh$

$b = 4$

$h = 8$

$A = 16$

~~$1 \cdot \frac{16}{32}$~~
 $\frac{16}{1}$

