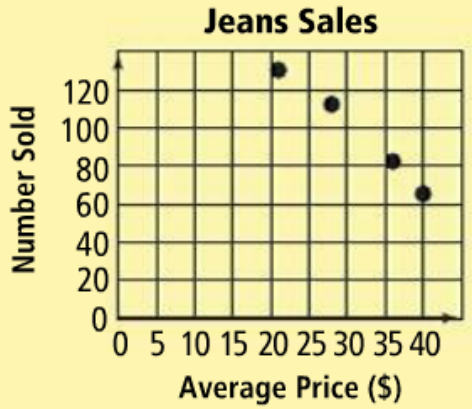
**For each table, make a scatter plot of the data. Describe the type of correlation the scatter plot shows.**

7.

| Jeans Sales | | | | |
|---|---|---|---|---|
| Average Price ($) | 21 | 28 | 36 | 40 |
| Number Sold | 130 | 112 | 82 | 65 |

**7.**

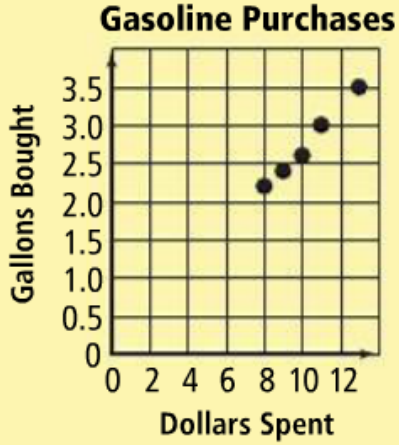



negative correlation

8.

| Gasoline Purchases | | | | | |
|---|---|---|---|---|---|
| Dollars Spent | 10 | 11 | 9 | 8 | 13 |
| Gallons Bought | 2.6 | 3 | 2.4 | 2.2 | 3.5 |

**8.**




positive correlation

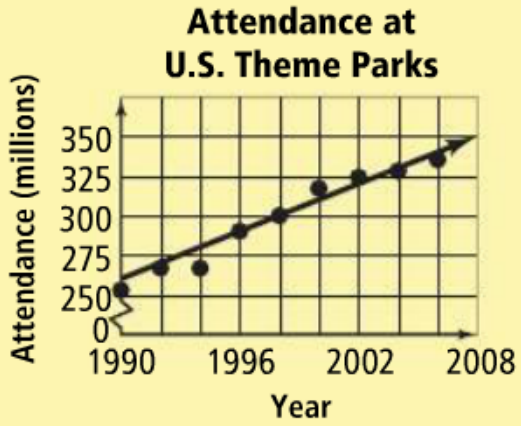
**Theme Parks** Use the table below for Exercises 9 and 10.

| Attendance and Revenue at U.S. Theme Parks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | 1990 | 1992 | 1994 | 1996 | 1998 | 2000 | 2002 | 2004 | 2006 |
| Attendance (millions) | 253 | 267 | 267 | 290 | 300 | 317 | 324 | 328 | 335 |
| Revenue (billions of dollars) | 5.7 | 6.5 | 7.0 | 7.9 | 8.7 | 9.6 | 9.9 | 10.8 | 11.5 |

SOURCE: International Association of Amusement Parks and Attractions

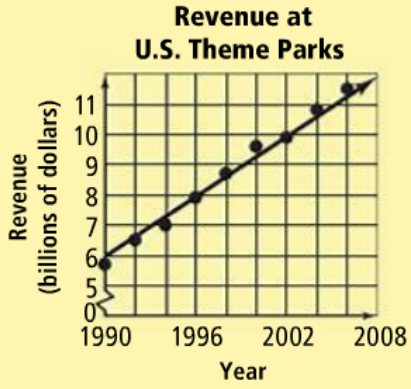
**9.** Make a scatter plot of the data pairs (year, attendance). Draw a trend line and write its equation. Estimate the attendance at U.S. theme parks in 2005.

**10.** Make a scatter plot of the data pairs (year, revenue). Draw a trend line and write its equation. Predict the revenue at U.S. theme parks in 2012.




$y = 5x - 9690$; about 335 million

**10.**

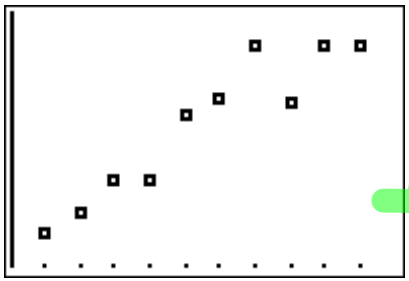


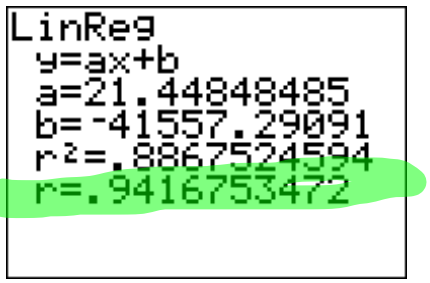

$y = 0.33x - 650.75$; about \$13.2 billion

**11. Entertainment** Use a graphing calculator to find the equation of the line of best fit for the data in the table. Find the value of the correlation coefficient $r$ to three decimal places. Then predict the number of movie tickets sold in the U.S. in 2014.

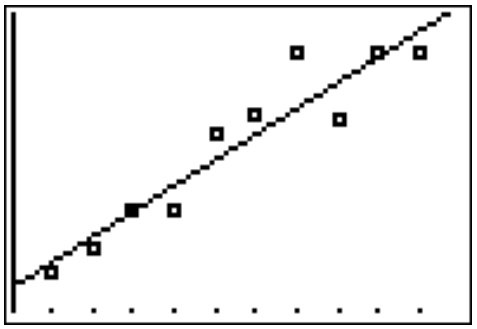
| Movie Tickets Sold in U.S. by Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Tickets Sold (millions) | 1289 | 1311 | 1340 | 1339 | 1406 | 1421 | 1470 | 1415 | 1472 | 1470 |

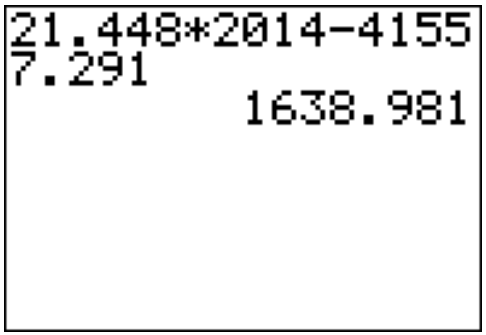
SOURCE: Motion Picture Association of America

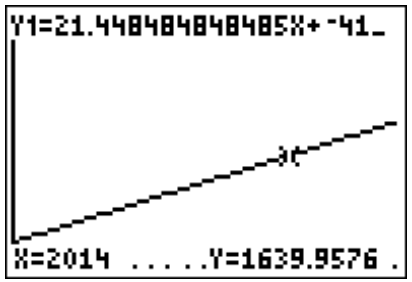





Trace/Value






**11.** $y = 21.4x - 41557$; 0.942; 1542.6 million tickets

**In each situation, tell whether a correlation is likely. If it is, tell whether the correlation reflects a causal relationship. Explain your reasoning.**

**12.** the amount of time you study for a test and the score you receive

**12.** There is likely a correlation and a causal relationship, because the more you study, the better prepared you are for the test.

**13.** a person's height and the number of letters in the person's name

**13.** no correlation likely

**14.** the shoe size and the salary of a teacher

**14.** no correlation likely

**15.** the price of hamburger at a grocery store and the amount of hamburger sold

**15.** There is likely a correlation and a possible causal relationship, because the higher the price of hamburger, the less people are likely to buy.

**16. Open-Ended** Describe three real-world situations: one with a positive correlation, one with a negative correlation, and one with no correlation.

Here you have a lot of room to be creative, for a positive correlation think of something for the independent variable - and as something increases it causes an increase in the dependent y variable.

If x is time, think of something that increases over time.

For a negative correlation, for example, think of something that decreases over time.

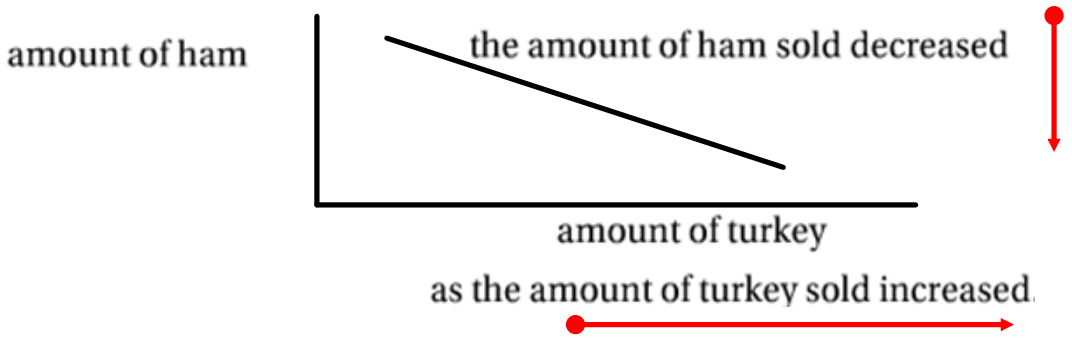
Remember units - time could be seconds, hours, years, centuries.

For something with no correlation think of things that you would not expect to be related. Think of survey to ask other students that had two questions - that have would seem to have nothing to do with each other.

**17. Writing** Give two data sets that are correlated but do *not* have a causal relationship.

**18. Business** During one month at a local deli, the amount of ham sold decreased as the amount of turkey sold increased. Is this an example of *positive correlation*, *negative correlation*, or *no correlation*?

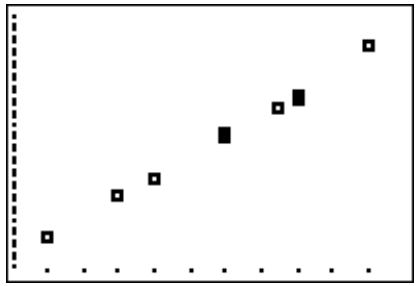
If one variable is decreased, as one is increased, then it will have a negative correlation.

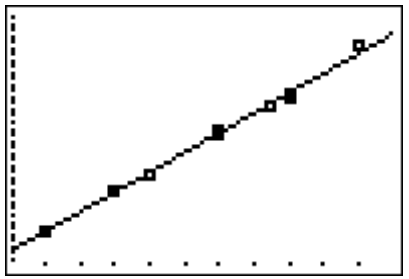


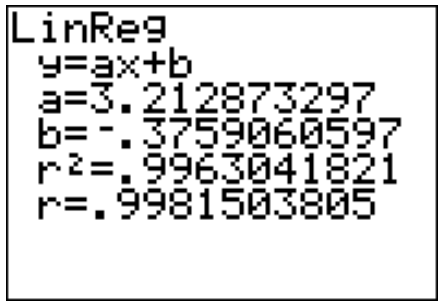
**19. Think About a Plan** Students measured the diameters and circumferences of the tops of a variety of cylinders. Below are the data that they collected. Estimate the diameter of a cylinder with circumference 22 cm.

| Cylinder Tops | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diameter (cm) | 3 | 3 | 5 | 6 | 8 | 8 | 9.5 | 10 | 10 | 12 |
| Circumference (cm) | 9.3 | 9.5 | 16 | 18.8 | 25 | 25.6 | 29.5 | 31.5 | 30.9 | 39.5 |

- How can you use a scatter plot to find an equation of a trend line?
- How can you use the equation of the trend line to make an estimate?





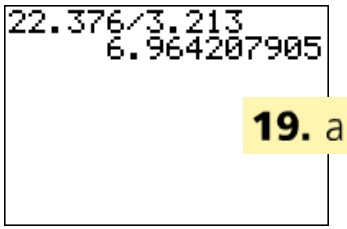



The equation is y = 3.213x - 0.376

calculate the value when y = 22

22 = 3.213x - 0.376

22.376 / 3.213 = x




**19.** about 7 cm

**20. U.S. Population** Use the data below.

| Estimated Population of the United States (thousands) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Year** | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| **Male** | 138,482 | 140,079 | 141,592 | 142,937 | 144,467 | 145,973 | 147,512 |
| **Female** | 143,734 | 145,147 | 146,533 | 147,858 | 149,170 | 150,533 | 151,886 |

SOURCE: U.S. Census Bureau

**a.** Make a scatter plot of the data pairs (male population, female population).

**b.** Draw a trend line and write its equation.

**c.** Use your equation to predict the U.S. female population if the U.S. male population increases to 150,000,000.

**d. Reasoning** Consider a scatter plot of the data pairs (year, male population). Would it be reasonable to use this scatter plot to predict the U.S. male population in 2035? Explain your reasoning.

**20. U.S. Population** Use the data below.

| Estimated Population of the United States (thousands) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
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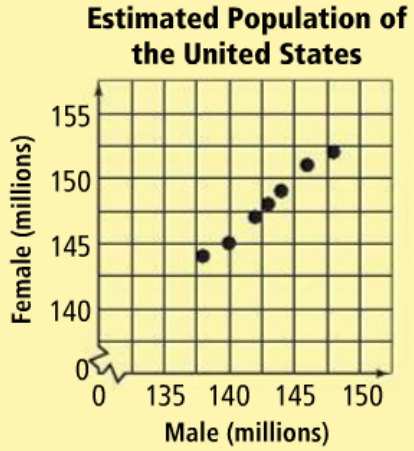
SOURCE: U.S. Census Bureau

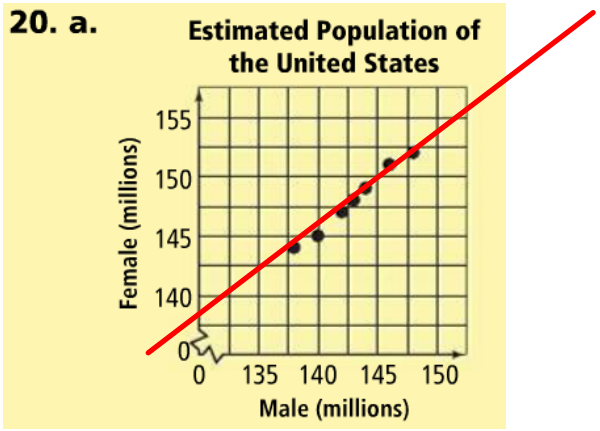
**a.** Make a scatter plot of the data pairs (male population, female population).

**20. a.**




**b.** Draw a trend line and write its equation.

**20. a.**




**b.** $y = 0.906x + 18173$

Your trend line could be slightly different, and your equation could be slightly different

**20. U.S. Population** Use the data below.

| Estimated Population of the United States (thousands) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Year** | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 |
| **Male** | 138,482 | 140,079 | 141,592 | 142,937 | 144,467 | 145,973 | 147,512 |
| **Female** | 143,734 | 145,147 | 146,533 | 147,858 | 149,170 | 150,533 | 151,886 |

SOURCE: U.S. Census Bureau

**c.** Use your equation to predict the U.S. female population if the U.S. male population increases to 150,000,000.

$y = 0.906x + 18173$ x = 150,000,000

**c.** about 154,179,000

**d. Reasoning** Consider a scatter plot of the data pairs (year, male population). Would it be reasonable to use this scatter plot to predict the U.S. male population in 2035? Explain your reasoning.

**d.** No; 2035 is too far in the future to predict. Growth rates may change by then.

| U.S. Computer and Video Game Unit Sales | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
| Unit Sales (millions) | 152.4 | 184.5 | 196.3 | 210.3 | 225.8 | 240.9 | 249.5 | 229.5 | 241.6 | 267.9 |

SOURCE: The NPD Group/Retail Tracking Service

**21. a. Graphing Calculator** Use a graphing calculator to find the equation of the line of best fit for the data below. Let $x = 8$ represent 1998, $x = 9$ represent 1999, and so on.

**b.** What is the slope of the line of best fit? What does the slope mean in terms of the number of computer and video game units sold?

**c.** What is the $y$-intercept of the line of best fit? What does the $y$-intercept mean in terms of the number of computer and video game units sold?

**21. a.** $y = 10.5x + 88.2$

**b.** 10.5; the sales increase by about 10.5 million units each year.

**c.** 88.2; the estimated number of units sold in the year 1990

## Challenge

**22. a.** Make a scatter plot of the data below. Then find the equation of the line of best fit. Draw the line of best fit on your scatter plot.

| Car Stopping Distances | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Speed (mi/h)** | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
| **Stopping Distance (ft)** | 27 | 44 | 63 | 85 | 109 | 136 | 164 | 196 |

**b.** Use your equation to predict the stopping distance at 90 mi/h.

**c. Reasoning** The actual stopping distance at 90 mi/h is close to 584 ft. Why do you think this distance is not close to your prediction?

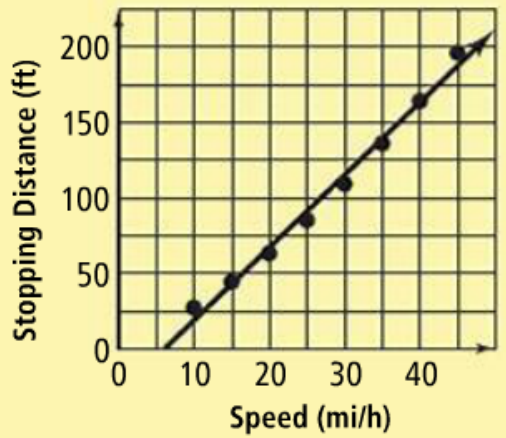
**d.** Suppose you plot (90, 584) on your scatter plot. What effect would it have on the slope and $y$-intercept of the line of best fit you found in part (a)?

## Challenge

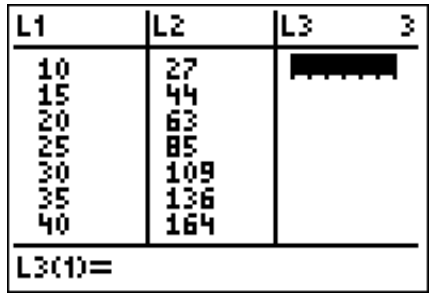
**22. a.** Make a scatter plot of the data below. Then find the equation of the line of best fit. Draw the line of best fit on your scatter plot.

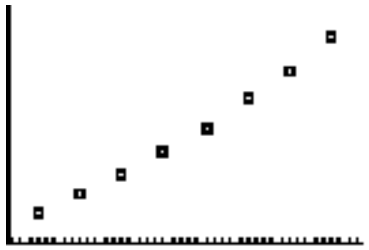
| Car Stopping Distances | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Speed (mi/h) | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 |
| Stopping Distance (ft) | 27 | 44 | 63 | 85 | 109 | 136 | 164 | 196 |

**22. a.**

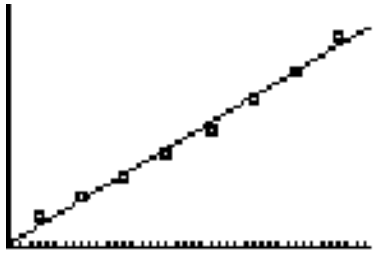



$y = 4.82x - 29.65$



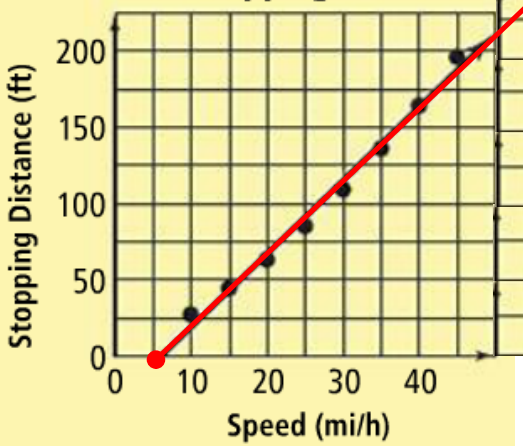
```
LinReg
 y=ax+b
 a=4.823809524
 b=-29.6547619
 r²=.9901359717
 r=.9950557631
```



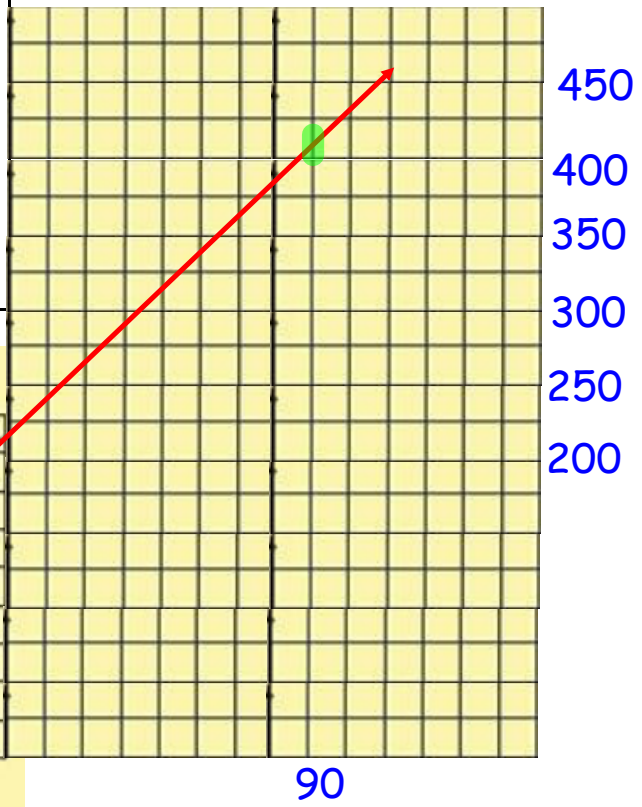
**b.** Use your equation to predict the stopping distance at 90 mi/h.

```
4.82(90)-29.65
              404.15
```

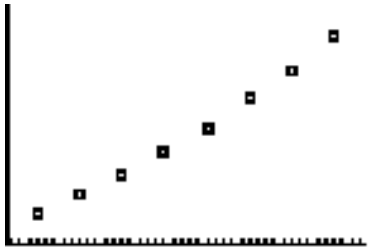
**22. a.**




$y = 4.82x - 29.65$



**c. Reasoning** The actual stopping distance at 90 mi/h is close to 584 ft. Why do you think this distance is not close to your prediction?

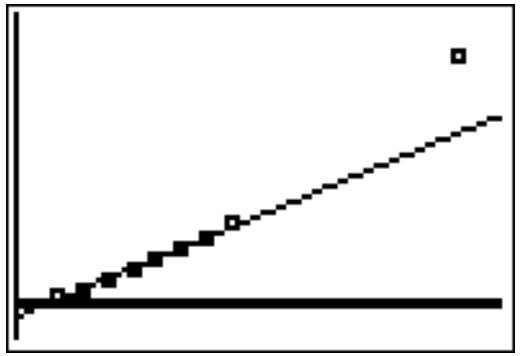


The relationship is not actually linear, so you cannot use the trend line to extrapolate the stopping distance for a speed of 90 mi/h.

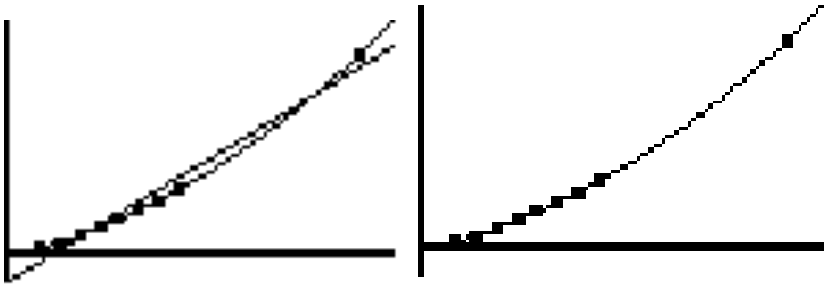
Show below - the new data point was added to the lists,
and the data is shown plotted with the original trendline:

| L1 | L2 | L3 1 |
|---|---|---|
| 25 | 85 | |
| 30 | 109 | |
| 35 | 136 | |
| 40 | 164 | |
| 45 | 196 | |
| 90 | 584 | |
| | ------ | |

L1(10) =



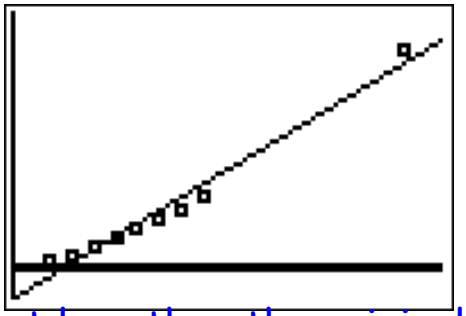
QuadReg
y=ax²+bx+c
a=.0475715193
b=2.206508878
c=.0994616013
R²=.9999975963



**d.** Suppose you plot (90, 584) on your scatter plot. What effect would it have on the slope and $y$-intercept of the line of best fit you found in part (a)?

Show below - the new data point was added to the lists,
and thetrendline is recalculated - which shows this equation is a good fit

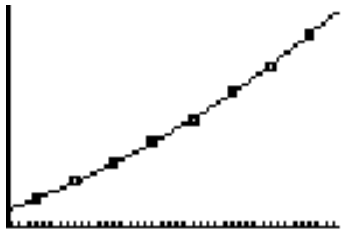
```
LinReg
 y=ax+b
 a=7.029115479
 b=-85.66953317
 r²=.9700683376
 r=.9849204727
```



This correlation value is good, but less than the original (.99xx)

What would the quadratic trendline look like without (90, 584)?

```
QuadReg
 y=ax²+bx+c
 a=.0480952381
 b=2.178571429
 c=.4047619048
 R²=.9999787725
```



The calculated stopping distance:

```
.048*90²+2.1786*
90+.40476
          585.27876
```

## Standardized Test Prep

**23.** Suppose you survey each school in your state. What relationship would you expect between the number of students and the number of teachers in each school?

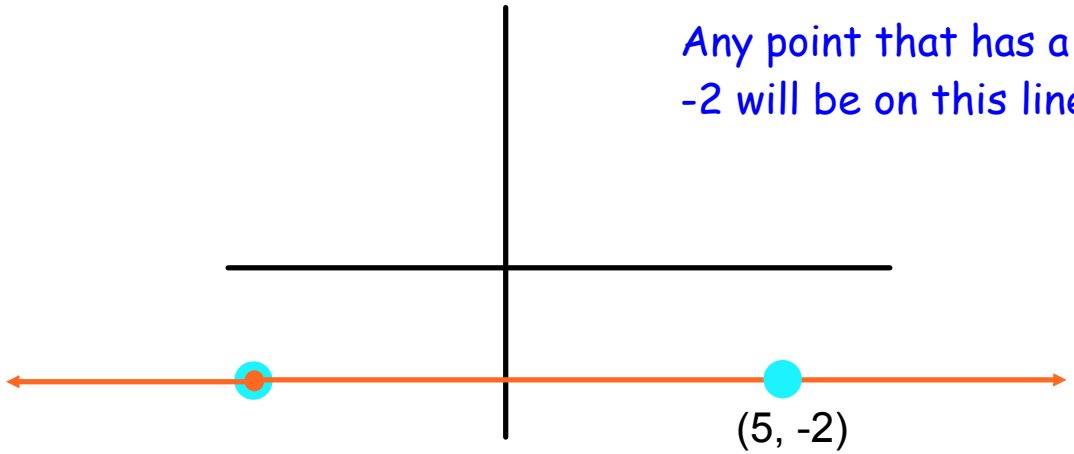
(A) positive correlation
(B) negative correlation
(C) no correlation
(D) none of the above

Think about some possible school sizes - and exaggerate the values
how many teachers for a school with 10 students, 100 students, 1000 students?

**24.** A horizontal line passes through $(5, -2)$. Which other point is also on the line?

(F) $(5, 2)$
(G) $(-5, -2)$
(H) $(-5, 2)$
(I) $(5, 0)$

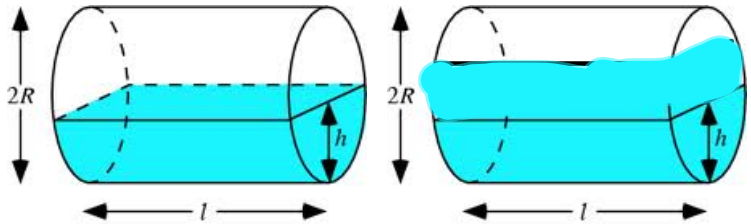
Any point that has a y-coordinate -2 will be on this line.



## Standardized Test Prep

**25.** When 18 gal of water are pumped into an empty tank, the tank is filled to three fourths of its capacity. How many gallons of water does the tank hold?

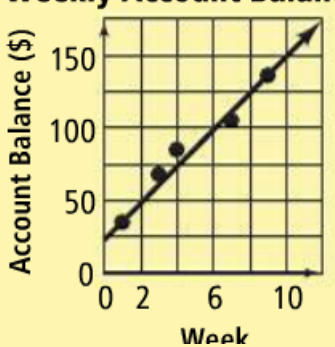
(A) 12 (B) 13.5 (C) 18.5 (D) 24




18 gal = 3/4 full
6 gal = 1/4 full
12 gal = 1/2 full
24 gal = 4/4 full

**26.** The table shows the balance of a student's bank account at various times. Estimate how much money is in the student's bank account in Week 6. Justify your answer.

| Weekly Account Balance | | | | | |
|---|---|---|---|---|---|
| Week | 1 | 3 | 4 | 7 | 9 |
| Account Balance | $35 | $68 | $85 | $105 | $136 |




Using the points (1, 35) and (9, 136), the equation of the trend line is $y = 12.625x + 22.375$.

So in week 6, the student has about $98.13 in the account.

## Mixed Review

**Write an equation of the line in slope-intercept form that passes through the given point and is parallel to the graph of the given equation.**

**27.** $y = 5x + 1; (2, -3)$

**27.** $y = 5x - 13$

A line that is parallel to this will have the same slope (5).

y = mx + b

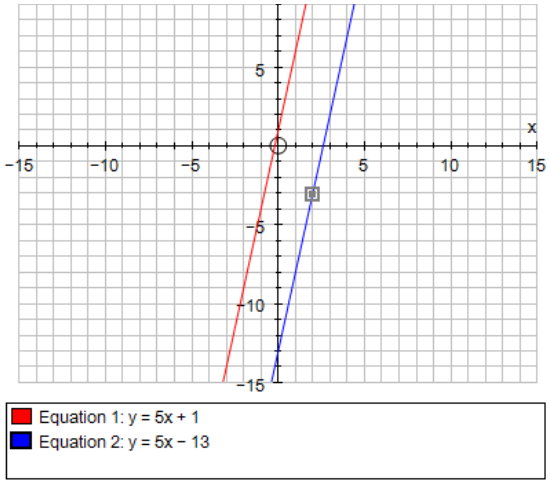
y = 5x + b. We have a value for x and y, solve for b.

-3 = 5(2) + b

-3 = 10 + b

-13 = b

y = 5x - 13 is the equation of the line that is parallel to y = 5x + 1 and goes through the point (2, -3)



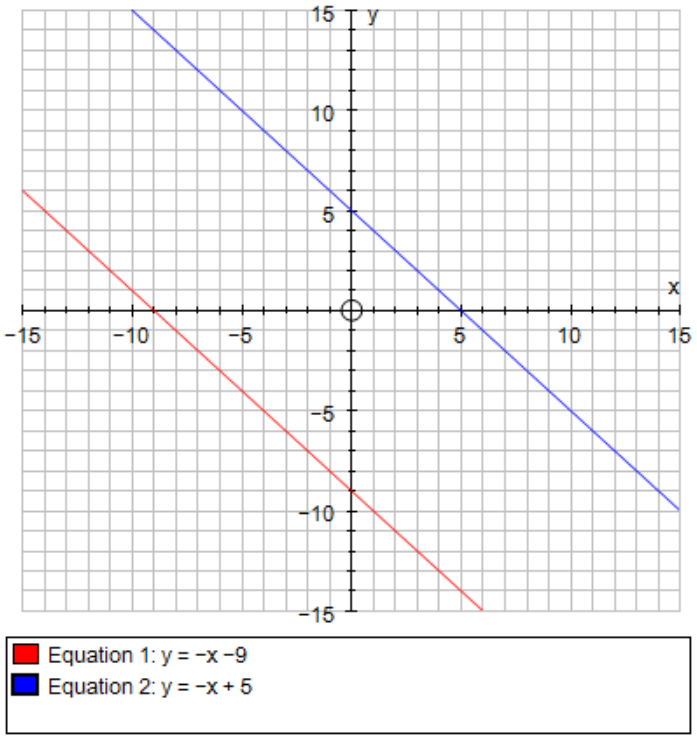
**Write an equation of the line in slope-intercept form that passes through the given point and is parallel to the graph of the given equation.**

**28.** $y = -x - 9; (0, 5)$

A line that is parallel to this will have the same slope (-1).

**28.** $y = -x + 5$

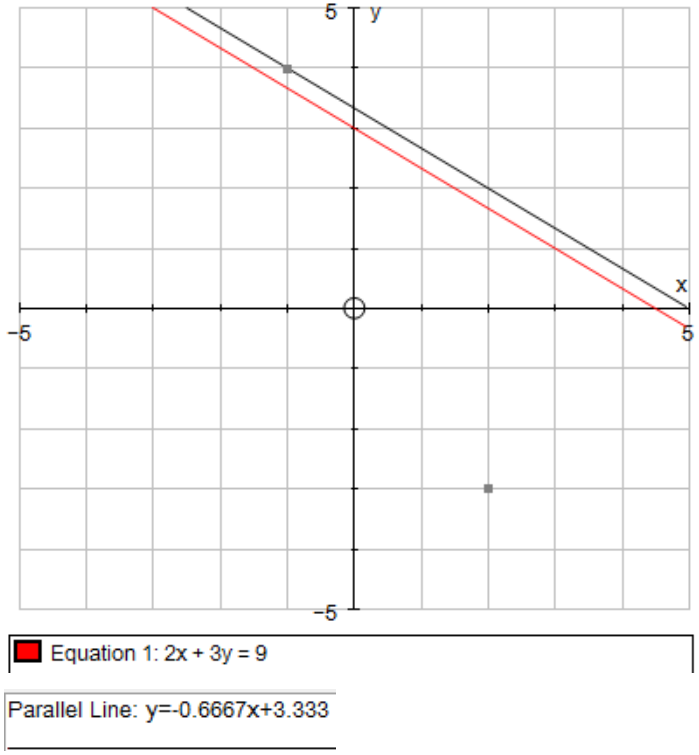
The point this needs to go through (0, 5) is the y-intercept.



**Write an equation of the line in slope-intercept form that passes through the given point and is parallel to the graph of the given equation.**

**29.** $2x + 3y = 9; (-1, 4)$

**29.** $y = -\frac{2}{3}x + \frac{10}{3}$




What is the slope of the line where 2x + 3y = 9?

Solve for y

3y = -2x + 9

y = (-2/3)x + 3

A line that is parallel to this will have the same slope.

y = mx + b

y = (-2/3)x + b

if x = -1 and y = 4 what is b?

4 = (-2/3)(-1) + b

4 = 2/3 + b

3 1/3 = b

y = (-2/3)x + 10/3