KEY

Calculator Instructions: Finding the Zeros of a Quadratic using your Graphing Calculator

1. Find the DISCRIMINANT first. This will let you know in advance how many solutions you will need to find on your calculator.

GRAPH

2. Type "y=" which is located at the TOP LEFT of your calculator. → Type in Function.

3. Adjust zoom if you cannot see where the PARABOLA is crossing the X-AXIS.

    a. Click "zoom" then choose the option option 6: ZOOM STANDARD

    b. Click "zoom" then choose the option option 0: ZOOM FIT

4. Click "2nd" then "trace"

5. Click the menu option #2 for ZEROS

6. Scroll to the LEFT of the zero and press ENTER

7. Scroll to the RIGHT of the zero and press ENTER

8. Press "enter" again when you see the word GUESS ?

9. The ZERO will appear at the bottom of your calculator

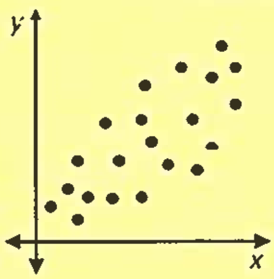
*FOLLOW STEPS AGAIN STARTING AT STEP 4 TO FIND OTHER ZERO

Name: KEY

Notes: Linear Regression (Line of Best Fit)

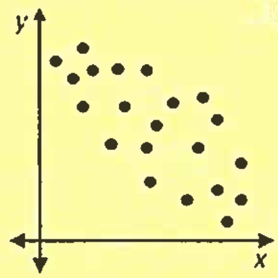
Linear Correlation: When analyzing a SCATTER PLOT, we can describe the correlation between two variables X and Y.

Positive Correlation
As 'x' increases,
'y' tends to INCREASE.
(looks like a POSITIVE slope)



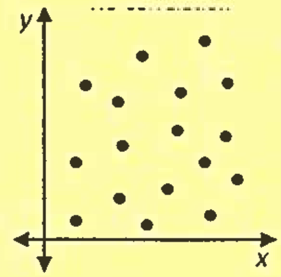
Example: The number of homework assignments a student thoughtfully completes compared to their grade earned on a test usually has a positive correlation.

Negative Correlation
As 'x' increases,
'y' tends to DECREASE.
(looks like a NEGATIVE slope)



Example: The number of hours a student spends watching television compared to their grade earned on a test usually has a negative correlation.

No Correlation
'x' and 'y' have
NO RELATIONSHIP

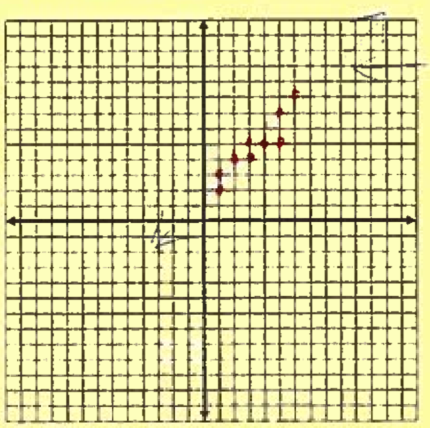


Example: The eye color of a student compared to their grade earned on a test has no correlation.

ample 1: Make a scatter plot of the data. Tell whether the data shows a positive correlation, negative correlation, or no correlation.

a.

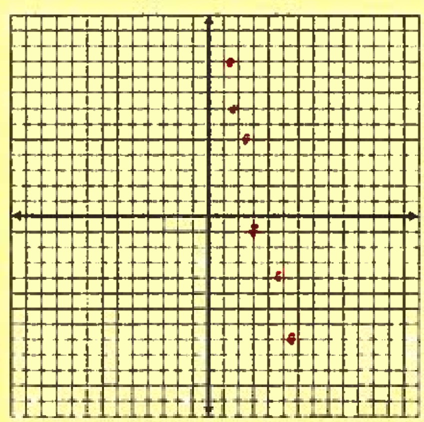
x	1	1	2	3	3	4	5	5	6
y	2	3	4	4	5	5	5	7	8



The correlation is: POSITIVE

b.

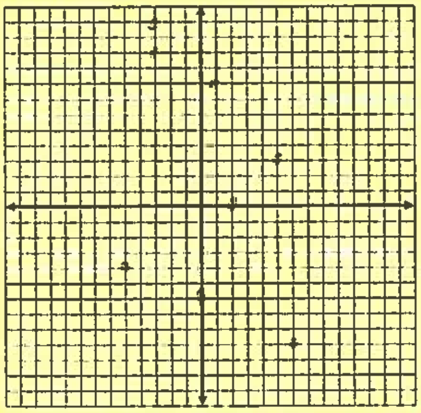
x	1.2	1.8	2.3	3.0	4.4	5.5
y	10	7	5	–1	–4	–8



The correlation is: NEGATIVE

c.

x	−5	−3	−3	0	1	2	5	6
y	−4	12	10	−6	8	0	3	−9



The correlation is: NO CORRELATION (RELATIONSHIP)

Line of Best Fit

The LINE that lies as CLOSE as possible to all the data points.

The line of best fit can be used to PREDICT values of points that are NOT in the ACTUAL collection of data.

ON SOL

The process of finding the line of best fit is called LINEAR REGRESSION.

To **find a line of best fit by hand**, create a SCATTER PLOT. Then, sketch a line that is CLOSE to all data values in the scatter plot. There should be about the same amount of points ABOVE the line as there are BELOW the line.

ON SOL

★ **Linear Model:** The EQUATION of the line of BEST FIT. The linear model is given in y = ax + b form where a is our SLOPE and b is our Y-INTERCEPT.

a → calculator calls "m" "a"

Finding the Linear Model using the Graphing Calculator

We can use TECHNOLOGY in order to find the most EXACT line of best fit.

ENTER THE DATA:

Press STAT ENTER . This allows us to edit our lists (enter numbers).

Position the cursor at the top empty space in column L1 and enter the values of the independent variable, x. Do this by typing the number and then pressing ENTER .

Position the cursor at the top empty space in column L2 and enter the values of the dependent variable, y.

Each row contains an ordered pair, so the lists L1 and L2 must have the same number of entries.

CLEARING YOUR LISTS:

To clear the lists, scroll up to L1 and press Clear one time. Scroll over to L2 and press Clear one time. (The numbers will not go away until you arrow back down.)

****NEVER use the delete button. This will completely remove the column.

→ THERE'S A DIFFERENCE BETWEEN DELETE/CLEAR

VIEW THE SCATTER PLOT:

Turn on stat plot by pressing 2nd Y= ENTER ENTER .

Press GRAPH .

To view all of the data points, press ZOOM 9 or adjust the Window.

FINDING THE LINEAR MODEL (EQUATION):

Press [STAT] [CALC] [4] [ENTER]

Round to at least FOUR decimal places.

GRAPH THE MODEL:

Type the equation into [Y=] . Then press [GRAPH] .

USING THE MODEL TO PREDICT VALUES:

Replace the given *x* or *y* value into the regression equation. Solve the equation for the missing variable.

Example 2: The quality control department at Tappan Industries experimented with the microwave defrosting cycle to see if there was a relationship between the number of ounces a steak weighs and the number of minutes it takes to defrost.

*MODEL = EQUATI

a) Find a model to fit the data.

a = 1.9728 b = 0.7739
Slope

$y = 1.9728x + 0.7739$

this is the model

Number of Ounces (x)	Number of Minutes (y)
2	6
4	12
10	13
14	26
17	36
18	40
24	48

y (how long)

b) Predict how long it will take to defrost 30 ounces.

x

$y = 1.9728(30) + 0.7739 = 59.957$

$\boxed{\approx 60 \text{ minutes}}$

x

c) How much meat can be defrosted in 30 minutes?

Find x

y

$30 = 1.9728x + \cancel{0.7739}$

$-0.7739 \quad -0.7739$

$\frac{29.2261}{1.9728} = \frac{1.9728x}{1.9728}$

$= 14.8 \approx \boxed{15 \text{ oz}}$

d) Predict how long it will take to defrost 52 ounces.

Find y

x

$y = 1.9728(52) + 0.7739 = 103.35$

≈ 103 minutes

Example 3: The table shows the number of active woodpecker clusters in a part of the De Soto National Forest in Mississippi.

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000
Active Clusters	22	24	27	27	34	40	42	45	51

a) Find a model to fit the data.

a = 3.7 (Slope)   b = -7350.5333

$y = 3.7x - 7350.5333$

b) Predict the number of active clusters in 2010.

$y = 3.7(2010) - 7350.5333 =$

$86.4667 \approx$ 86 clusters

c) In what year will the forest have 63 active clusters?

$63 = 3.7(x) - 7350.5333$

$+7350.5333 \quad +7350.5333$

$7413.5333 = 3.7x$

$2003.657 = x$

$2004 \approx x$

d) Estimate the number of active clusters in 1987.

$y = 3.7(1987) - 7350.5333 =$

$y = 1.3667 \approx 1$

Line of Best Fit/Linear Models/Linear Regression on the SOL

Example 4:

This question is <u>straight from</u> the Algebra 1 SOL Test from this past spring (2015).

$\{(^-5, 9), (2, 31), (9, 143), (11, 151), (0, 42), (5, 97)\}$

Using the equation of the line of best fit, which number is the best prediction of the output when the input is 13 ?

$a = 9.785121103$

$b = 42.95437262$

model $y = 9.7852x + 42.9544$

$y = 9.7852(13) + 42.9544$

$y = 170.162$

A 127

B 159

C 170

D 178

Example 5:

This question is <u>straight from</u> the Algebra 1 SOL Test from 2014.

The number of complaints a company received at the end of each of six weeks is shown in this table.

Company's Complaints

Week	Number of Complaints
1	225
2	205
3	187
4	169
5	147
6	130

Based on the line of best fit, how many complaints should the company expect at the end of week 8 ?

A 75

B 91

~~C 96~~

D 110

$y = ax + b$

$a = -19.05714$

$y = -19.0571x + 243.8667$

$y = -19.0571(8) + 243.8667$

$y = 91.4099$

Name KEY

Notes: Simplifying Cube Roots $\sqrt[3]{\ }$

Objectives:
- Identify the perfect cubes through five.
- Explain why you can have the cube root of a negative but not the square root of a negative.
- Simplify the cube root of a number.

Simplifying Cube Roots (numbers only)

*ALWAYS TAKE OUT A NEGATIVE TO SIMPLIFY COMPLETELY

PERFECT CUBES

$2^3 = 8$	$(-2)^3 = -8$
$3^3 = 27$	$(-3)^3 = -27$
$4^3 = 64$	$(-4)^3 = -64$
$5^3 = 125$	$(-5)^3 = -125$

Find the BIGGEST perfect cube factor. →
Take the CUBE root of the perfect cube.

Example: Simplify each radical completely.

a. $\sqrt[3]{8} = 2$

b. $\sqrt[3]{-54}$
$\sqrt[3]{-27\cdot2}$
$-3\sqrt[3]{2}$

c. $\sqrt[3]{250}$
$\sqrt[3]{125\cdot2}$
$5\sqrt[3]{2}$

d. $\sqrt[3]{-40}$
$\sqrt[3]{-8\cdot5}$
$-2\sqrt[3]{5}$

e. $2\sqrt[3]{128}$
$2\sqrt[3]{64\cdot2}$
$2\cdot4\sqrt[3]{2}$
$8\sqrt[3]{2}$

f. $4\sqrt[3]{-16}$
$4\sqrt[3]{-8\cdot2}$
$4\cdot-2\sqrt[3]{2}$
$-8\sqrt[3]{2}$

g. $-3\sqrt[3]{-24}$
$-3\sqrt[3]{-8\cdot3}$
$-3\cdot-2\sqrt[3]{3}$
$6\sqrt[3]{3}$

h. $-6\sqrt[3]{-8}$
$-6\cdot-2$
12

i. $5\sqrt[3]{64}$
$5\cdot4$
20

j. $-2\sqrt[3]{-500}$
$-2\sqrt[3]{-125\cdot4}$
$-2\cdot-5\sqrt[3]{4}$
$10\sqrt[3]{4}$

k. $6\sqrt[3]{-27}$
$6\cdot-3$
-18

l. $3\sqrt[3]{384}$
$3\sqrt[3]{64\cdot6}$
$3\cdot4\sqrt[3]{6}$
$12\sqrt[3]{6}$

SIMPLIFY CUBE ROOTS WITH VARIABLES, YOU LOOK FOR GROUPS OF THREE.

$2a\sqrt[3]{54a^6b^7d^3} = 2a\sqrt[3]{27\cdot2a^6b^7d^3}$
$2\cdot3a\sqrt[3]{2a^6b^7d^3}$
$2\cdot3a\cdot a^2b^2d\sqrt[3]{2b} = \boxed{6a^3b^2d\sqrt[3]{2b}}$

Name KEY

Notes: Simplifying Square Roots

Examples of Radicals

$\sqrt{20}$, $\sqrt{x^2y}$, $\sqrt[3]{8}$, $\sqrt[5]{102x^4}$ → 5th ROOT } RADICAL EXPRESSIONS

→ CUBED ROOT

SQ ROOT

Key Vocabulary:

Radical: The SQUARE ROOT symbol. PICTURE: $\sqrt{}$

Radicand: The EXPRESSION under the RADICAL.

Guide on How to Simplify ~~Perfect Squares~~ RADICALS:

Find the biggest PERFECT SQUARE factor. Take the SQUARE ROOT of the value and place it in **FRONT** of the ~~[illegible]~~ RADICAL.

When you find a SMALL perfect square factor, ensure that there are NO MORE perfect square factors before you complete the problem.

★ A radical is only SIMPLIFIED when there is NO more simplifying possible!

PERFECT SQUARES CHART:

$\sqrt{1} = 1$	$\sqrt{121} = 11$
$\sqrt{4} = 2$	$\sqrt{144} = 12$
$\sqrt{9} = 3$	$\sqrt{169} = 13$
$\sqrt{16} = 4$	$\sqrt{196} = 14$
$\sqrt{25} = 5$	$\sqrt{225} = 15$
$\sqrt{36} = 6$	$\sqrt{400} = 20$
$\sqrt{49} = 7$	$\sqrt{625} = 25$
$\sqrt{64} = 8$	
$\sqrt{81} = 9$	
$\sqrt{100} = 10$	

YOU ARE GOING TO WANT TO MEMORIZE THESE

Example 1: Find the biggest perfect square factor for each radical.

a. $\sqrt{8} = \sqrt{4\cdot 2} = \boxed{2\sqrt{2}}$

b. $\sqrt{20} = \sqrt{4\cdot 5} = \boxed{2\sqrt{5}}$

c. $\sqrt{320} = \sqrt{64\cdot 5} = \boxed{8\sqrt{5}}$

d. $\sqrt{48} = \sqrt{16\cdot 3} = \boxed{3\sqrt{3}}$

e. $\sqrt{162} = \cancel{\sqrt{9\cdot 18}}$ $\cancel{3\sqrt{18}}$ $\sqrt{81\cdot 2} = \boxed{9\sqrt{2}}$

f. $\sqrt{180} = \sqrt{36\cdot 5} = \boxed{6\sqrt{5}}$

Example 2: Simplify each radical completely.

a. $\cancel{\sqrt{8}}$

b. $\cancel{\sqrt{20}}$

c. $\cancel{\sqrt{320}}$

d. $\cancel{\sqrt{48}}$

e. $3\sqrt{162} = 3\sqrt{81\cdot 2}$
$= 3\cdot 9\sqrt{2}$
$= 27\sqrt{2}$

f. $2\sqrt{180} = 2\sqrt{36\cdot 5}$
$= 2\cdot 6\sqrt{5}$
$= \boxed{12\sqrt{5}}$

THINK ABOUT SOCK
IF YOU HAVE 4 SOCK
HOW MANY PAIRS (2)

Simplifying Square Roots with Variables

When simplifying square roots with variables, look for PAIRS of variables (groups of 2).

Example 3: Simplify each radical completely.

a. $\sqrt{x^2} =$ x

b. $\sqrt{x^4} =$ x^2

c. $\sqrt{y^6} =$ y^3

d. $\sqrt{c^8} =$ c^4

e. $\sqrt{x^3} =$ $\sqrt{x \cdot x \cdot x}$

x^{2}

$x\sqrt{x}$

f. $\sqrt{x^4y^5} =$

$x^2y^2\sqrt{y}$

g. $\sqrt{a^8b^{10}} =$

a^4b^5

h. $\sqrt{x^2y^2z^4} =$ $\sqrt{x\,x\,y\cdot y\cdot z}$

xyz^2

Example 4: Simplify each radical completely.

a. $\sqrt{32x^2}$

$\sqrt{16 \cdot 2 \cdot x^2}$

$4\sqrt{2x^2}$

$4x\sqrt{2}$

b. $\sqrt{75a^3b^4}$

$\sqrt{25 \cdot 3a^3b^4}$

$5ab^2\sqrt{3a}$

c. $2\sqrt{50x^3y}$

$2\sqrt{25 \cdot 2x^3y}$

$2 \cdot 5\sqrt{2x^3y}$

$10x\sqrt{2xy}$

d. $3x\sqrt{200x^4}$

e. $2a^2b\sqrt{24ab^2c^3}$

$2a^2b\sqrt{4 \cdot 6ab^2c^3}$

$4a^2b^2c\sqrt{6ac}$

f. $-5\sqrt{32x^5}$

$-5\sqrt{16 \cdot 2x^5}$

$-5 \cdot 4\sqrt{2x^5}$

$-20x^4\sqrt{2x}$

g. $2x\sqrt{16x^3y^4}$

h. $2ab^3\sqrt{4a^5b^3}$

i. $-3\sqrt{100x^4}$

Name: KEY

Notes: Quadratic Regression ("Curve of Best Fit") $y = ax^2 + bx + c$

We will follow the same steps as we did for a linear regression, except we will choose option 5 for "QuadReg".

Example : The table shows the height of a baseball hit, with x representing the time (in seconds) and y representing the baseball's height (in feet).

	Time, x	0	2	4	6	8
sec.	Time, x	0	2	4	6	8
ft.	Height, y	3	28	40	37	26

a) Find the quadratic model that best fits the data.

$y = -1.5536x^2 + 15.1786x + 3.3714$

$y=$ ___ $\rightarrow 9 = x$

b) Predict the height when the time is 9 seconds.

$y = -1.5536(9)^2 + 15.1786(9) + 3.3714$
$= 14.1372$ ≈ 14 ft

c) Predict the height when the time is 5 seconds.

$y = -1.5536(5)^2 + 15.1786(5) + 3.3714$
$= 40.4244$ ≈ 40 ft