

Scatter Plots

Math 8 10.S

Scatter Plots display data in two variables.

Data points are plotted on a graph to represent data and determine **correlation**.

Scatter Plots may show **positive**, **negative**, or **no correlation**.

Positive correlation means when one variable increases, so does the other.

Negative correlation means that when one variable increases, the other decreases.

No correlation means that the data appear unrelated.

Practice: Label the correlation that you suspect would be demonstrated by each:

(pos., neg., or no)

1. Height versus weight of 100 male African elephants. _____

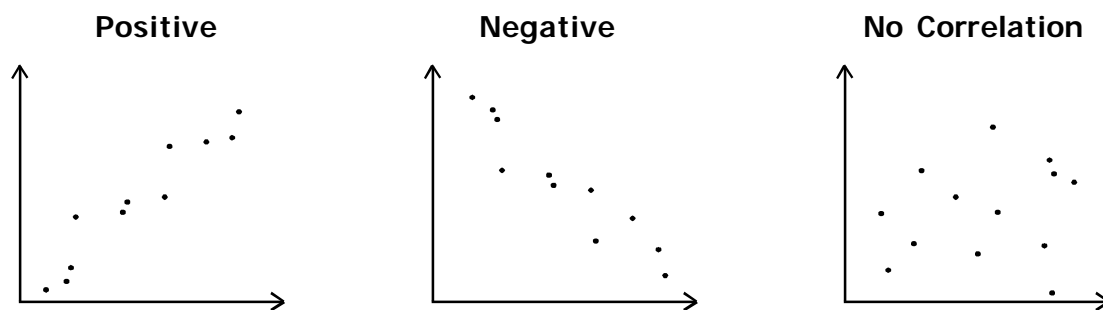
2. Distance driven versus gas used. _____

3. Amount of time spent studying versus G.P.A. _____

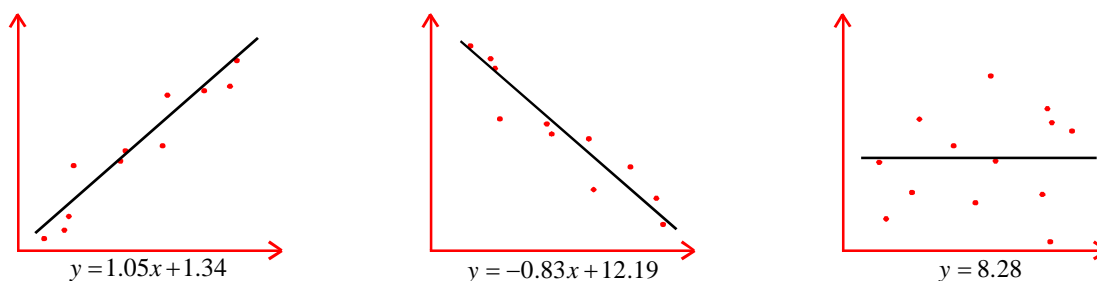
4. Hair length versus height of 150 adult women. _____

5. Distance walked in a pair of shoes versus the thickness of the sole. _____

On a graph, it is easy to recognize the correlation:



The trend line for a scatter plot is called the **Best Fit Line** or Line of Best Fit and can be described as a linear equation in slope-intercept form.



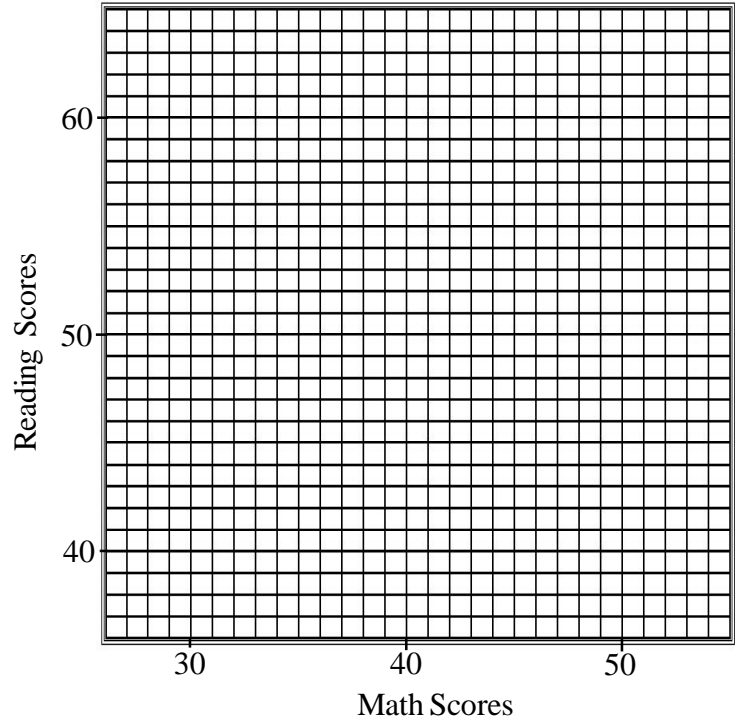
Scatter Plots

Creating a scatter plot is easy once the graph is drawn.

Practice: The Data Below shows the average test scores in California on the standardized Reading and Math tests for 8 years from 1992-1999. Create a Scatter Plot to display the data.

Math vs. Reading Scores

Year	Math Score	Reading Score
1992	32	38
1993	40	39
1994	50	55
1995	48	48
1996	39	46
1997	45	50
1998	42	45
1999	40	47



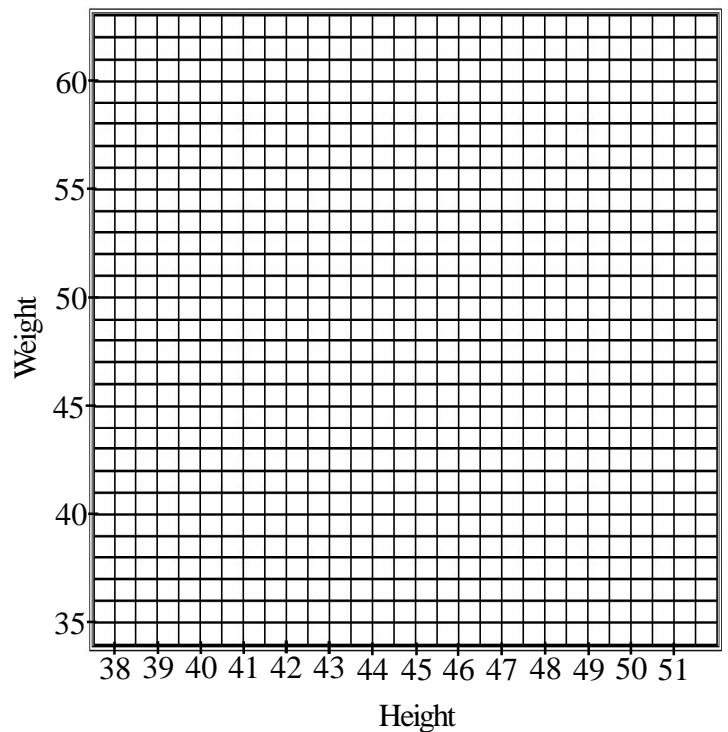
Relationship shown: _____

Creating a scatter plot is more difficult when you must create your own graph.

Practice: The Data Below shows the height and weight of 12 female students in Mrs. Phillips' first grade class. Plot the points below.

Height versus Weight

Name	Height	Weight
Lisa	44	47
Simone	50	54
Meredith	38.5	40
Penny	39	45
Sheila	41	36
Tara	45.5	49
Meg	48	61
Mara	51	47
Steph	42.5	42
Callie	50.5	49
Cynthia	46.5	52
Joy	45	43



Relationship shown: _____

Scatter Plots

Math 8

Answer the following questions about the graphs you created for California Math/Reading scores and 1st graders' height/weight.

1. Draw a straight-line to represent the trend of the data in the math/reading scatter plot.
What is the approximate slope of the line of best fit?

a. $1/2$ b. $3/5$ c. $9/10$ d. $10/9$ e. $5/3$
2. Draw a straight-line to represent the trend of the data in the height/weight scatter plot.
What is the approximate slope of the line of best fit? (careful, the scale is different on each axis.)

a. $1/5$ b. $2/3$ c. $4/3$ d. $7/2$ e. 5
3. Look at the math/reading score chart and graphs. During which year were the reading scores lowest compared to math scores?

a. 1993 b. 1994 c. 1996 d. 1998 e. 1999
4. Based on the height/weight graph, which two students appear to be most overweight?
a. Meg/Sheila b. Simone/Meg c. Lisa/Tara
d. Simone/Cynthia e. Penny/Meg
5. A new student joins the class. She is 4 feet tall. What is the best prediction of her weight in pounds?

a. 35 b. 40 c. 45 d. 50 e. 55
6. If the average math score in 2000 was 45, what would be the expected reading score?

a. 46 b. 49 c. 52 d. 55 e. 58
7. What is graphed as the dependent variable in the classroom graph?
a. Name b. Height c. Weight
d. Positive e. Slope
8. What is graphed as the independent variable in the classroom graph?
a. Name b. Height c. Weight
d. Positive e. Slope

Glencoe Algebra p. 43

Tables

Tables and Linear Equations:

You can create a table of values for a function just as you would any other equation.

Review:

Create a table of values for the function $y = 5x - 7$

x	y

You can go in reverse as well. Some functions are obvious.

Practice:

Try to determine what function was used to create each table:

1.

x	y
2	12
3	13
4	14

y=

2.

x	y
5	10
7	14
9	18

y =

3.

x	y
-2	2
-7	7
9	-9

y=

Other times, it is not as easy.

For linear equations there is **a method that will always work.**

1. Find the slope. 2. Use Slope-Intercept Form and solve for b.

Examples:

Try to determine what function was used to create each table:

1.

x	y
2	-9
5	-15
6	-17

y=

2.

x	y
-6	-6
-8	-7
4	-1

y=

3.

x	y
4	16
-1	1
-3	9

y=

Functions

Practice: Write a slope-intercept form equation for each table of values.

1.

x	y
-3	-2
1	-6
5	-10

y =

2.

x	y
6	-1
3	-3
-9	-11

y =

3.

x	y
7	49
2	4
-3	9

y =

Some functions will not be linear.

If the slope of an equation is not constant, the function is not linear.

Look for squares, square roots, absolute value, and other common functions.

Practice: Write a function for each table of values.

1.

x	y
1	-1
4	-2
9	-3

y =

2.

x	y
3	3
-4	4
-6	6

y =

3.

x	y
1	1
2	0.5
4	0.25

y =

Practice: Be careful, tables will not always look the same.

1.

y	x
-5	3
-9	5
3	-1

y =

2. Three miles
in two hours.
Five miles in
three hours.
Seven miles in
four hours.

h =

3.

a	4	-4	-8
b	-4	2	5

b =

Functions

Math 8 5.4

Write a slope-intercept equation for each table of values.

1.

x	y
5	9
7	13
9	17

$y =$

2.

x	y
-3	10
-1	8
1	6

$y =$

3.

x	y
-7	14
-3	6
9	-18

$y =$

4.

y	x
3	3
-5	7
-13	11

$y =$

5.

x	y
-9	0
-6	2
3	8

$y =$

6.

x	y
-3	-4
8	7
-11	-12

$y =$

7.

x	y
5	-8
-5	-10
-15	-12

$y =$

8.

x	y
4	-1.8
3	-2.1
2	-2.4

$y =$

9.

x	y
5	12.5
11	27.5
-1	-2.5

$y =$

Write an equation for each table of values. These are not linear. Try absolute value, squares, and square roots.

10.

x	y
-2	5
5	26
12	145

$y =$

11.

x	y
-3	2
-7	6
9	10

$y =$

12.

x	y
16	-4
9	-3
25	-5

$y =$

Functions

Math 8

Write a slope-intercept equation for each table of values.

1.

x	y
5	3
7	7
9	11

$y=$

2.

x	y
-4	1
-2	2
6	6

$y=$

3.

x	y
-7	20
-3	8
9	-30

$y=$

4.

y	x
8	6
4	3
-4	-3

$y=$

5.

x	y
6	8
-6	0
-9	-2

$y=$

6.

x	y
-2	-1
4	-4
6	-5

$y=$

7.

x	y
2	19
-1	-8
-4	-35

$y=$

8.

x	y
7	-5
0	-2
-14	4

$y=$

9.

x	y
-8	-3
-12	-4
-16	-5

$y=$

One of these is not linear.

10.

x	y
-2	3
5	-11
12	-25

$y=$

11.

x	y
1	-1
-2	-4
-3	-9

$y=$

12.

x	y
3	-2
-9	2
-12	3

$y=$

Scatter Plots on the TI-83 Calc.

Math 8 10.S

Using the data from Mrs. Phillips' first grade class, we will use the graphing calculator to display the data and determine the line of best fit.

Clear the memory of your calculator before starting.

1. Enter the data. Choose STAT and select 1: Edit...

Enter the height data under L1 and the weight data under L2.

Name	Height (L1)	Weight(L2)	Name	Height (L1)	Weight(L2)
Lisa	44	47	Meg	48	62
Simone	50	57	Mara	51	47
Meredith	38.5	32	Steph	53	65
Penny	39	42	Callie	50.5	49
Sheila	41	36	Cynthia	46.5	52
Tara	45.5	49	Joy	45	43

Tips:

Make sure all of the data lines up properly.

If you need to delete an entry use DEL. To insert a missing entry use INS (2nd DEL).

2. Plot the data.

Choose STAT PLOT (2nd Y=)

Select 1: Plot 1...

Turn the graph On. (highlight On and hit Enter)

Note the other settings, we will not change these.

ZOOM 9: ZoomStat

3. Calculate the Line of Best Fit

Push the STAT button. This time toggle right to CALC in the menu.

Select 4: LinReg (ax+b) This will calculate an equation in the form $y=mx+b$. Hit ENTER.
(If you did everything correctly so far, you should have gotten $a=1.652$ and $b=-27.573$).

4. Plot the Line of Best Fit

Go to $Y_1=$ and then hit VARS.

Choose 5: Statistics...

Toggle right to EQ and select 1: RegEQ and GRAPH.

You may also enter the equation manually, but it will not be as accurate in most cases.

5. Trace the Line of Best Fit

Hit TRACE. Use the left and right arrows to bounce from point to point.

Use the down arrow to toggle onto the line (not the points).

Answer: Round to the tenth.

How much would you expect a first grade girl to weigh for each height given below?

40in _____ lbs

42in _____ lbs

45in _____ lbs

48in _____ lbs

50in _____ lbs

53in _____ lbs

hint: Discover the TABLE function on your own.

Scatter Plots on the TI-83 Calc.

Math 8 10.S

Use each table of data to create a graph and a line of best fit on your calculator to answer the questions that follow.

Latitude and Average Daily Temperature in July for 10 world cities

Name	Latitude (°N)	July Temp. (°C)
Oslo	59	7
Berlin	52	18.5
London	51	17
Vancouver	49	17
Tunis	37	26
Tomsk	56	18
Kiev	50	20
Coppermine	67	10
Rome	41	24
Salah	27	37

1. What is the linear equation that represents the July temperature of a city based on its north latitude?
(Round decimals to the thousandth 0.001)

2. What would be the expected July temperature at each of the given latitudes below?

25°N _____°C

54°N _____°C

70°N _____°C

Latitude and Average Daily Rainfall in July for 10 world cities

Name	Latitude (°N)	July Rainfall (mm)
Oslo	59	73.6
Berlin	52	57.4
London	51	59.5
Vancouver	49	31.3
Tunis	37	3.3
Tomsk	56	73.6
Kiev	50	77.1
Coppermine	67	31.9
Rome	41	16.3
Salah	27	0.1

1. Write the equation (to the thous.):

2. What would be the expected July rainfall at each of the given latitudes below?

35°N _____mm

45°N _____mm

60°N _____mm

3. Does this graph appear to show more or less correlation than the one above? _____

Using TBLSET

Math 8

Review: Use the data in the table below to create a graph to answer the questions that follow.

Made-Up Statistics: Age/Mass

Age (days)	Mass (grams)
5.5	19.5
7.2	25.3
9.3	32.2
11.1	37.6
13.1	44.9
15.0	51.1
15.7	53.1
19.2	65.1
19.7	65.2
21.1	70.2
24.4	81.4

- Use Stat - Edit to enter the data into L_1 and L_2 .
- Turn on StatPlot #1 (above $y=$). Plot the points (use Zoom 9).
- Calculate the line of best fit using STAT-CALC-LinReg-Enter.
- Put this equation into Y_1 . While in Y_1 , use VARS-Statistics-EQ-RegEQ. Graph it.

- Write the Linear equation (round to the thous.): _____
- What is the slope of the line of best fit (round to the thous.)? _____
- According to the line of best fit, what is the expected mass in grams at 14 days (to the tenth)? _____
Use trace and type 14 for X, or use the table.
- According to the line of best fit, what is the expected mass in grams at 1 year (365 days)? _____
Here we will learn to change the table settings.
- According to the line of best fit, what is the expected mass in grams at each age below?
100 days _____ 200 days _____ 300 days _____ 400 days _____

Made-Up Statistics: (x, y)

(x, y) coordinates: (80, 173.56) (85, 184.61) (90, 195.66) (110, 239.86) (120, 261.96)

- Write the Linear equation (round to the thous.): _____
- What is the slope of the line of best fit (round to the thous.)? _____
- Predict y for each x value: (200, _____) (250, _____) (350, _____) (500, _____)

Scatter Plots on the TI-83 Calc.

Math 8

Use each table of data to create a graph and a line of best fit on your calculator to answer the questions that follow.

Global Temperature by Year 1900-2000

Year	Temp. (°F)
1900	57.20
1910	56.82
1920	56.97
1930	57.13
1940	57.47
1950	56.93
1960	57.16
1970	57.27
1980	57.67
1990	58.08
2000	57.92

9. Write the Linear equation (to the thous.): _____

10. According to this (very limited) data, predict the mean global temperature for the following years.
(Use TBLSET and TABLE, or change your WINDOW values and use TRACE)

2010 _____ 2025 _____ 2050 _____ 2100 _____

North American Population 1986-1995

Year	Population (millions)
1986	346
1987	350
1988	354
1989	358
1990	363
1991	369
1992	374
1993	379
1994	383
1995	388

11. Write the Linear equation (to the thous.): _____

12. Calculate and graph the Linear Equation. What does it show as the North American population for the year 1900? 2010?

1900: _____ million 2010: _____ million

13. What is wrong with the linear prediction for 1900? _____

When to use the Calculator:

Math 8

Most of the time you can write an equation for a table of values quicker without using a calculator:

x	y
5	5
7	9
9	13

$$y = \underline{\hspace{2cm}}$$

x	y
-5	8
-7	10
-9	12

$$y = \underline{\hspace{2cm}}$$

x	y
5	13
-5	9
-15	5

$$y = \underline{\hspace{2cm}}$$

Sometimes it is easier to use the calculator to determine the linear equation:

x	y
-4.5	-21
-1.5	-9
7.5	27

$$y = \underline{\hspace{2cm}}$$

x	y
-18	-5.8
2	-33.8
22	-61.8

$$y = \underline{\hspace{2cm}}$$

x	y
-3.9	-22.99
1.3	3.53
6.5	30.05

$$y = \underline{\hspace{2cm}}$$

It is important that you can still convert the equations above to other forms (the calculator won't). Convert each of the equations above into Standard Form. ($Ax + By = C$)

Match each table below with the linear equation that describes it:

1.

x	y
5	5
7	9
9	13

2.

x	y
-14	6
-7	4
21	-4

3.

x	y
4	3.375
-1	0.875
-5	-1.125

a. $5x - 2y = 8$

b. $3x - 5y = 17$

c. $4x - 8y = -11$

d. $2x - 3y = -5$

e. $2x - y = 5$

f. $2x + 7y = 14$

Scatter Plots on the TI-83 Calc.

Math 8 10.S

Use each table of data to create a graph and a line of best fit on your calculator to answer the questions that follow.

Made-Up Meaningless Statistical Data Table 1

Age (years) Length (cm)

15	143.6
20	140.7
25	132.9
30	133.7
35	129.1
40	108.9
45	109.1

1. What is the slope of the line of best fit (to the hundredth)? _____
2. What is the length at age 0 according to this equation? _____cm
3. Predict the length at age 100: _____cm

Made-Up Meaningless Statistical Data Table 2

X:	10	11	16	7	4	-5	1	-3
Y:	-2	-1.5	1	-3.5	-5	-9.5	-6.5	-8.5

4. What equation does this table represent (in slope-intercept form)? _____
5. What is the value of y when x=100? _____

Made-Up Meaningless Statistical Data Table 3

X:	6.1	8.7	9.9	10.1	11.0	12.9	15.1	17.3
Y:	9.3	6.1	4.2	3.5	2.8	1.5	0.3	-1.1

6. Write the linear equation for the line of best fit (to the hundredth). _____
7. Predict Y when X=50: (to the hundredth). _____

Made-Up Meaningless Statistical Data Table 4

8. Fill-in the missing data point in the table below.

X:	7.2	8.9	9.1	18.7	21.9	32.2	35.8	41.1
Y:	23.1	29.1	29.9	63.1	74.5	_____	123.2	142.1

Interpreting Data:

Use a calculator to plot the data in the table below and answer the questions that follow:

Patrice and her family were going on a long vacation drive to Florida. To pass the time, Patrice frequently recorded how long they had been traveling, and the distance they had driven. Below is the table of data.

Family Vacation: Day 1.

Time (hours) Distance (Miles)

0	0
.5	24
2.5	145
3.25	201
5	335
6.5	354
8.25	494
9.5	530

1. Enter the data in L_1 and L_2 .
2. Turn on the STAT PLOT.
3. Calculate the line of best fit: $y =$ _____
4. What does the slope of the line of best fit approximate? _____
5. Between which two checkpoints are they traveling the fastest? _____
6. They made a long stop on the way for dinner. Where on the graph/table do you suspect this occurred? _____

Homework Averages versus Test Average.

Student	HW	Test	Student	HW	Test
Grady	65	74	Ty	100	101
Phillup	88	91	Anthony	55	98
Will	100	89	Carly	25	67
Eric	95	100	Bobby	70	77
Crystal	90	79	Ava	85	78

7. Calculate the line of best fit: $y =$ _____
8. Is the correlation generally positive or negative? _____
9. Which student(s) likely needs more challenge? _____
10. Which student(s) would you guess are the worst test-takers? _____
11. If you remove Carly from the data set, do you think the correlation will still be positive? Remove Carly and re-calculate the slope of the line of best fit. _____

Interpreting Data:

Use a calculator to plot the data in the table below and answer the questions that follow:

NYC Taxi Fees: \$/Mile

Miles	Fee
1.5	9.35
3.5	18.15
0.75	6.05
2.5	13.75
5	24.75

1. Calculate the line of best fit: $y =$ _____
2. What does the slope of the line of best fit represent? _____
3. What is the cost just to get in the cab (even if you don't go anywhere)? _____
4. What would be the cost of a 4.25-mile ride in the taxi? _____
5. You have exactly \$36.85. How far can you go in a NYC taxi? _____
(Note: taxis charge by the quarter-mile, set your table to calculate every 1/4 mile.)

Workout: Calories vs. Minutes

Day	Minutes	Calories Burned
Mon	15	106
Tue	25	176
Wed	45	318
Th	20	165
Fri	55	275
Sat	40	175
Sun	25	195

6. Calculate the line of best fit: $y =$ _____
7. What does the slope of the line of best fit represent? _____
8. On what day was the exercise most effective at burning calories? _____
9. On what day did the exercise appear least effective at burning calories? _____
10. Based on the line of best fit, how many calories would you expect to burn in a typical 30-min workout? _____

Plotting more than one graph:

Math 8

It is possible to compare data from more than one set. This data can be used to make comparisons.

Cost of a phone call.

UltraComm and TeleCell are phone companies that each charge a certain fixed connection fee, plus a charge per minute of phone use as shown on the chart to the right.

UltraComm		TeleCell	
Min.	Cost	Min.	Cost
5	0.65	6	1.05
11	1.13	9	1.20
19	1.77	14	1.45
23	2.09	17	1.60
45	3.85	55	3.50

- Enter the data in L_1 and L_2 for UltraComm. Turn on StatPlot and ZoomStat (9).
- Calculate the line of best fit for UltraComm: $y = \underline{\hspace{2cm}}$
- Enter this equation for Y_1 .
- Replace the data in L_1 and L_2 with the TeleCell data (do not erase the memory).
(note: We could use L_3 and L_4 but this gets more complicated.)
- Calculate the line of best fit for TeleCell: $y = \underline{\hspace{2cm}}$
- Enter this equation for Y_2 .
- Look at the graph of both lines at the same time. It is clearer if you turn off StatPlot.
- The two lines intersect. What is significant about the point where the two lines intersect?

- Use the trace function. Try to get as close as you can to the intersection of the two lines on the graph. Write the approximate coordinates of the intersection. $\underline{\hspace{2cm}}$
- Look at the table. What is the most minutes you can talk with UltraComm for cheaper than it costs with TeleCell? $\underline{\hspace{1cm}}$ minutes.
- Look at the table. What is the fewest minutes you can talk with TeleCell for cheaper than it costs with UltraComm? $\underline{\hspace{1cm}}$ minutes.
- Above TRACE is the CALC menu for graphs. Use 2nd-TRACE to access this menu. You are looking for the point of intersection. Choose 5: Intersect. The calculator asks you for the 1st curve (this just means choose a line and hit enter), the 2nd curve (choose the other line and hit enter), and a guess (you do not need to get that close, but move the cursor close to the intersection).

Hit ENTER and write the coordinates of the intersection of the two graphs. $\underline{\hspace{2cm}}$

Plotting more than one graph:

Math 8

It is possible to compare data from more than one set. This data can be used to make comparisons.

Cost to ship a package:

POSTall

U-Ship

POSTall and U-Ship are package-delivery companies that charge a fixed fee plus a cost per pound to ship large items overnight. Answer the questions that follow about the two companies.

lbs.	Cost	lbs.	Cost
16	48.00	14	51.60
19	54.75	21	64.90
29	77.25	25	72.50
33	86.25	30	82.00
40	102.00	37	95.30

- Use the data in both charts to graph the linear equations for POSTall (in Y_1) and U-Ship (Y_2).
- What is the line of best fit for POSTall: $y =$ _____
- What is the line of best fit for U-Ship: $y =$ _____

Using the Table:

- What is the cost to mail a 10-pound package with POSTall? _____ U-ship? _____
- What is the cost to mail a 50-pound package with POSTall? _____ U-ship? _____
- What is the heaviest package you can send for \$50 with POSTall? _____ lbs.
- What is the heaviest package you can send for \$50 with U-Ship? _____ lbs.

Understanding the equations:

- What is the cost per-pound with POSTall? _____ U-Ship? _____
- What is the initial fixed fee with POSTall? _____ U-Ship? _____

Graphing: Round answers to the hundredth.

If you just graph the equations now, there is a good chance the ZOOM will be weird and you won't see both lines. Turn on StatPlot and use Zoom9 to get a better view of the graphs, then turn off StatPlot.

- Where do the two lines intersect? _____
- For what weight in pounds is the cost to mail a package with both companies the same? _____
- What is the cost to mail the package in #11? _____

Extension:

Incredeliver offers to ship packages for a rate of \$3.00 per pound with no initial charge.

Write and use this equation in Y_3 .

- For what weight is the cost to mail a package with Incredeliver the same as POSTall? _____
- For what weight is the cost to mail a package with Incredeliver the same as U-Ship? _____
- Who is the cheapest company if you are mailing a 10lb package? _____ 30? _____

Practice Test: Scatter Plots/etc.

Math 8

Write the slope-intercept form equation for each table of values:
One or more may be non-linear.

1.

x	y
5	-13
-5	7
-1	-1

1. _____

2.

x	y
2	-1
3	6
4	13

2. _____

3.

x	y
-5	-5
5	-1
15	5

3. _____

4.

x	y
1.4	2.566
-0.6	2.216
-1.8	2.048

4. _____

5. (8, 15) (-4, 21) (6, 16) (-2, 20) (-12, 25)

5. _____

6. (-3, -1) (12, 9) (-9, -5) (-15, -9) (9, 7)

6. _____

Use the following table for questions 7-8:

Data Table 1:

X:	4.2	5.9	7.6	9.4	11.5	12.8	14.5	17.3
Y:	-17.4	-21.4	-25.9	-30.1	-33.3	-37.5	-41.2	-45.4

7. Write the slope of the linear equation for the line of best fit (to the hundredth).

7. _____

8. Predict Y when X=20: (to the tenth).

8. _____

Practice Test: Scatter Plots/etc.

Math 8

Use the following table for questions 9-11:

Data Table 2:

X:	6.5	9.5	15.5	17.0	21.5
Y:	11.3	17.9	31.1	34.4	44.3

9. Write the linear equation for the line of best fit (to the tenth).

9. _____

10. Predict Y when X=25: (to the hundredth).

10. _____

11. For what value of X is Y equal to 70.7? (to the tenth)

11. _____

Cost of Rental:

Auto rentals are based on the number of miles you drive a car after a fixed rental fee. Use the data in the table to the left to answer the questions that follow.

Honda

Miles	Cost
20	33.00
80	57.00
120	73.00
200	105.00
250	125.00

Nissan

Miles	Cost
30	33.45
90	60.45
110	69.45
170	96.45
210	114.45

12. What is the initial fee to rent a Honda?

12. _____

13. What is the cost per mile for Honda rental?

13. _____

14. What is the initial fee to rent a Nissan?

14. _____

15. What is the cost per mile for Nissan rental?

15. _____

16. For how many miles is the cost of Honda rental the same as the cost for Nissan rental?

16. _____

Identify each correlation as positive, negative, or no correlation:

17. The size of a television screen and its cost.

17. _____

18. The size of a bathtub drain and the amount of time it takes the tub to drain.

18. _____