Plot the points from the table in a coordinate plane. Write the equation of the line in slope-intercept form.

1.

x	-3	-2	-1	0	1
y	-19	-13	-7	-1	5

linear $m = \frac{5+1}{1-0} = \frac{6}{1} = 6$

$y = 6x + (-1) = \boxed{y = 6x - 1}$

2.

x	2	3	4	5	6
y	12	18	24	30	36

$m = \frac{18-12}{3-2} = \frac{6}{1}$

$y - 18 = 6(x - 3)$

$y - 18 = 6x - 18$
$+18 \quad +18$

$\boxed{y = 6x}$

Cumulative Warm Up

* Warm up - Review

· Provide graph paper

· write equations

· determine if each table is linear

· Calculate slope

· Write equation using slope and y-intercept

Solve the equation. Determine whether the equation has *one solution, no solution,* or *infinitely many solutions.*

1. $4t - 3 = 13 + 4t$

$-4t \quad -4t$

$-3 = 13$

No solution

2. $3h = 6h + 6$

$6 = 3h$

$2 = h$

3. $14y - 5 = 7(2y - 2)$

$14y - 5 = 14y - 14$

$-5 = -14$

No Solution

4. $2(5g - 5) = 3(5g - 10)$

$10g - 10 = 15g - 30$

$20 = 5g$

$4 = g$

5. $3(6 - 4m) = 2(9 - 6m)$

$18 - 12m = 18 - 12m$

$18 = 18$

all solution

6. $3(t - 5) = \frac{2}{5}(25 + 10t)$

$3t - 15 = 10 + 4t$

$-t = 25$

$t = -25$

Warm Up

* Spiral review

· Watch signs and order of operations

Essential Question

How can you *analytically* find a line of best fit for a scatter plot?

What you will learn

- Use residuals to determine how well lines of fit model data.
- Use technology to find lines of best fit
- Distinguish between correlation and causation

Essential Question

Creating scatter plot: (do after getting points for equation)

- Stat plot - turn on
- Clear an y1 functions
- Enter lists Stat, Edit
- Zoom 9 Zoom Stat

Work with a partner.

The scatter plot shows the median ages of American women at their first marriage for selected years from 1960 through 2010. In Exploration 2 in Section 4.4, you approximated a line of fit graphically. To find the line of *best* fit, you can use a computer, spreadsheet, or graphing calculator that has a *linear regression* feature.

a. The data from the scatter plot is shown in the table. Note that 0, 5, 10, and so on represent the numbers of years since 1960. What does the ordered pair (25, 23.3) represent?

L1	L2	L3
0	20.3	
5	20.6	
10	20.8	
15	21.1	
20	22	
25	23.3	
30	23.9	
35	24.5	
40	25.1	
45	25.3	
50	26.1	

L1(55)=

* partner work - class discussion.

Create list:

- STAT
- Edit
- Enter x values in L_1
- Enter y values in L_2
- 2nd Quit

- Stat
- Calc
- LinReg (ax+b) enter
  - L_1
  - L_2

  enter

Exploration 1a

Work with a partner.

The scatter plot shows the median ages of American women at their first marriage for selected years from 1960 through 2010. In Exploration 2 in Section 4.4, you approximated a line of fit graphically. To find the line of *best* fit, you can use a computer, spreadsheet, or graphing calculator that has a *linear regression* feature.

b. Use the *linear regression* feature to find an equation of the line of best fit. You should obtain results such as those shown.

```
LinReg
 y=ax+b
 a=.1261818182
 b=19.84545455
 r²=.9738676804
 r=.986847344
```

c. Write an equation of the line of best fit. Compare your result with the equation you obtained in Exploration 2 in Section 4.4.

If not showing:
2nd 0
down to
Exploration 1b-c · diagnostic on
· enter
· done
will show

a.) The median age of American Women at their first marriage in 1985 was 23.3

b.) Walk through steps

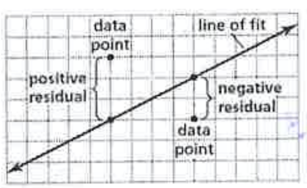
c.) $y = .13x + 19.8$

(can also do by hand)

Core Concept

Residuals

A **residual** is the difference of the y-value of a data point and the corresponding y-value found using the line of fit. A residual can be positive, negative, or zero.



A scatter plot of the residuals shows how well a model fits a data set. If the model is a good fit, then the absolute values of the residuals are relatively small, and the residual points will be more or less evenly dispersed about the horizontal axis. If the model is not a good fit, then the residual points will form some type of pattern that suggests the data are not linear. Wildly scattered residual points suggest that the data might have no correlation.

Core Concept

residual: the difference of the y-value of ~~the~~ a data point and the corresponding y-value found using the line of fit.

· Can be positive, negative or zero

* use desmos to graph

In Example 3 in Section 4.4, the equation $y = -2x + 20$ models the data in the table shown. Is the model a good fit?

Week, x	1	2	3	4	5	6	7	8
Sales (millions), y	\$19	\$15	\$13	\$11	\$10	\$8	\$7	\$5

Example 1

x	y	y from model	Residual
1	19	18	19-18=1
2	15	16	15-16=-1
3	13	14	13-14=-1
4	11	12	11-12=-1
5	10	10	10-10=0
6	8	8	8-8=0
7	7	6	7-6=1
8	5	4	5-4=1

· because points are evenly dispersed around the horizontal axis, the equation y=-2x+20 is a good fit.

* use desmos to graph

The table shows the ages x and salaries y (in thousands of dollars) of eight employees at a company. The equation $y = 0.2x + 38$ models the data. Is the model a good fit?

Age, x	35	37	41	43	45	47	55	55
Salary, y	42	44	47	50	52	51	49	45

Example 2

x	y	y from model	Residual
35	42	45	42-45=-3.0
37	44	45.4	44-45.4=-1.4
41	47	46.2	47-46.2=.8
43	50	46.6	50-46.6=3.4
45	52	47	52-47=5.0
47	51	47.4	51-47.4=3.6
55	49	48.6	49-48.6=.4
55	45	49	45-49=-4.0

because data points are spread out >1, these do not support the equation y=0.2x+38 as being a good fit for the data.

1. The table shows the attendances y (in thousands) at an amusement park from 2005 to 2014, where $x = 0$ represents the year 2005. The equation $y = -9.8x + 850$ models the data. Is the model a good fit?

Year, x	0	1	2	3	4	5	6	7	8	9
Attendance, y	850	845	828	798	800	792	785	781	775	760

Monitoring Progress 1

Student practice

* have students use desmos to graph

* create table for support

*Set up scatter plot by hand

The table shows the durations x (in minutes) of several eruptions of the geyser Old Faithful and the times y (in minutes) until the next eruption. (a) Use a graphing calculator to find an equation of the line of best fit. Then plot the data and graph the equation in the same viewing window. (b) Identify and interpret the correlation coefficient. (c) Interpret the slope and y-intercept of the line of best fit.

Duration, x	2.0	3.7	4.2	1.9	3.1	2.5	4.4	3.9
Time, y	60	83	84	58	72	62	85	85

* Set up on desmos after for check

* Students can explore w/ desmos to see how to enter coordinates

· how to set line of fit

Example 3

· Graphing calculators use linear regression to find lines of best fit

Correlation coefficient (r) on a graphing calculator

between -1 and 1 good fit

Strong correlation

as r gets closer to 0 the correlation is weaker

* Use desmos OR
* Use graphing calculator

2. Use the data in Monitoring Progress Question 1. (a) Use a graphing calculator to find an equation of the line of best fit. Then plot the data and graph the equation in the same viewing window. (b) Identify and interpret the correlation coefficient. (c) Interpret the slope and y-intercept of the line of best fit.

$y = 11.9x + 35.1$

the line of fit is not a good fit.

Interpolation: using a graph or it equation to approximate a value between two known values

Extrapolation: using a graph or its equation to predict a value outside the range.

* the farther removed a value is from the known values, the less confidence you can have in the accuracy of the prediction.

Monitoring Progress 2

$y = 12x + 35$ round to make easier

Refer to Example 3. Use the equation of the line of best fit.

a. Approximate the duration before a time of 77 minutes.

b. Predict the time after an eruption lasting 5.0 minutes.

Time = y

Duration = x

a.) $77 = 12x + 35$

$3.5 = x$ eruption lasts about 3.5 min. before a time of 77 minuits

b.) $y = 12(5.0) + 35$

$y = 95$ a time of about 95 minutes will follow an erruption of 5.0 minutes

Example 4

* Student practice

729, 300

Slide at the top of page 5

3. Refer to Monitoring Progress Question 2. Use the equation of the line of best fit to predict the attendance at the amusement park in 2017.

Monitoring Progress 3

Causation: when a change in one variable causes a change in another variable.

Tell whether a correlation is likely in the situation. If so, tell whether there is a causal relationship. Explain your reasoning.

a. time spent exercising and the number of calories burned

b. the number of banks and the population of a city

a.) Strong ⇒ Positive Correlation and a causal relationship the more you exercise, the more calories you burn.

b.) positive relationship - but no causal relationship
*building more banks will not cause the population to grow.

Correlation: a relationship between the data.

Example 5

4. Is there a correlation between time spent playing video games and grade point average? If so, is there a causal relationship? Explain your reasoning.

4.) There may be a negative correlation;

a causal relationship is possible because the more time you spend playing video games, the less time you spend studying.

Monitoring Progress 4

Exit Ticket: Find the line of best fit for the data in the *Motivate*. Use the line to estimate the cumulative snowfall in week 5.

Closure