Middle School Advanced Math

–

Using TI–84 Graphing Calculators to Dive Deeper Into 7th and 8th Grade Standards

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Your Presenters

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TI Regional Instructor

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TI Regional Instructor

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Norms

- Prepare your electronic devices for learning
- Be an active participant
- Respect the learning environment
- Questions and comments should be placed in the chat

Agenda

- ❑ Explore the uses of the calculator for basic computations.
- ❑ Examine features of the graphing calculator application
- ❑ Model data in a variety of ways to facilitate exploration.

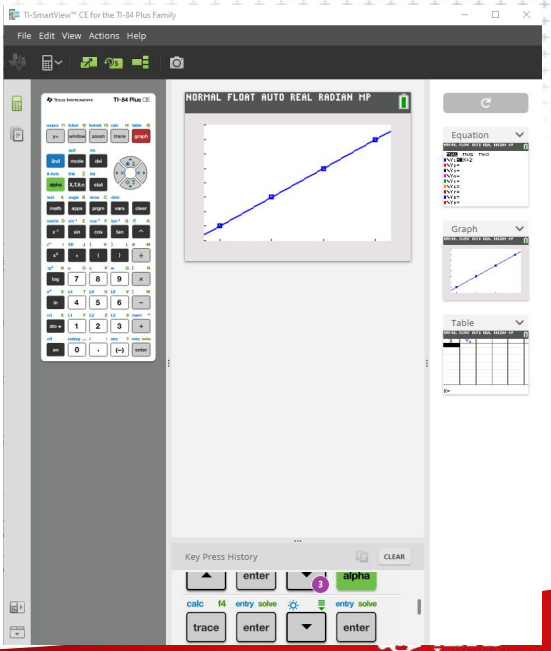
What is Your Level of Experience?

- ❑ **1** – I am new to the TI–84 graphing calculator family
- ❑ **2** – My students are only allowed to use the calculator features.
- ❑ **3** – My students use the calculator and graphing features.
- ❑ **4** – My students use their TI–84 everyday to investigate mathematical ideas.

CHAT

TI-SmartView Emulator

[Single Three-Year Software License Request Form]



Calculator Basics

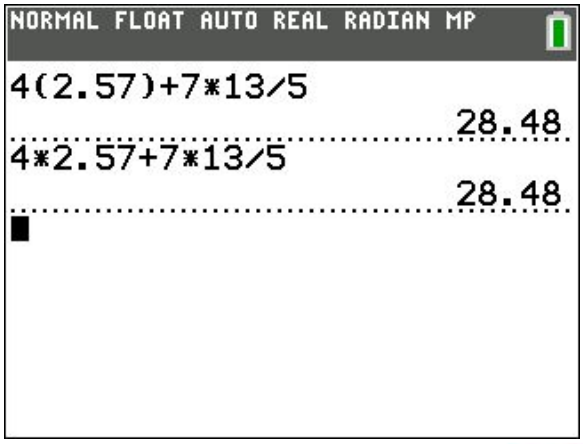
TEKS: 7.9A, 7.11A, 7.11B, 8.2B, 8.2D, 8.7A, 8.8C

Calculator Basics

- Order of Operations
- Overwrite mode
- Copy and paste
- Entering exponents
- Square root of a number
- Fractions and decimals
- Ordering real numbers
- Numeric Solver
- Store function

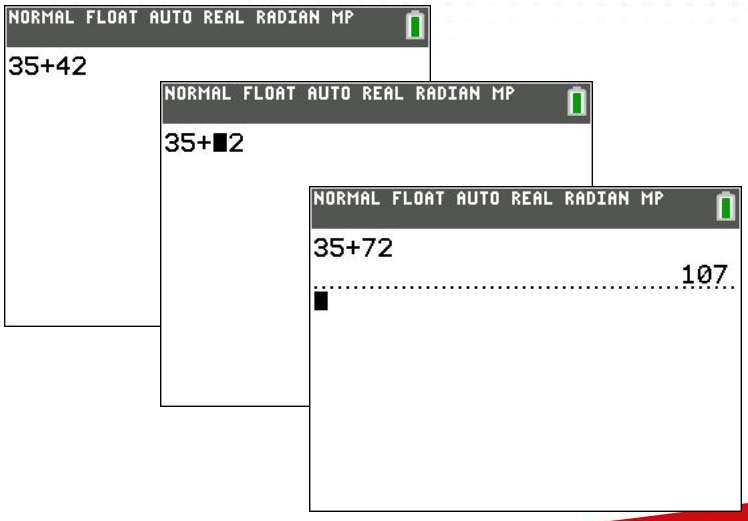
Order of Operations

$4\,(2.57) + 7 \cdot 13/5$



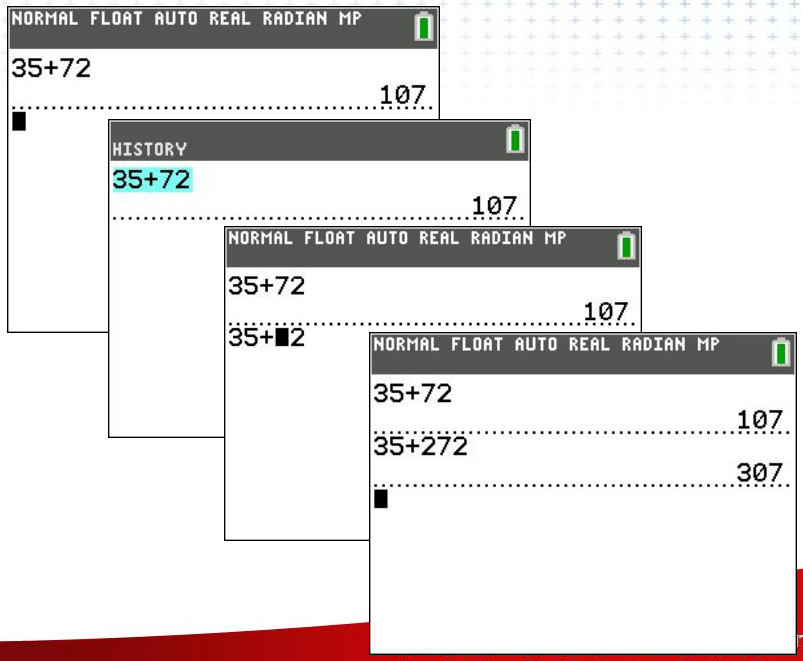
Overwrite Mode

35 + 72



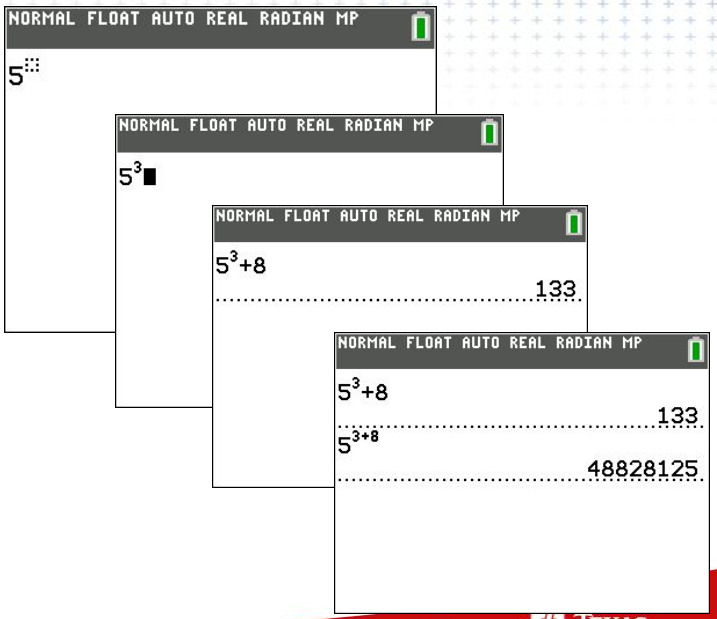
Copy and Paste

$35 + 272$



Entering Exponents

$5^3 + 8$

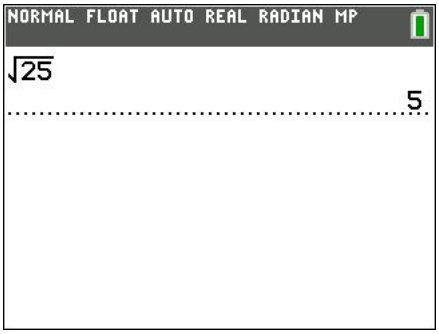


Square root of a number

$\sqrt{25}$

The square root function is located above the x² key.

To access this function press the 2nd key followed by the (x²) key.



Fractions and Decimals

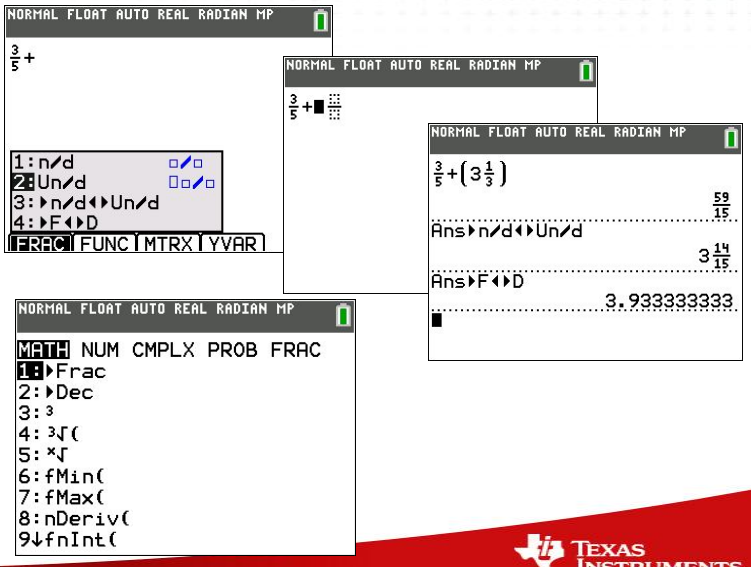
$\frac{3}{5} + 3\frac{1}{3}$

Press [alpha], [y=]

1. n/d is a template for a fraction
2. Un/d is a template for a mixed number
3. Converts a number between a fraction and mixed number
4. Converts a number between fractions and decimals

OR

[Math] and choose 1 or 2 to convert from Frac to Dec.

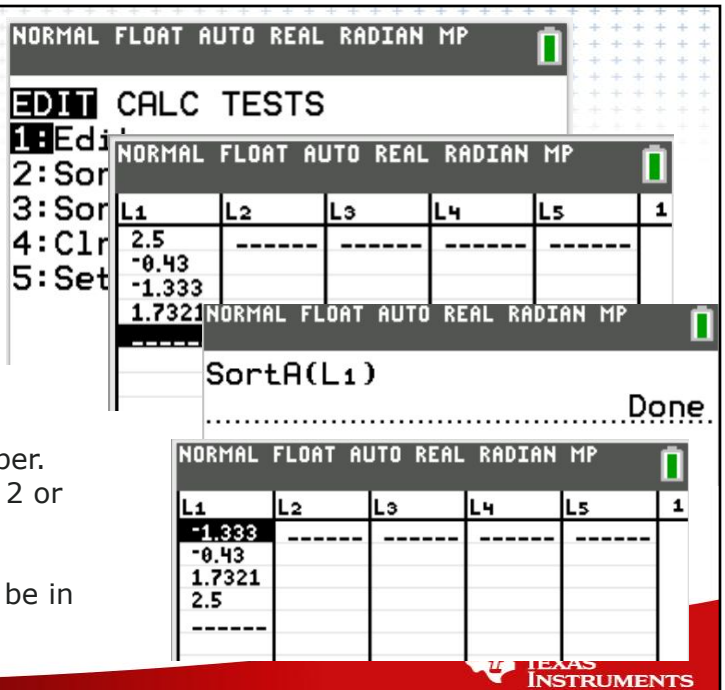


Ordering real numbers

Order the following numbers from least to greatest.

$$\frac{5}{2} \quad -.043 \quad -\frac{4}{3} \quad \sqrt{3}$$

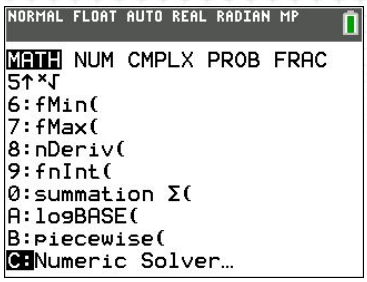
Press [Stat], Edit.
Put the numbers in L1 recording the decimal representation of each number.
Hit [Stat] again, but this time select 2 or 3 based on the question.
Enter L1 within the parenthesis.
Go back to the list and numbers will be in order from least to greatest.

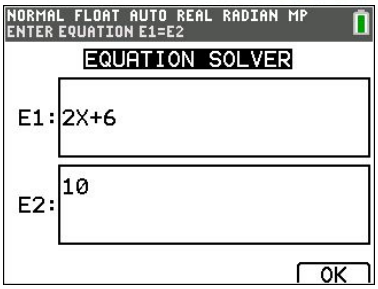


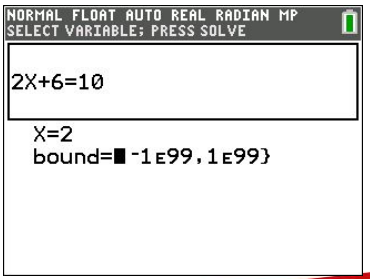
Numeric Solver

Solve ***2x + 6 = 10***

- **[Math],** arrow to **Numeric Solver**
- Enter each side of the equation into E1 and E2. Hit [enter[.
- Then hit [alpha] solve (enter) or alpha f5.

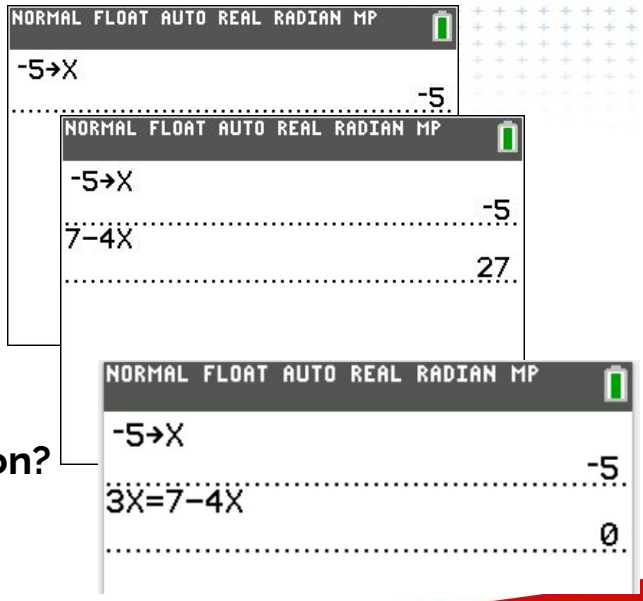






Store Function

For $f(x) = 7 - 4x$
What is the value of f(-5)?



For $3x = 7 - 4x$, is -5 a solution?

Let's Practice Calculator Basics

Ordering Real Numbers

List the following numbers in order from least to greatest.

$$-7\frac{7}{10} \quad -7.16 \quad -\sqrt{61} \quad -\frac{68}{9}$$

Let's Practice Calculator Basics

Numeric Solver, Store Function, or Boolean Check

Which value of ***x*** makes this equation true?

$$4x - 1 = 6x + 8 - 8x + 15$$

A. 4
B. 12
C. -2
D. 8

Standards Supported by Calculator

7.9 Expressions, equations, and relationships. The student applies mathematical process standards to solve geometric problems. The student is expected to:

(A) solve problems involving the volume of rectangular prisms, triangular prisms, rectangular pyramids, and triangular pyramids;

(C) determine the area of composite figures containing combinations of rectangles, squares, parallelograms, trapezoids, triangles, semicircles, and quarter circles

7.11 Expressions, equations, and relationships. The student applies mathematical process standards to solve one-variable equations and inequalities. The student is expected to:

(A) model and solve one-variable, two-step equations and inequalities;

(B) determine if the given value(s) make(s) one-variable, two-step equations and inequalities true; and

(C) write and solve equations using geometry concepts, including the sum of the angles in a triangle, and angle relationships.

Standards Supported by Calculator

8.2 Number and operations. The student applies mathematical process standards to represent and use real numbers in a variety of forms. The student is expected to:

(B) approximate the value of an irrational number, including π and square roots of numbers less than 225, and locate that rational number approximation on a number line;

(D) order a set of real numbers arising from mathematical and real-world contexts

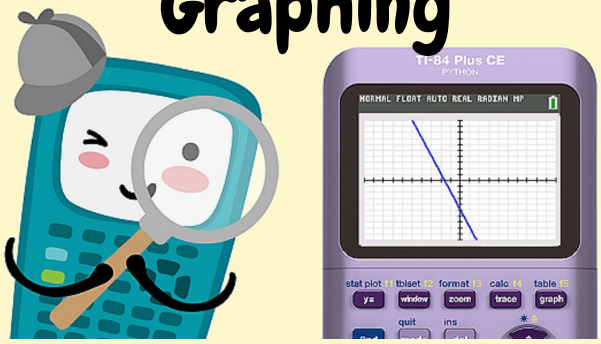
8.7 Expressions, equations, and relationships. The student applies mathematical process standards to use geometry to solve problems. The student is expected to:

(A) solve problems involving the volume of cylinders, cones, and spheres;

8.8 Expressions, equations, and relationships. The student applies mathematical process standards to use one-variable equations or inequalities in problem situations. The student is expected to:

(C) model and solve one-variable equations with variables on both sides of the equal sign that represent mathematical and real-world problems using rational number coefficients and constants;

Graphing



TEKS: 7.4A, 7.7A, 7.11A, 8.4B, 8.5B, 8.5I, 8.8C

Graphing

- Graph functions
- Change viewing grid
- Trace points on the function
- Determine key attributes of the function
- Work with tables of the function and adjust table settings

Graph the following line:

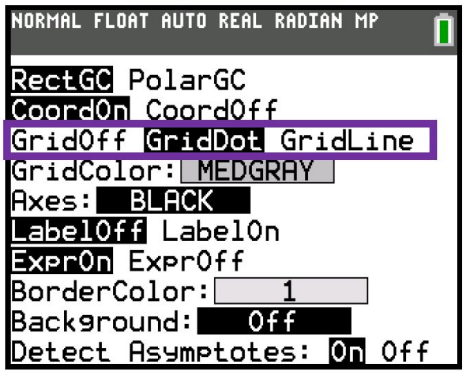
$$f(x) = 3x + 4$$

Grid Lines

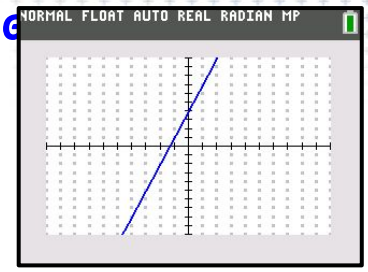
Press 2nd, ZOOM [FORMAT]

In the third row, you can select:

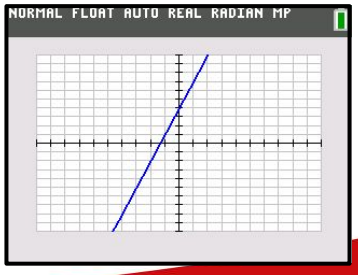
- GridOff: No grid
- GridDot: Dot grid
- GridLine: Line Grid



Dot G

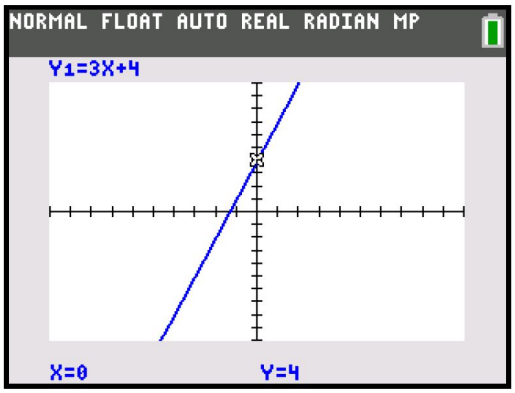


Line Grid



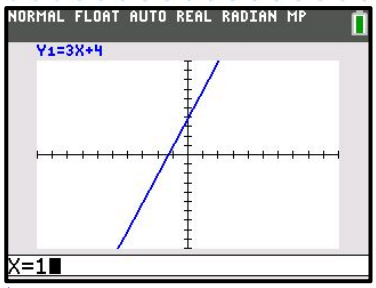
Graph Trace

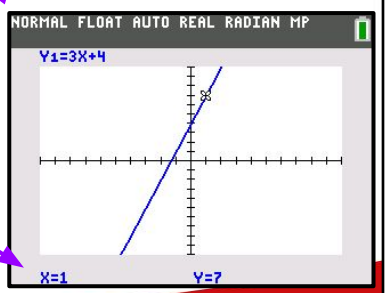
Press TRACE



Use arrows to move left/right on the graph. Coordinates will display below the graph.

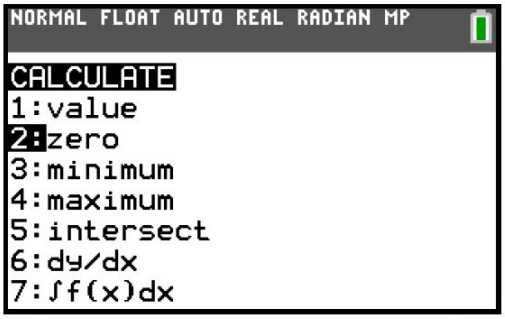
OR type in a value for "x" and press ENTER



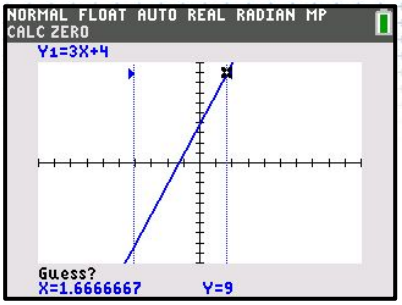


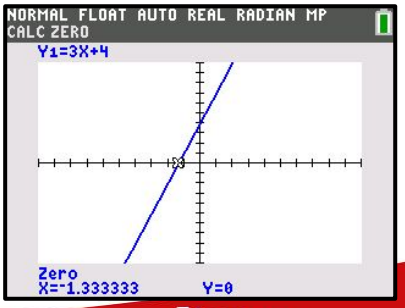
Analyze Graph (calc)

Press 2nd, TRACE [CALC]



Use the left/right arrows to select the left/right bounds, pressing ENTER to make selections. Then press ENTER for "check." The zero (x-intercept) will show at the bottom of the graph.





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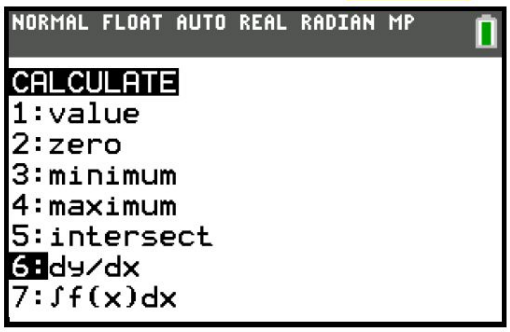
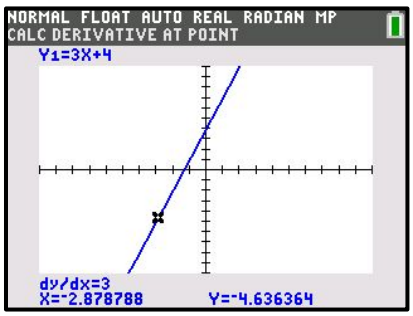
Analyze Graph (calc)

Press 2nd, TRACE [CALC]



Use the arrows to select any part of the line and then press ENTER. The slope will show at the bottom of the graph.



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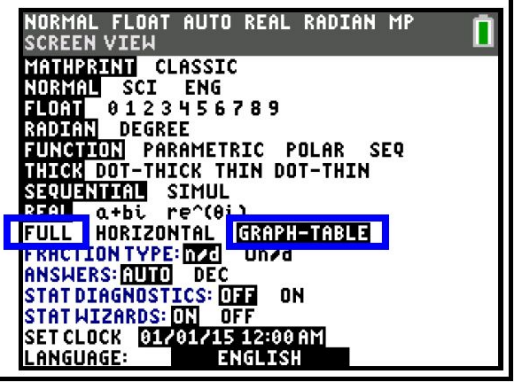
Split Screen Tables

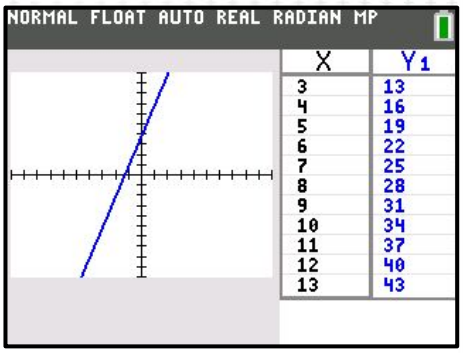
Enter the equation into Y=

Press MODE

Scroll down to 9th row and select Graph-Table.

To undo, press MODE again and select Full.





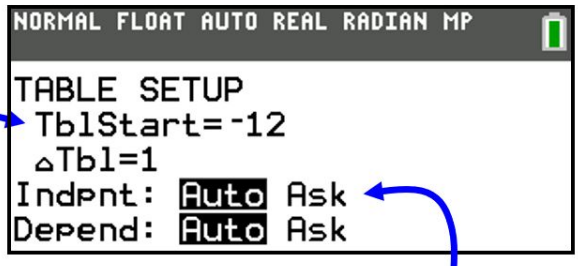
Can obtain function values from either the table or the graph

Table Settings

To change table settings,

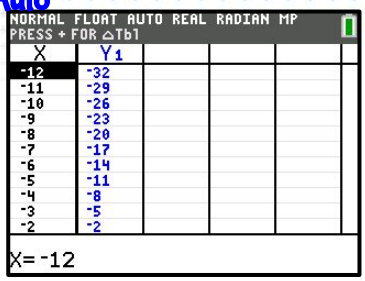
Press 2nd, WINDOW

Change the starting value or step of the table

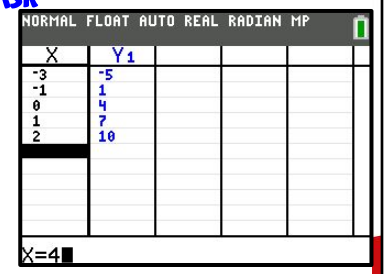


Change from "auto" to "ask" to input specific x-values.

Auto



Ask



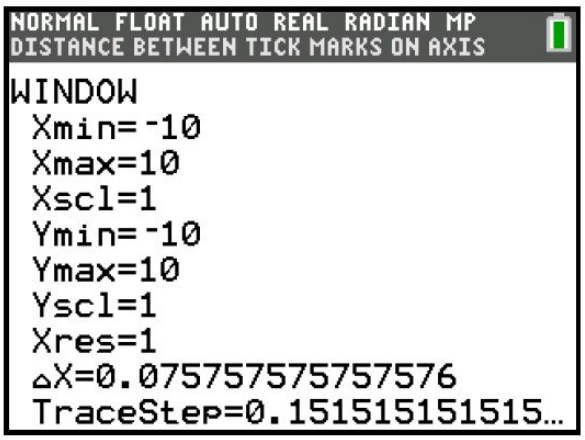
Let's add the graph of the following line on the same

$$f(x) = -\frac{2}{3}x + 15$$

Change Window

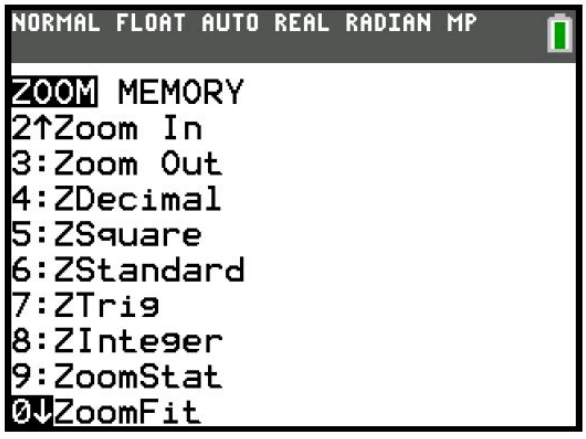
Press WINDOW

Change values to adjust your window as desired.



Zoom

Press [ZOOM]



2: **Zoom-In** →
If you need a closer look

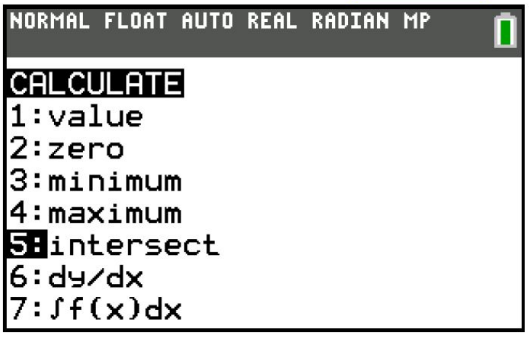
3: **Zoom-Out** →
If you can't see your graph

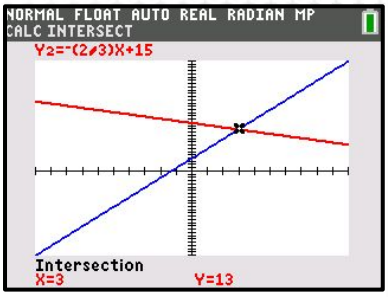
6: **Zoom-Standard** →
Returns the window to original setting

0: **Zoom-Fit**→
Readjust the grid to fit most graphs

Analyze Graph (calc)

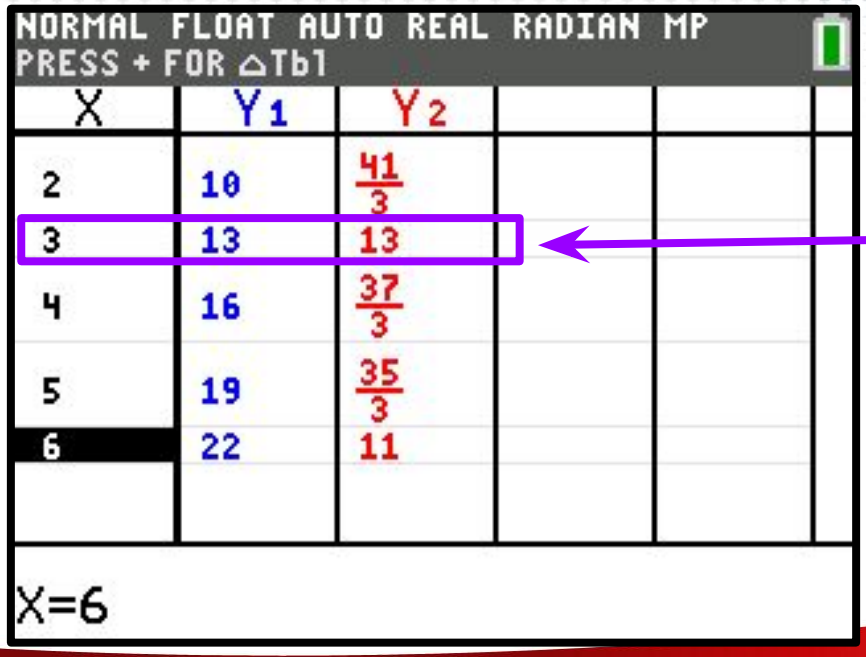
Press [2nd], [TRACE] [CALC]





Select 5:Intersect then press [ENTER] three times. The intersection will show at the bottom of the graph.

Note: Intersection must show on the screen



The table can also be used to find the solution in our example

Standards Graphing Can Support

7.4 Proportionality. The student applies mathematical process standards to represent and solve problems involving proportional relationships. The student is expected to:

(A) represent constant rates of change in mathematical and real-world problems given pictorial, tabular, verbal, numeric, graphical, and algebraic representations, including d = rt.

7.7 Expressions, equations, and relationships. The student applies mathematical process standards to represent linear relationships using multiple representations. The student is expected to:

(A) represent linear relationships using verbal descriptions, tables, graphs, and equations that simplify to the form y = mx + b.

7.11 Expressions, equations, and relationships. The student applies mathematical process standards to solve one-variable equations and inequalities. The student is expected to:

(A) model and solve one-variable, two-step equations ~~and inequalities~~.

Standards Graphing Can Support

8.4 Proportionality. The student applies mathematical process standards to explain proportional and non-proportional relationships involving slope. The student is expected to:

(B) graph proportional relationships, interpreting the unit rate as the slope of the line that models the relationship.

8.5 Proportionality. The student applies mathematical process standards to use proportional and nonproportional relationships to develop foundational concepts of functions. The student is expected to:

(B) represent linear non-proportional situations with tables, graphs, and equations in the form of $y = mx + b$, where $b \neq 0$.

(I) write an equation in the form $y = mx + b$ to model a linear relationship between two quantities using verbal, numerical, tabular, and graphical representations.

8.8 Expressions, equations, and relationships. The student applies mathematical process standards to use one-variable equations or inequalities in problem situations. The student is expected to:

(C) model and solve one-variable equations with variables on both sides of the equal sign that represent mathematical and real-world problems using rational number coefficients and constants.

Data & Statistics

Dot Plots & Scatterplots

TEKS: 8.5C, 8.5D, 8.11A

Histograms, Box Plots

TEKS: 7.6F, 7.6G, 7.12C, 7.12C

Inchworm

George wanted to know:

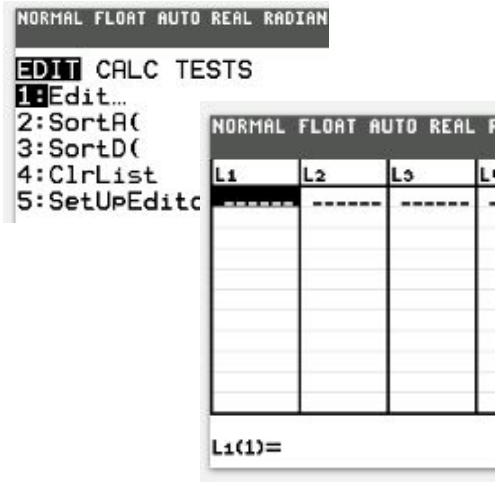
1. How far can an inchworm travel in 5 minutes?
2. How many minutes it would take the worm to travel 12 cm.

He collected data and found his pet inchworm took 1 minute to crawl 2 cm, 2 minutes to crawl 3.5 cm, and 3 minutes to crawl 6.5 cm.

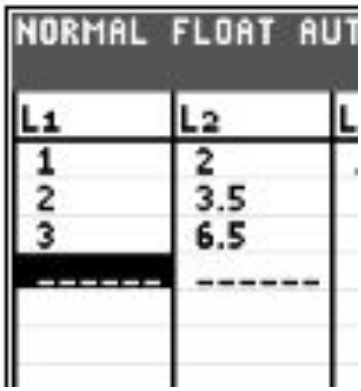
Build a scatter plot and analyze the data to help George find the answers to his questions.

Building a Table

Press STAT, 1 Edit…, ENTER

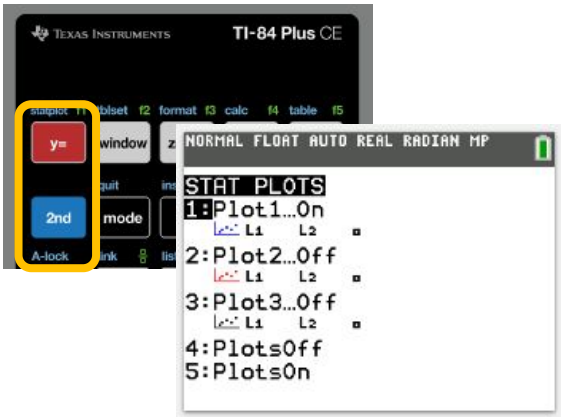


Enter ***time*** in L1 and ***distance*** in L2

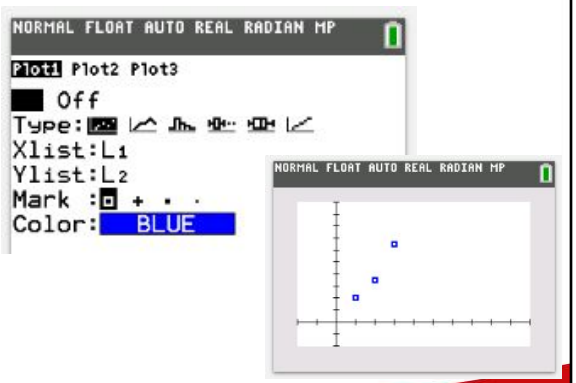


Creating a Scatterplot

2nd , Y=, 1: Plots On, Enter

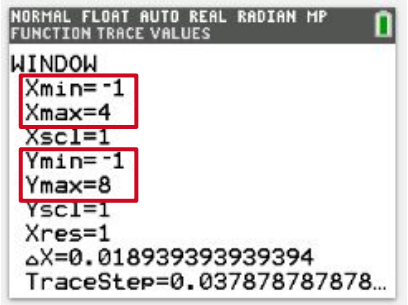


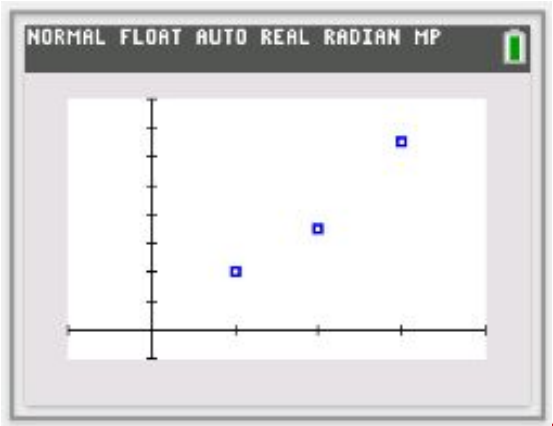
PLOT 1: ON, Scatterplot, L1, L2, Big Dot, Blue, GRAPH



Adjust the Window

Window, set the parameters, Graph





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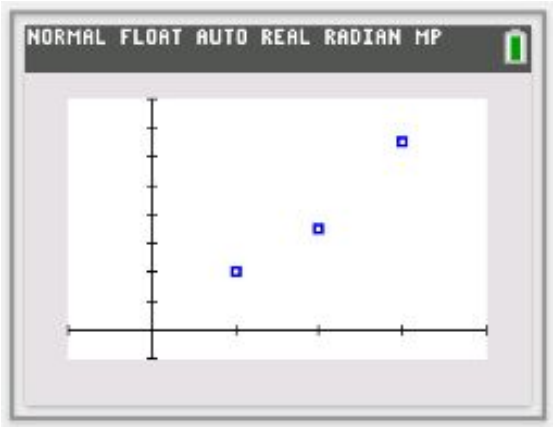
Questions to Ask from the Scatterplot

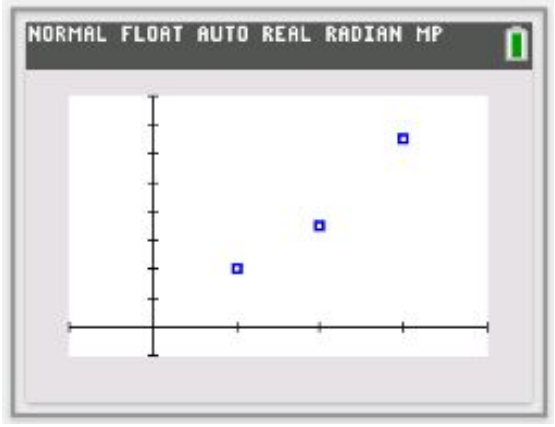


Complete the following sentence stem based on the graph:

The graph data appears to be __ (linear, nonlinear).

The graph data appears to be linear.

Questions to Ask from the Scatterplot

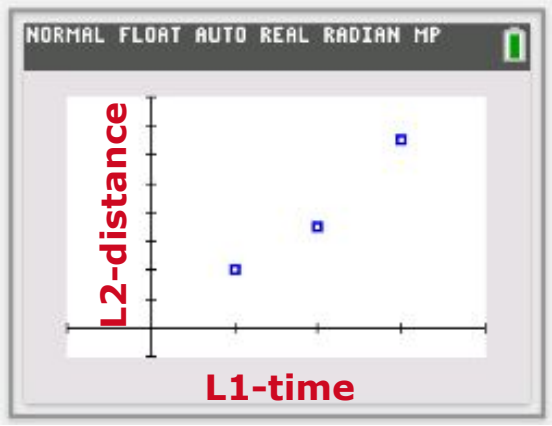


Complete the following sentence stem based on the graph:

The data appears to have __ (positive, negative, no) correlation.

The data appears to have positive correlation.

Questions to Ask from the Scatterplot



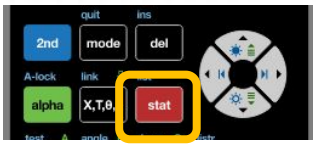
Complete the following sentence stem based on the graph:

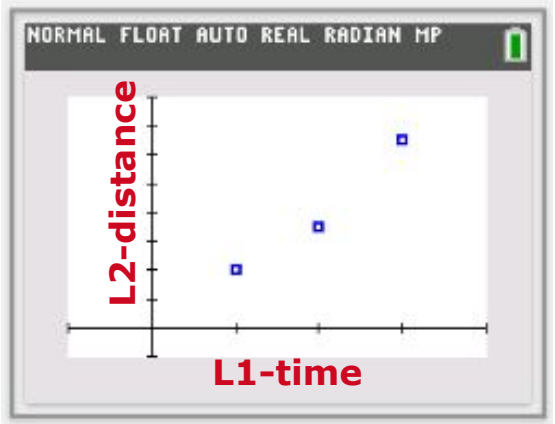
As __ (independent variable) increases,
the __ (dependent variable)
__ (increases or decreases).

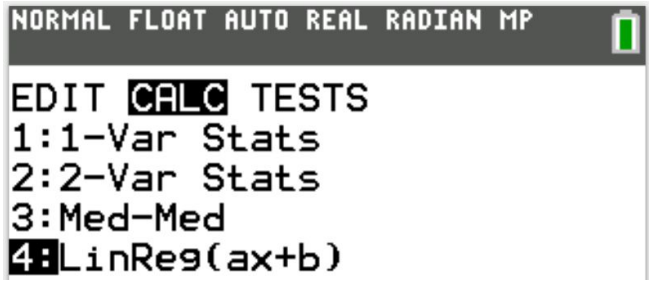
As time increases, distance increases.

Making Predictions with Linear Regression

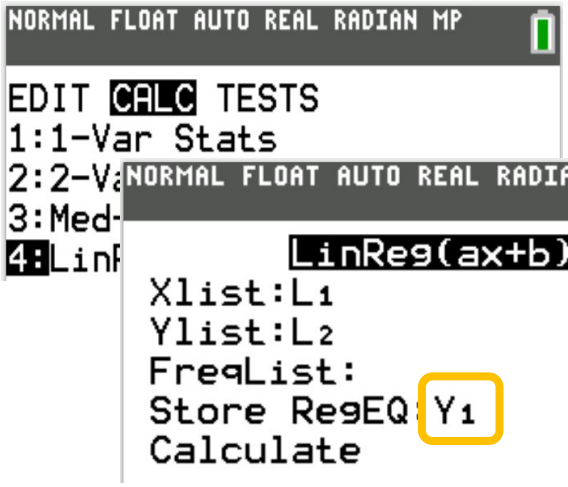
STAT, CALC, 4 LinReg (ax+b), ENTER



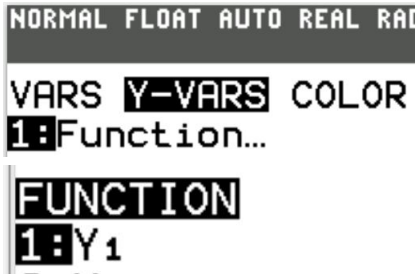




Making Predictions with Linear Regression



To get Y1, press VARS, Y-VARS, 1, 1



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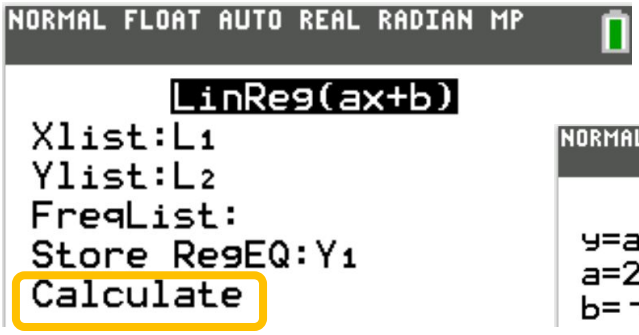
Making Predictions with Linear Regression

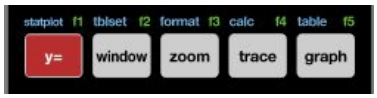
Highlight CALCULATE and press ENTER

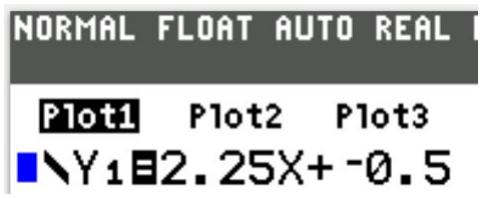


48

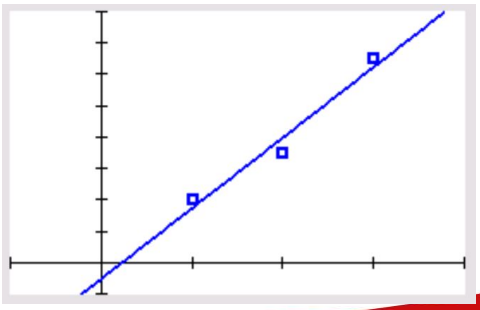
Making Predictions with Linear Regression

Press Y=





Press GRAPH



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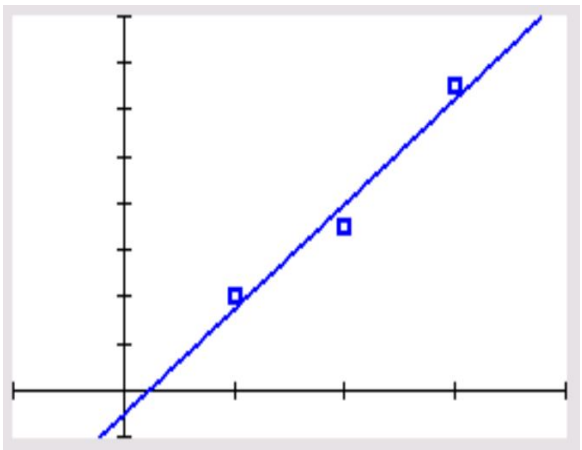
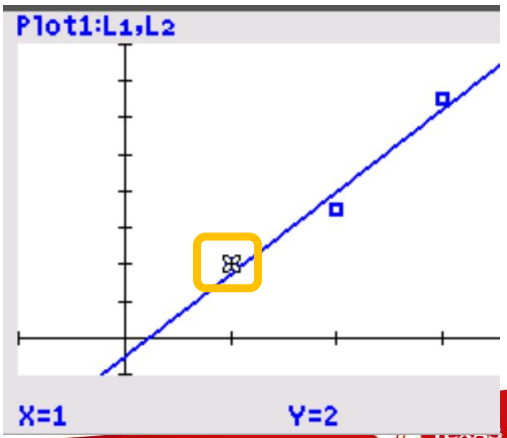
Making Predictions with Linear Regression



Press TRACE

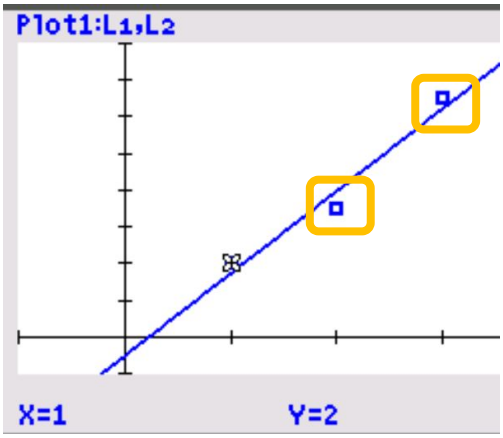


Press Y=

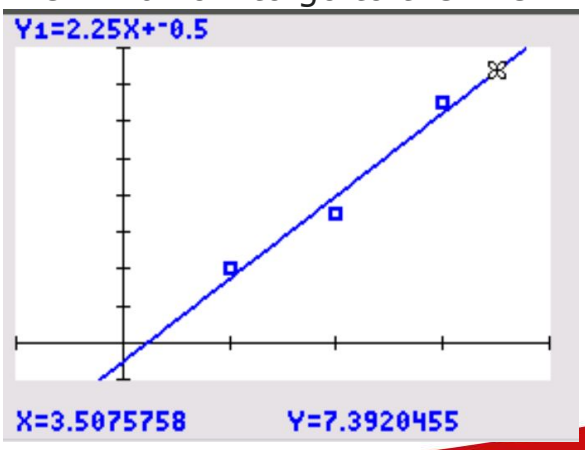
50

Making Predictions with Linear Regression

RIGHT arrow to go to the points



DOWN arrow to go to the line

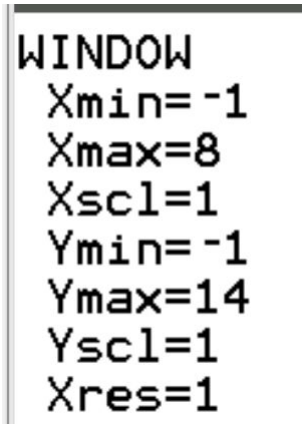


Press Y=

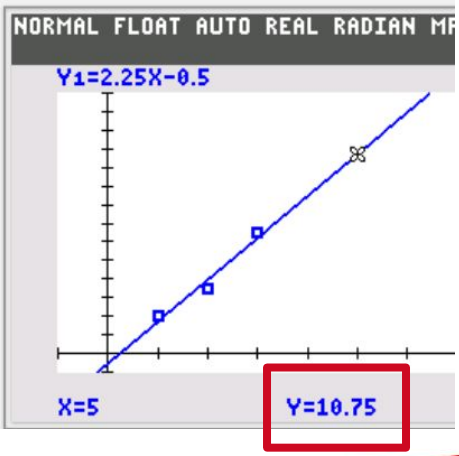
51

How far will inchworm travel in 5 minutes?

Reset the window



Press TRACE, 5, ENTER



The inchworm can travel 10.75 cm in 5 minutes!

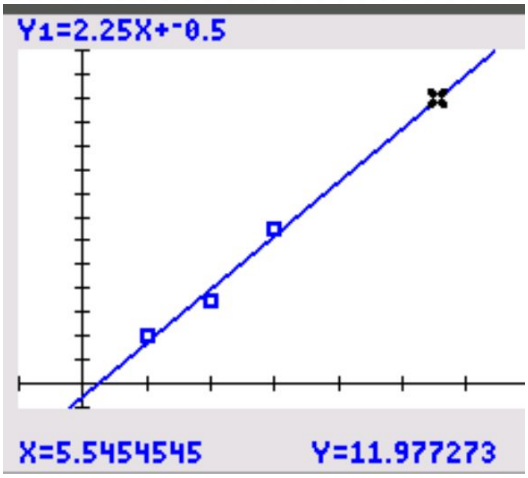
Press Y=

52

How long will it take the inchworm to go 12 cm?

RIGHT arrow on line to get as close as you can to y=12.

Type more precise x-values to get closer.



The inchworm will take about 5.5 minutes to crawl 12 cm!

Press Y=

Statistics Standards Supported

8.5 Proportionality. The student applies mathematical process standards to use proportional and non-proportional relationships to develop foundational concepts of functions. The student is expected to:

(C) contrast bivariate sets of data that suggest a linear relationship with bivariate sets of data that do not suggest a linear relationship from a graphical representation;

(D) use a trend line that approximates the linear relationship between bivariate sets of data to make predictions;

8.11 Measurement and data. The student applies mathematical process standards to use statistical procedures to describe data. The student is expected to:

(A) construct a scatterplot and describe the observed data to address questions of association such as linear, non-linear, and no association between bivariate data;

Statistics Standards Supported (3-Hr Workshop)

7.6 Proportionality. The student applies mathematical process standards to use probability and statistics to describe or solve problems involving proportional relationships. The student is expected to:

(F) use data from a random sample to make inferences about a population;

(G) solve problems using data represented in bar graphs, dot plots, and ~~circle graphs~~, including part-to-whole and part-to-part comparisons and equivalents;

7.12 Measurement and data. The student applies mathematical process standards to use statistical representations to analyze data. The student is expected to:

(A) compare two groups of numeric data using comparative dot plots or box plots by comparing their shapes, centers, and spreads;

(C) compare two populations based on data in random samples from these populations, including informal comparative inferences about differences between the two populations.

In the 3–hour training participants will:

- Investigate multiple ways to solve problems.
- Apply learning in classroom setting
- Implement strategies that are helpful with your students.
- Acquire in-depth instructions on ways to use your device on STAAR-like questions.
- Access exploration activities to engage learners.

Questions?

Thank You!

Mendy Caviness
TI Regional Instructor

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