Math 70 3.1, 3.2 and 3.3 Intro to Graphing

Lesson 5

3.1 Plotting Points and Scaling Graphs

Objectives

1) Plot points (ordered pairs)
2) Read points from a given graph
3) Identify quadrants and axes
4) Adjusting Window in GC

3.2 Graphing Equations

Objectives

1) Determine if an ordered pair is a solution of an equation.
2) Graph linear equations
3) Graph nonlinear equations, incl. abs. values.
4) Determine whether an equation is linear or nonlinear

3.3 Linear Equations & Intercepts

Objectives

1) Recognize Standard form of linear equation
2) Find x-intercept and y-intercept of a linear equation.
3) Using intercepts to graph a line
4) Graphing Vertical & horizontal lines

Math 70 5/e

Graphing Equations
Adjusting the Window Size

GC 15 Settings and Basic Graph
Examples 1-8

GC 17 Changing the Window
Examples 1-7

GC 16 Linear vs. Nonlinear Graphs, Zoom Out and Zoom In
Examples 1-7 and 10
(do Ex 8 & 9 afterclass)

GC 14 Absolute Value Graphs
Example 1-7
(do 8 – 10 after class)

GC 18 Cursor, Trace, Value, Zoom Integer
Examples 1-6 time permitting

Remember:

To find x-intercept, set $y = 0$ and solve for x
Get $(x, 0)$ ordered pair on graph
and on x-axis

To find y-intercept, set $x = 0$ and solve for y
Get $(0, y)$ ordered pair on graph
and on y-axis

Graphing Linear Equations

These techniques are a review of Math 45, though we now use function notation in place of y, occasionally.

Objectives:

1) Graph linear functions
   - plot points (make table)
   - find x-intercept and y-intercept
   - plot y-intercept and use slope
   - plot any point on line and use slope

2) Graph vertical and horizontal lines.

> See GC16 for a reminder of what characteristics of an equation or expression are linear or non-linear.

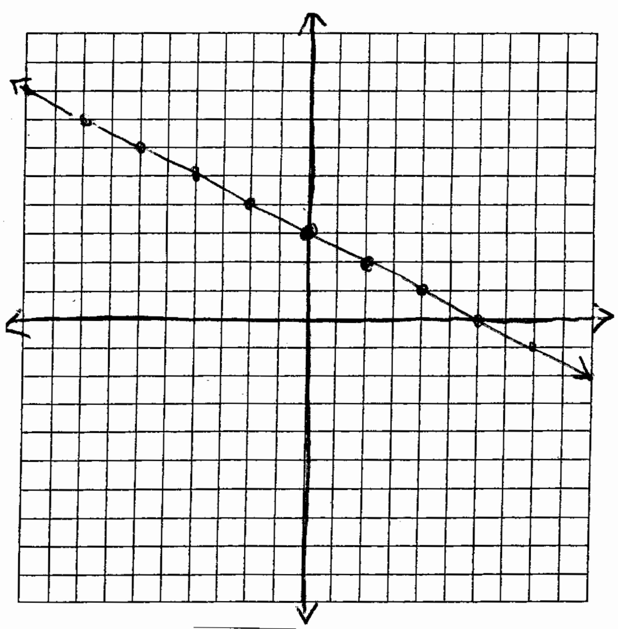
Graph neatly.

① $g(x) = -.5x + 3$

$m = -.5 = -\frac{1}{2}$

$b = 3 \Rightarrow (0,3)$

> Recall:
> Slope-intercept form
> $y = mx + b$
> m = slope
> b = y-coord of y-int



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② $x - 3y = 6$

x-int: set $y = 0$

$x - 3(0) = 6$

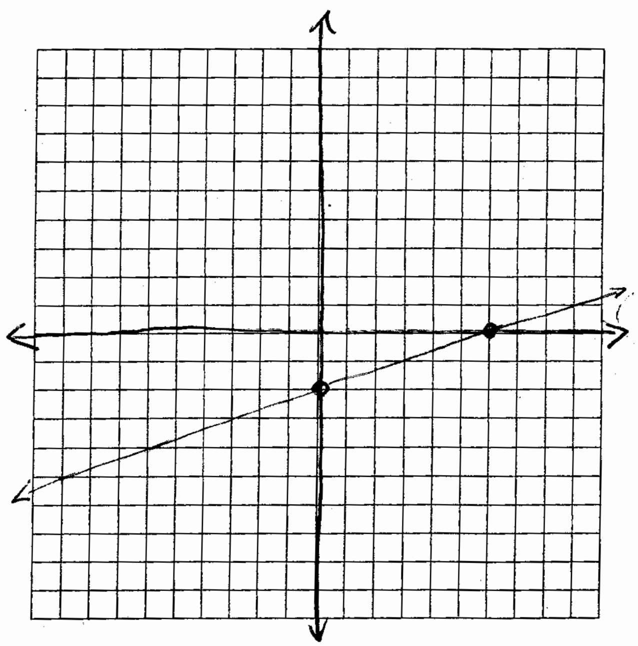
$x = 6 \Rightarrow (6, 0)$

y-int: set $x = 0$

$0 - 3y = 6$

$-3y = 6$

$y = -2 \Rightarrow (0, -2)$



③ $x = -2y$

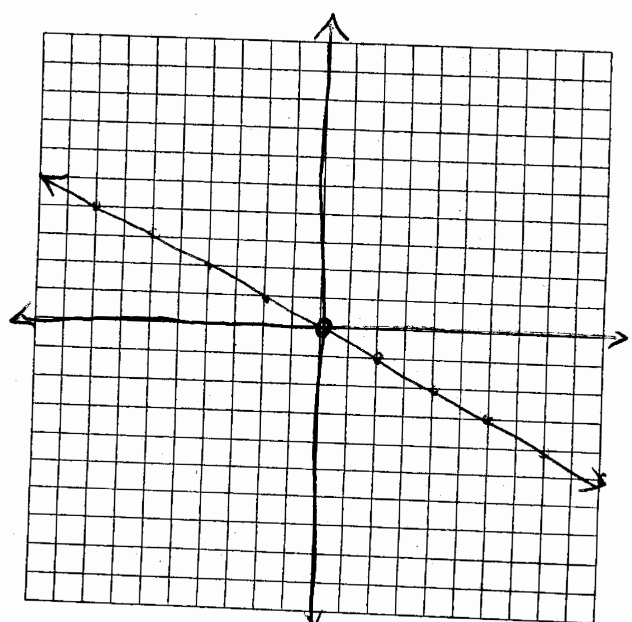
$\frac{x}{-2} = y$

$y = -\frac{1}{2}x$

$y = -\frac{1}{2}x + 0$

$m = -\frac{1}{2}$

$b = 0 \Rightarrow (0, 0)$



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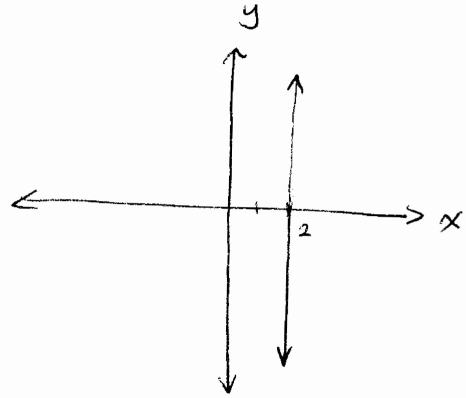
(4) $x = 2$

vertical

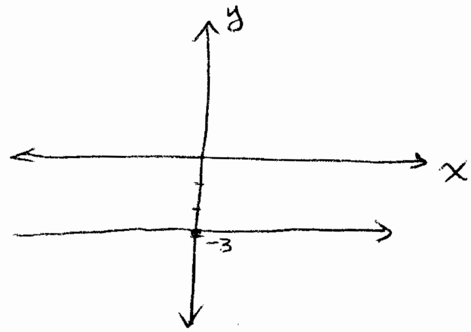
x-variable but no y.



(5) $y = -3$

horizontal

y-variable but no x



(6) The cost of renting a car for a day is given by $C(x) = 35 + 0.15x$, where $C(x)$ represents the cost in dollars and x is the number of miles driven.

a) Graph the function

b) Complete the chart

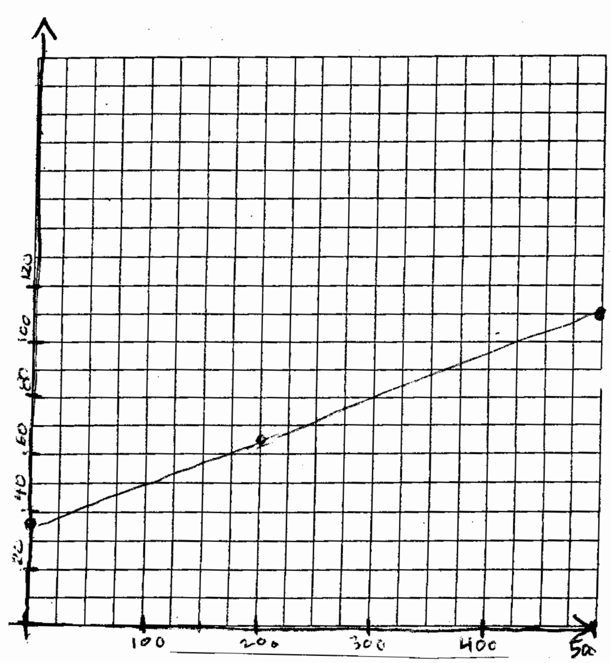
x	150	200	325	500
C(x)				

$y = 0.15x + 35$

$m = 0.15 = \frac{3}{20}$ (use > frac)

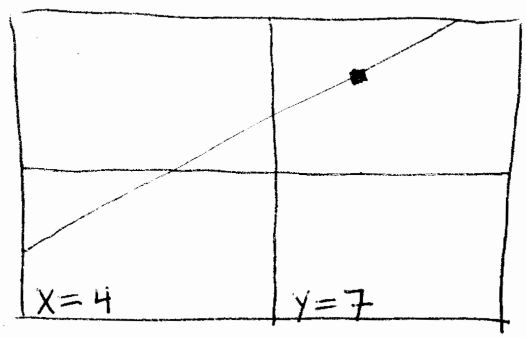
Complete chart (use Ask table)

x	C(x)
150	57.5
200	65
325	83.75
500	110



M70 MG

⑦ A graphing calculator screen is given.



Which is true?

a) $f(7)=4$

b) $f(4)=0$

c) $f(0)=7$

d) $f(4)=7$

$x=4$ and $y=7$ means $f(4)=7$, **d.**

⑧ The cost of in-state tuition and fees for attending a public 4-year college full-time can be estimated by the linear function $f(x)=318x+4467$, where x is the number of years after 2000 and $f(x)$ is the total cost in dollars.

a) Use $f(x)$ to approximate yearly cost in 2016.
- algebraically
- on GC using graph

b) Use $f(x)$ to predict when costs will exceed \$10,000.
- algebraically
- on GC using graph

a) $2016 - 2000 = 16$ } 16 years after 2000

$f(16) = 318(16)+4467 =$ **\$9555**

on GC graph

[Y=] $Y_1 = 318x+4467$, [WINDOW] XMAX > 16

[2nd][TRACE] = [CALC]

option 1: value

$x=16$ enter $\Rightarrow$ $Y = 9555$

b) $10,000 = 318x+4467$

$5533 = 318x$

$x \approx 17.399$ $\Rightarrow$ during 18th year.

$2000+18 =$ **2018**

on GC [Y=] Y_1 as above, $Y_2 = 10,000$

WINDOW YMAX > 10,000   2nd TRACE CALC, option 5, intersect

Rev 12-2-11

Name ____________________

Date ____________________

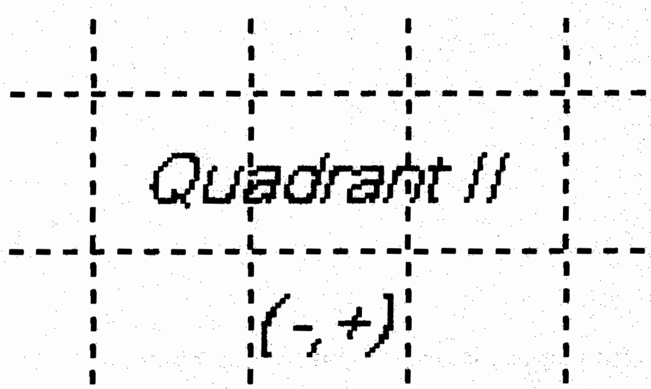
TI-84+ GC 12 Scale, Quadrants, and Axis Placement on Paper

Objectives: Identify the scale of an existing graph
Determine useful scales for x- and y-axes for graphing given points
Determine useful axis placement for a graphing given points
Neatly graph points on shifted axes and/or scale not equal to 1
Neatly graph points requiring a discontinuous axis

When the GC draws a graph, it will place the graph on standard axes or altered axes that you choose. If a graph does not show in the standard window, you'll need to choose the placement of the axes and the scales to show a graph you can transfer to your paper, where it will be graded.

The scale of a graph is the numerical value of a tick mark. Since the scale of the x-axis does not have to be the same as the scale of the y-axis, the scales should be written on both axes. Choosing a good scale makes graphing easier, and sometimes clearer or smaller. Scales are always positive.

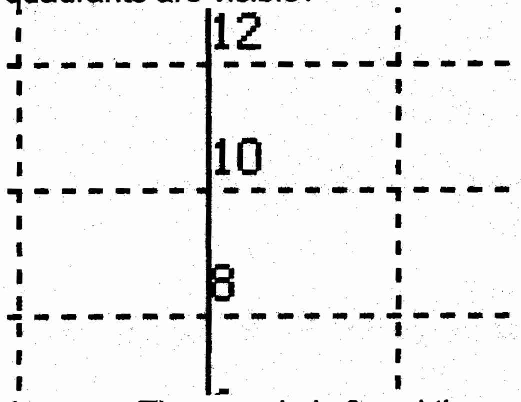
Recall the quadrants of a rectangular coordinate system, given by Roman numerals.



The origin (0,0), where the x-axis crosses the y-axis, can be drawn anywhere on the graph. Choosing a good location for the origin (also called axis placement) can make the graph easier or clearer (or smaller), and is determined by which quadrant(s) we need to see.

Points have these signs:	Need these quadrants:	Place the axes in this way:
(+,+) (-,+) (-,-) and (+,-)	QI, QII, QIII and QIV	Origin near center of graph
(+,+)	QI only	Origin at lower left corner
(-,+)	QII only	Origin at lower right corner
(-,-)	QIII only	Origin at upper right corner
(+,-)	QIV only	Origin at upper left corner
(+,+) and (-,+)	QI and QII	Origin at center bottom
(-,+) and (-,-)	QII and QIII	Origin at center right
(-,-) and (+,-)	QIII and QIV	Origin at center top
(+,+) and (+,-)	QI and QIV	Origin at center left
any three	any three quadrants	Origin near center of graph

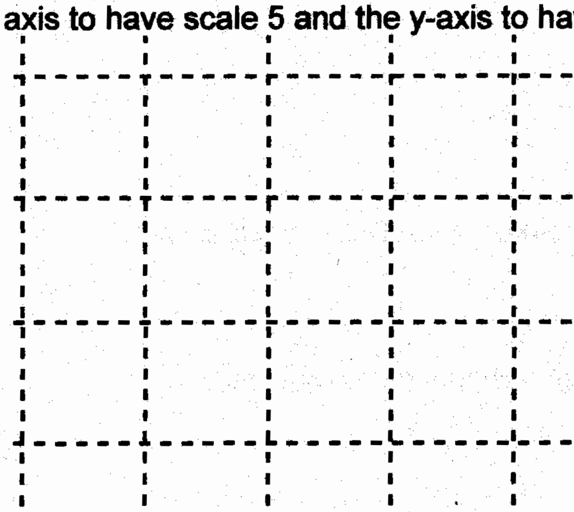
Example 1: Find the scale of the x-axis and the scale of the y-axis. Where is the origin? Which quadrants are visible?

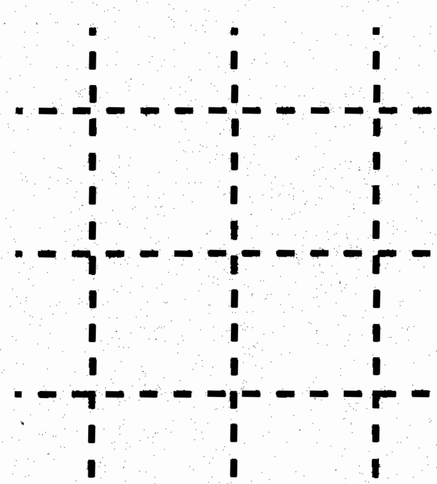


Answer: The x-scale is 3 and the y-scale is 2. The origin is in the lower left corner. QI is visible.

> When the points to be plotted are very large, it's helpful to draw the scale using tick marks representing large numbers. When the points to be plotted have similar fractional or decimal parts, that fraction or decimal may be a useful scale.
>
> CAUTION: When choosing the scale for the x-axis, consider only the x-coordinates. Similarly, when choosing the scale for the y-axis, consider only the y-coordinates.

Example 2: On the graph below, draw the axes so that quadrants II and III are visible. Mark the x-axis to have scale 5 and the y-axis to have scale 100.



Answer: 

Example 3: Without graphing (0,-10), (5,-5), and (10,0), identify which quadrants must be visible, and describe the location of the origin on the graph paper. What would be a useful x-scale? What would be a useful y-scale?

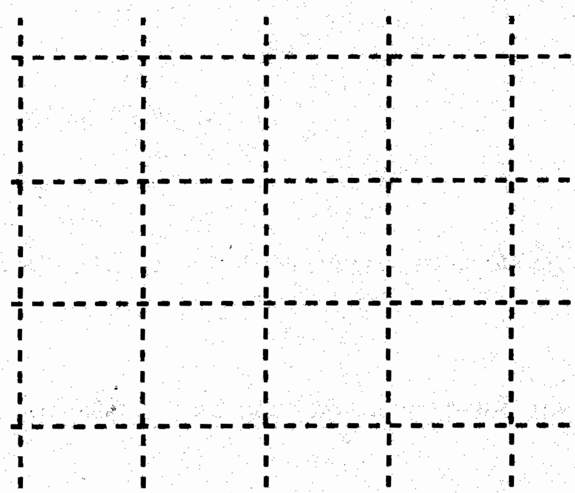
These points all have positive (or zero) x-coordinates and negative (or zero) y-coordinates.
All the coordinates are multiples of 5, but none of the numbers are very large.

Answer: Quadrant IV should be visible. Place the origin in the upper left. The x-scale and y-scale can both be 1 or 5.

Example 4: Without graphing the points in the table, identify which quadrants must be visible, describe the location of the origin, find a useful x-scale and y-scale, then draw the axes, label the scales, and neatly plot the points.

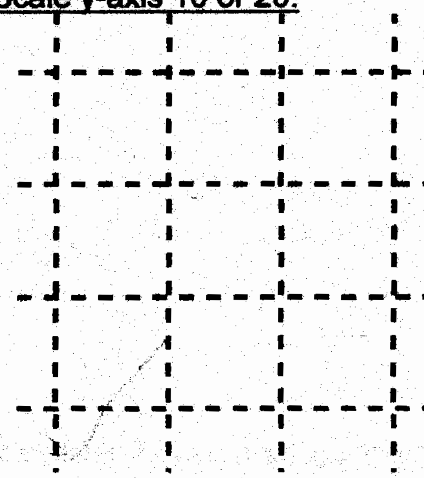
X	Y1	
-2	20	
-1.6	40	
-1.2	60	
-.8	80	
-.4	100	
0	120	
.4	140	

X=-2



To determine the location of the origin, consider the signs. Most of these points are (-,+), located in quadrant II. Only one point is (+,+), and its x-coordinate is small, close to the origin. Place the origin in the lower right corner.
To determine the x-scale, notice that the x-coordinates all have decimals in the tenths place, with even numbers that are divisible by 4. Using 0.2 or 0.4 for the x-scale will be useful.
To determine the y-scale, notice that the y-coordinates are multiples of 20. Using y-scale of 10 or 20 will be helpful.

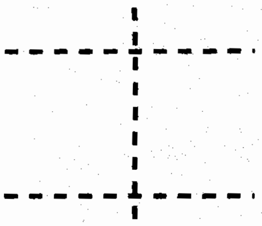
Answer: Quadrant II. Origin lower right. Scale x-axis 0.2 or 0.4. Scale y-axis 10 or 20.



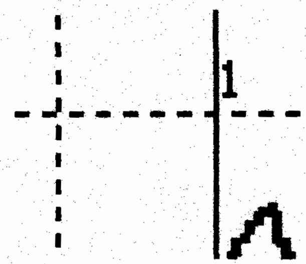
When points have large (or large-magnitude negative) x-coordinates (or y-coordinates) that are close together, it is useful to draw a discontinuous axis. This allows the scale to be written on the axis, even though the axis may be a long distance from the points to be graphed. The GC cannot draw discontinuous axes, even though they are very useful!

A discontinuous axis is designated with a zig-zag line at the break. Both the x-axis and y-axis can have this marking if necessary. Draw the zig-zag to represent all the numbers skipped.

Example 5: Draw a graph with x-scale 1, y-scale 1, and a discontinuity from 0 to 1000.



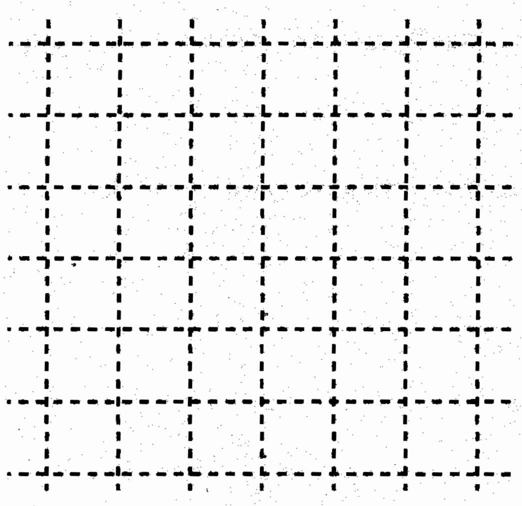
Answer: <u>Zig-zag replaces 1 through 999.</u>



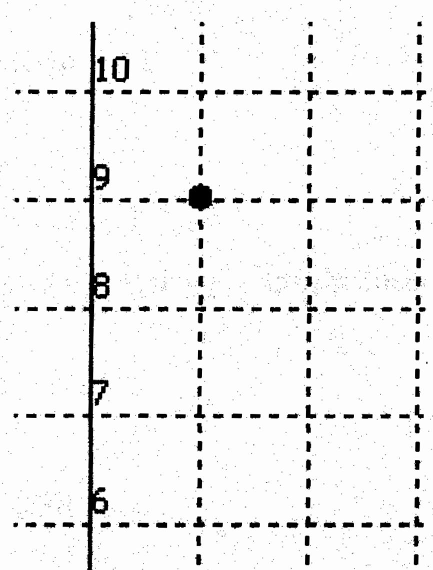
Example 6: Without graphing the points shown in this table, identify which quadrants must be visible, describe the location of the origin, find a useful x-scale and y-scale. Then draw the axes, label the scales, and neatly plot the points. Indicate any discontinuities in the axes.

X	Y1	
100	9	
101	4	
102	1	
103	0	
104	1	
105	4	
106	9	

X=100



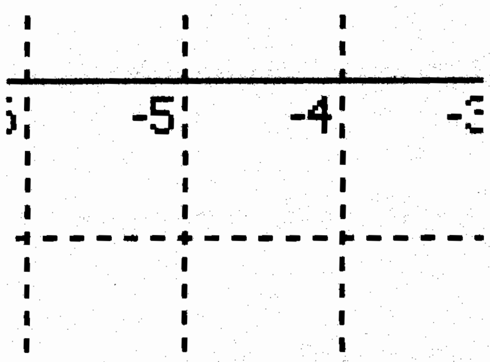
All the points have (+,+) signs, located in QI. Origin should be in the lower left corner. X-coordinates are large, but close together. Use x-scale 1, but with a discontinuous axis for the numbers 1 to 99. Y-coordinates are the usual size. Y-scale is 1.

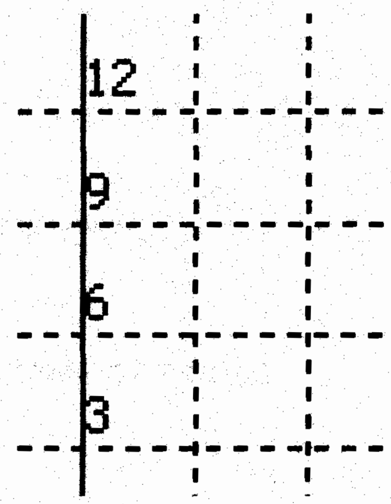


Answer: <u>Quadrant I, origin lower left. Scales both 1.</u>

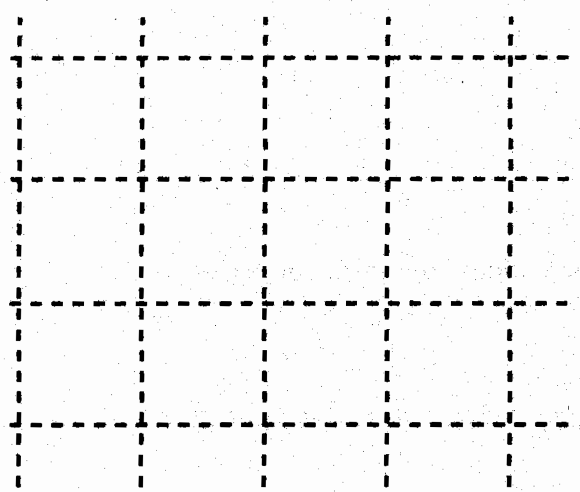
Practice

For each of the graphs, find the scale of the x-axis (x-scale), scale of the y-axis (y-scale), identify which quadrants are visible and describe the location of the origin.

1) 

2) 

3) On the graph below, draw the axes are that quadrant IV is visible. Mark the x-axis to have scale 20 and the y-axis to have scale 1.



Points to be graphed are given as a list or a table. Without graphing, identify which quadrants must be visible, describe the location of the origin, and find useful scales for the x-axis and y-axis.

4) (-9,8), (-7,3), (-5,-2), and (-3,-7)

5)

X	Y1	
-6	-153	
-4	-152	
-2	-151	
0	-150	
2	-149	
4	-148	
6	-147	

X=-6

Points to be graphed are given. Before graphing, identify which quadrants must be visible, describe the location of the origin, and find useful scales for the x-axis and y-axis. Then draw the axes, label the scales, and neatly plot the points. (These are not equations or functions; dots aren't connected.)

6) (0,100), (5,75), (10,50), (15,25), and (20,0)

Answer:________________________________

7) (0,-1), (4,-0.8), (6,-0.6), (8,-0.4), and (10,0)

Answer:________________________________

8) (-150,1), (-100,6), (-50,9), (0,10), (50,9), (100,6) and (150,1)

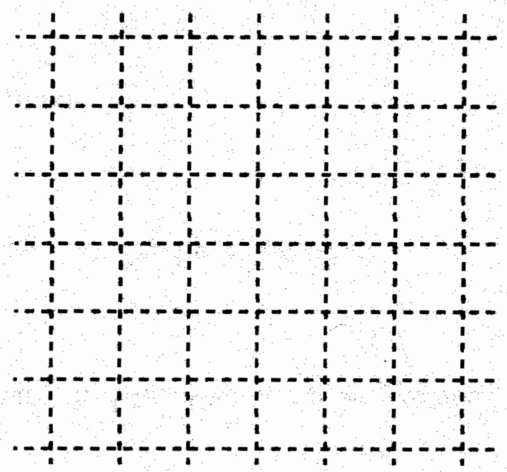
Answer:________________________________

Points to be graphed are given. Before graphing, identify which quadrants must be visible, describe the location of the origin, and find useful scales for the x-axis and y-axis. Then draw the axes, label the scales, and neatly plot the points. (These are not equations or functions; dots aren't connected.)

9)

X	Y1	
[illegible]	-153	
-4	-152	
-2	-151	
0	-150	
2	-149	
4	-148	
6	-147	

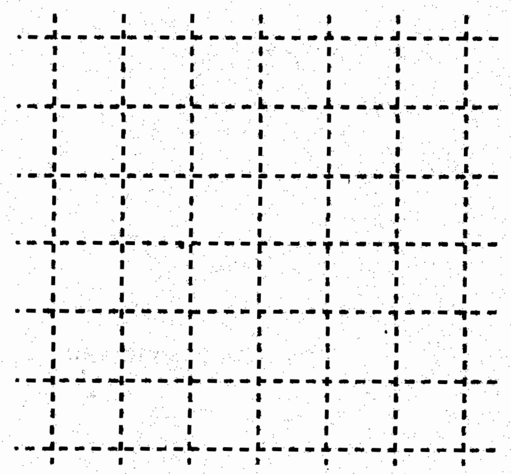
X= -6



10)

X	Y1	
[illegible]	-150	
50	-125	
100	-100	
150	-75	
200	-50	
250	-25	
300	0	

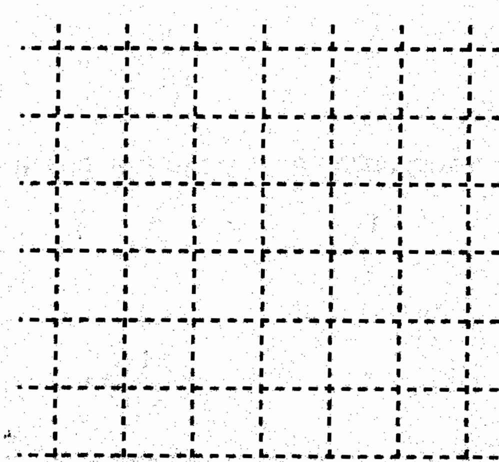
X=0



11)

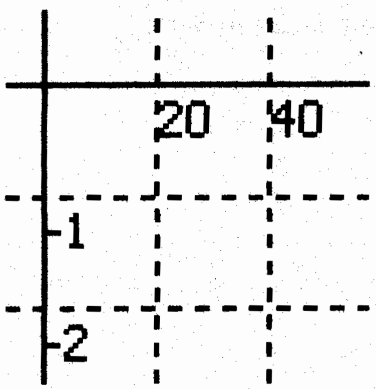
X	Y1	
[illegible]	1	
-2	-1	
-1	-3	
0	-5	
1	-3	
2	-1	
3	1	

X= -3



1) QIII. Origin upper right. x-scale 1, y-scale 1.

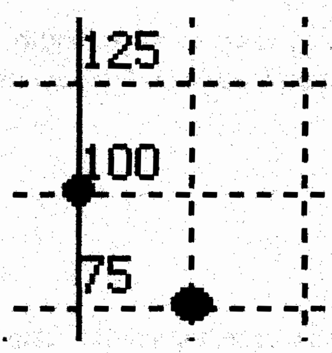
2) QI and QIV. Origin center left. x-scale 100, y-scale 3.

3) 

4) QII and QIII. Origin center right. X-scale 1 and y-scale 1.

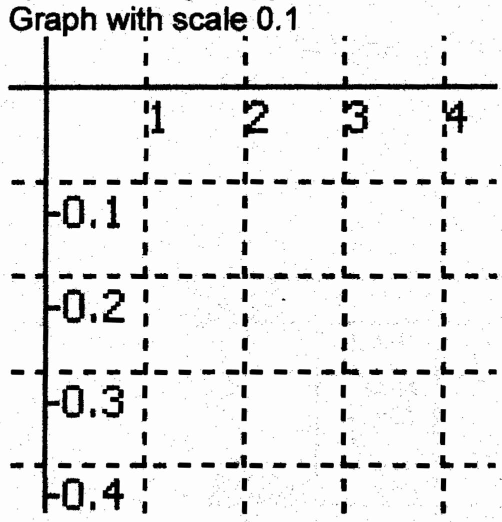
5) QIII and QIV. Origin center top. X-scale 2, y-scale 1. Discontinuous y-axis from 0 to -146.

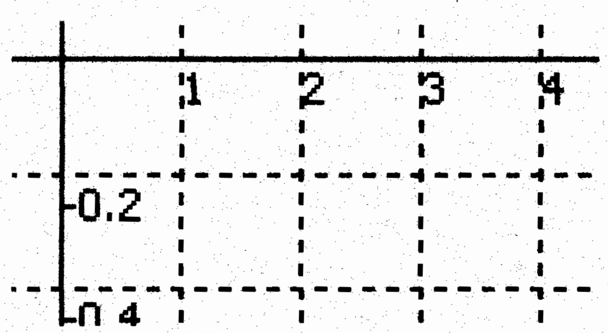
6) QI. Origin lower left. X-scale 5. Y-scale 25.

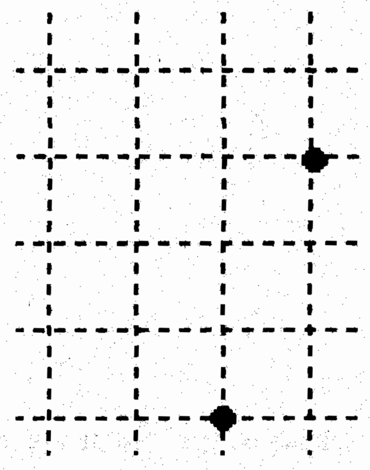


7) QIV. Origin upper left. X-scale 1. y-scale 0.1 or 0.2.

Graph with scale 0.1 or Graph with scale 0.2

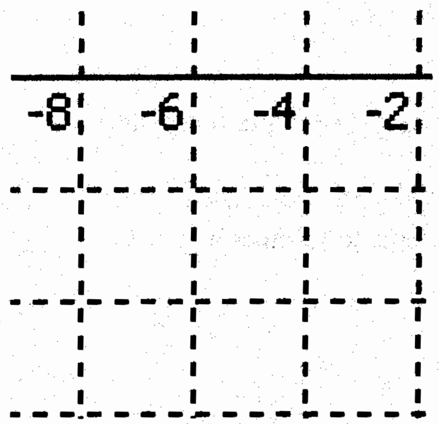


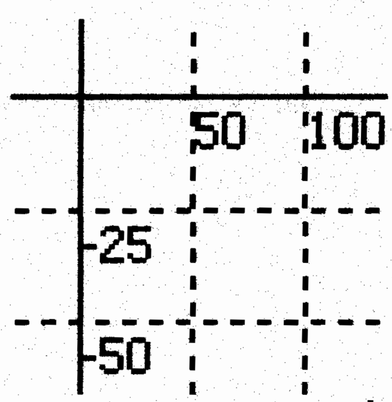




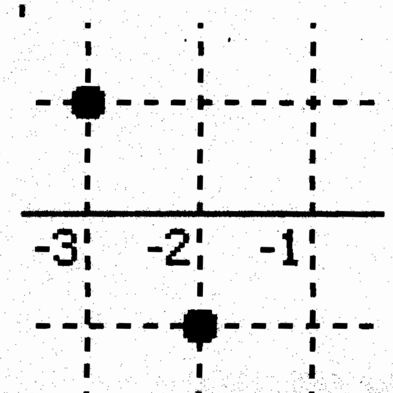
8) QI and QII. Origin center bottom. X-scale 50. y-scale 1.

9) QIII and QIV. Origin center top. X-scale 2. Y-scale 1. Discontinuous y-axis from 0 to -146.





10) QIV. Origin upper left. X-scale 50. Y-scale 25.



11) All four quadrants, but especially QIII and QIV. X-scale 1. Y-scale 1.

Rev 8-5-13

Name ____________________

Date ____________________

GC 13 Method for Graphing on Paper

Objectives: Learn the steps for graphing any function
Review facts that apply only to linear functions
Graph linear equations on paper

Facts about linear equations or linear functions:
1. Expressions are degree 1. (Exponents are 1; no variables are multiplied together and no variables in denominators; no absolute values, radicals, logarithms or trig functions of variables.)
2. The shape of the graph will be a line.
3. Find the slope and y-intercept by writing in slope-intercept ($y=mx+b$) form.
4. Use slope (rise over run) for graphing additional points.
5. Recognize the equation of a vertical line ($x=\#$) or horizontal line ($y=\#$).
6. Plot at least two points and connect them using a straight edge.

All equations or functions that aren't linear are called non-linear. There are more types of non-linear functions and equations than linear ones. You will learn the algebraic expression, shape, characteristics, and method of graphing for each type of non-linear equation that is taught.

Some facts about graphing apply to all types of functions, linear or non-linear. The following steps can be used for ANY function or equation:
1. Recognize the algebraic expressions and the shape of graph.
2. Use knowledge about that shape to find critical points, axes, or asymptotes.
3. Plot the *x*- and *y*-intercepts if possible. (Set $y=0$ and solve for x; set $x=0$ and solve for y.)
4. If needed, plot additional points by making a table of values.
5. Identify the scale of the graph and axis placement, draw and label both axes. There is often more than one correct way to choose the scale and axis placement.
6. Connect the points neatly, without jagged edges or stray marks. Draw carefully and extend the graph to the edges of the given grid.

A 6-inch ruler is very helpful. You may also find that a mechanical pencil makes a neater graph.

Linear or non-linear?

Example 1: $y = x^2 + 3x - 1$ NON-Linear, because x^2 is degree 2, graph is a parabola.

Example 2: $y = |2x-1|$ NON-Linear, because absolute value changes line to V-shape.

Example 3: $2x - 5y = 3$ Linear, because x and y have exponent 1 and are not multiplied to each other

Example 4: Find the slope and y-intercept of $5x + 3y = 15$

Solution:
Step 1: Re-write the linear equation in the form $y = mx + b$ by solving for y.

$5x + 3y = 15$

$3y = -5x + 15$

$\frac{3y}{3} = \frac{-5x}{3} + \frac{15}{3}$

$y = -\frac{5}{3}x + 5$

Step 2: The slope is the coefficient of x and the y-coordinate of the y-intercept is the constant.

Solution: Slope = $m = -\frac{5}{3}$, y-intercept = (0,5)

Example 5: Is $5x + 3y = 15$ vertical, horizontal, or neither?

Solution:

Since the slope found in Example 4 is $m = -\frac{5}{3}$, $5x + 3y = 15$ is neither vertical (undefined or no slope) nor horizontal (zero slope).

Example 6: Find the x-intercept of $5x + 3y = 15$

Solution:

Step 1: Set $y = 0$

$5x + 3(0) = 15$

Step 2: Solve for x.

$5x = 15$

$x = 3$

Solution: The x-intercept is (3,0)

Example 7: When graphing $5x + 3y = 15$, which quadrants should be visible? Where should the origin and axes be placed?

Solution:

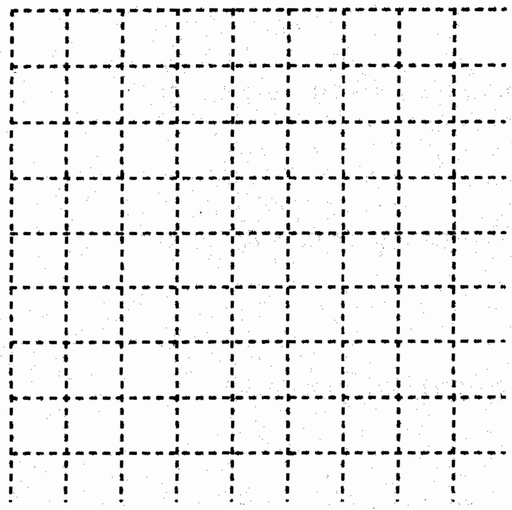
Consider the x-intercept, the y-intercept, and the slope.

Step 1: The x-intercept is on the positive x-axis, between Quadrants I and IV.

Step 2: The y-intercept is on the positive y-axis, between Quadrants I and II.

Step 3: The slope is negative, so the line goes downhill. All graphs must include Quadrant I. A larger graph could extend into Quadrant II and/or Quadrant IV. The origin should be toward the lower left corner.

Example 8: Sketch graph of $5x+3y=15$. Draw the axes, label the scale, plot the points, and neatly extend the graph to the edge of the grid. If you need more information, make a chart of points. Check your graph by comparing to the image on your GC.



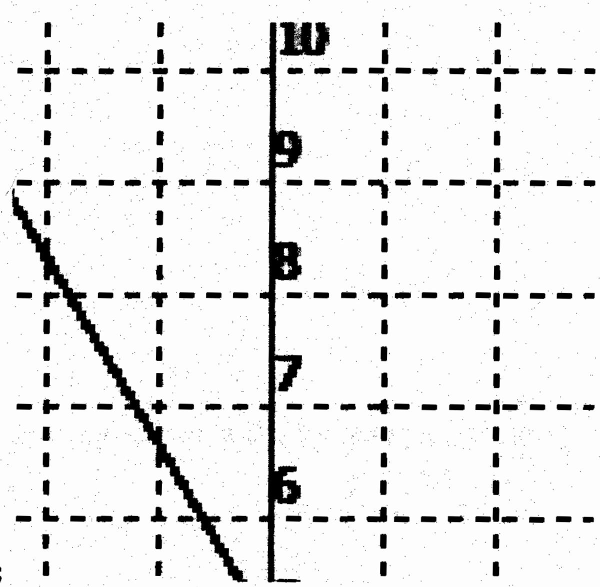
Draw the axes near the lower-left corner, with x-scale 1 and y-scale 1.

Plot the x-intercept and the y-intercept.

Connect the dots.

Check that the line goes downhill as the negative slope indicates it should.

Solution:



Practice

The next questions will include all the steps to graph $2x-7y=14$.

1) What shape is the graph of $2x-7y=14$?
2) Find the slope and y-intercept of $2x-7y=14$.

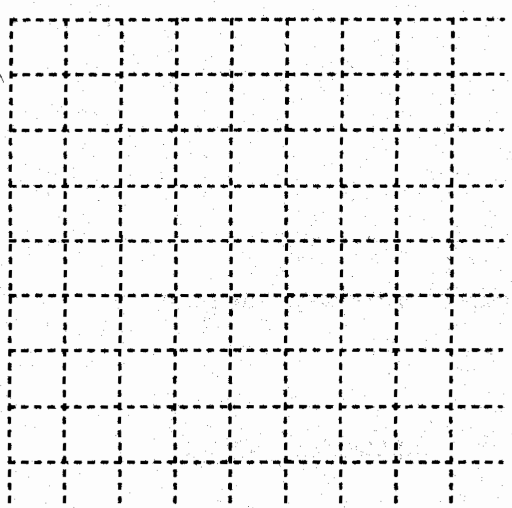
3) Is $2x-7y=14$ vertical, horizontal, or neither?

4) Find the x-intercept of $2x-7y=14$.

5) What quadrant(s) should be visible? Where should the origin (and axes) be placed?

6) What scale will you use for each axis?

7) Graph $2x-7y=14$. Draw the axes, label the scale, plot the points, and neatly extend the graph to the edge of the grid. If you need more information, make a chart of points. Check your graph by comparing to the image on your GC.



The next questions will include some of the steps to graph $y=-\frac{1}{3}x+\frac{2}{9}$

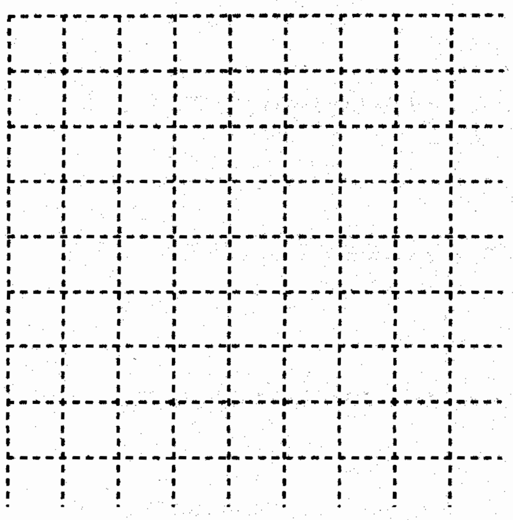
8) Find the slope and y-intercept of $y=-\frac{1}{3}x+\frac{2}{9}$.

9) Find the x-intercept of $y=-\frac{1}{3}x+\frac{2}{9}$.

10) What quadrant(s) should be visible? Where should the origin (and axes) be placed?

11) What scale will you use for each axis? (Hint: The best scales will be fractions.)

12) Draw the axes, label the scale, plot the points, and neatly extend the graph to the edge of the grid. If you need more information, make a chart of points. Check your graph by comparing to the image on your GC.

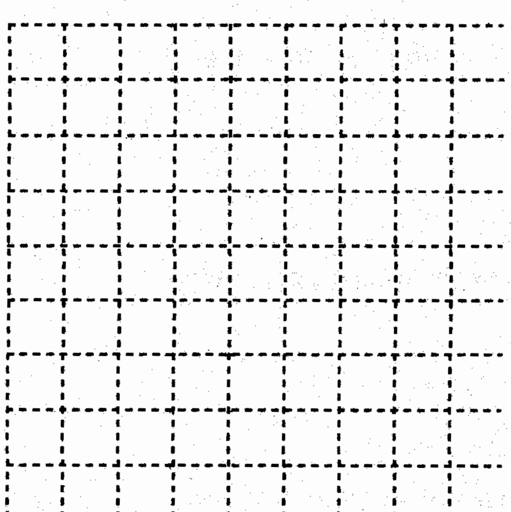


Now, remember the steps yourself!

Graph $y = -\frac{7}{10}x + 35$.

13) What scale will you use for each axis? (Hint: The best scale will be a multiple.)

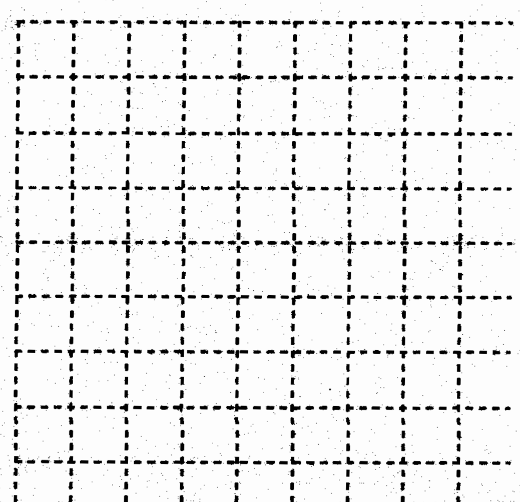
14) Draw the axes, label the scale, plot the points, and neatly extend the graph to the edge of the grid. If you need more information, make a chart of points. Check your graph by comparing to the image on your GC.



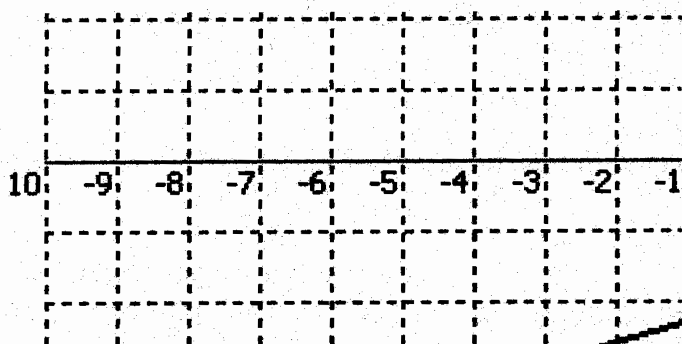
Graph $y = -80x - 40$.

15) What scale will you use for each axis? (Hint: The x-scale and y-scale will be quite different.)

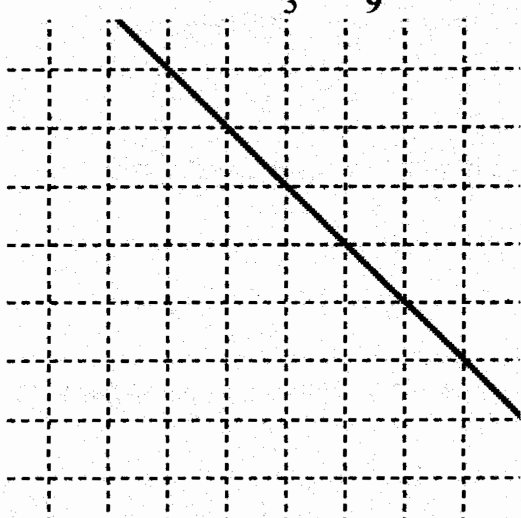
16) Draw the axes, label the scale, plot the points, and neatly extend the graph to the edge of the grid. If you need more information, make a chart of points. Check your graph by comparing to the image on your GC.



1) line
2) $y=\frac{2}{7}x-2$, slope $\frac{2}{7}$, y-intercept (0,-2)
3) neither horizontal nor vertical
4) x-intercept (7,0)
5) Q III and IV must be visible, so the origin could be centered, or toward the center top.
6) x-scale 1, y-scale 1.
7)

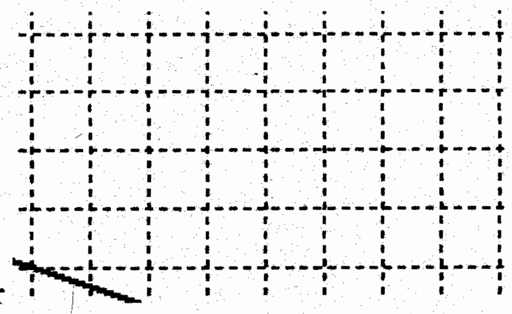


8) slope $-\frac{1}{3}$, y-intercept $\left(0,\frac{2}{9}\right)$.
9) x-intercept $\left(\frac{2}{3},0\right)$
10) Q I, II, and possibly IV. The origin could be centered or moved to the center bottom.
11) For example, x-scale $\frac{1}{3}$ (or $\frac{1}{9}$), y-scale $\frac{1}{9}$.

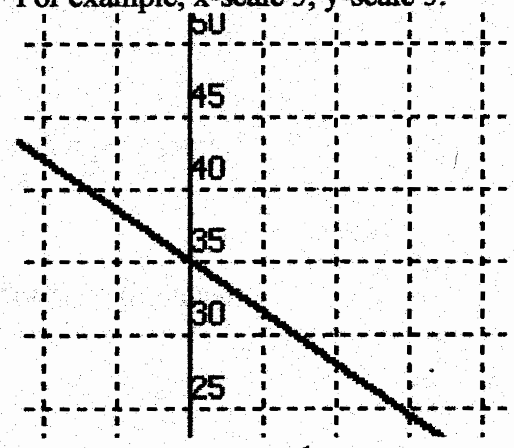


12)

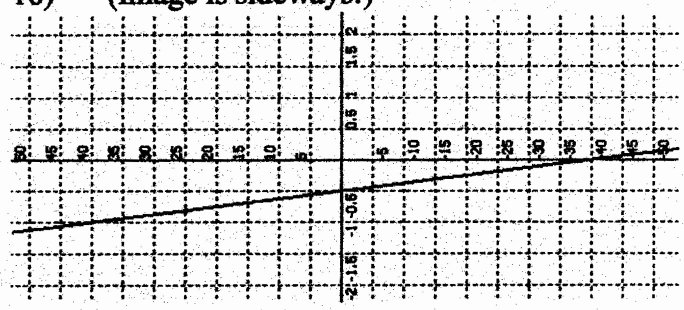
or



13) For example, x-scale 5, y-scale 5.



14)
15) For example, x-scale $\frac{1}{2}$, y-scale 5.
16) (Image is sideways!)



Rev 8-15-16

Name ______________________________

Date ______________________________

GC 14 Graphing Linear Absolute Value Functions on Paper

Objectives: Review absolute value and absolute value functions
Identify critical points on a linear or linear absolute value equation
Graph linear absolute value functions on paper

<u>Linear Absolute Value functions</u> are functions that have absolute values with a linear expression inside and no variables outside. The shape of the graph is a V, and the point of the V is a critical point (or critical value) which must be found and graphed correctly.

To find the x-coordinate of the critical point/value, identify the expression inside the absolute value, set it equal to 0, and solve for x.

To find the y-coordinate of the critical point/value, evaluate the function using the x-value just found.

Evaluate the function at two additional points, one to the left and one to the right of the critical point/value. Use a ruler to draw two straight lines to form the V-shape.

1) Find the x-coordinate of the critical value of $y=|x-3|$ by setting $x-3$ equal to 0 and solving for x.

2) Find the y-coordinate of the critical value of $y=|x-3|$ by evaluating $g(x)$ at the x-value you just found.

3) Find another point on the graph by choosing an x-value that is less than the x-coordinate of the critical value and evaluating $y=|x-3|$ at that value.

4) Find another point on the graph by choosing an x-value that is more than the x-coordinate of the critical value and evaluating $y=|x-3|$ at that value.

5) Check your work using the GC. Complete the table. On your calculator, the absolute value function is under the MATH button, second menu NUM:

[Y=] [MATH] [▶] [ENTER] [X,T,Θ,n] [−] [3] [)] [ENTER] [2nd] [MODE]

x	$y=\|x-3\|$	(x,y) pair
-1		
0		
1		
2		
3		
4		
5		
6		

GC 14 Graphing Linear Absolute Value Functions on Paper, page 2

6) Graph $y = |x-3|$. Draw and label axes with scale. Plot the critical point.

Graph the following linear absolute value functions. Draw and label axes with scale, and find and plot the critical point. Check your graph using your GC.

7) $y = |x-4| - 2$

9) $y = -|x+3| - 4$

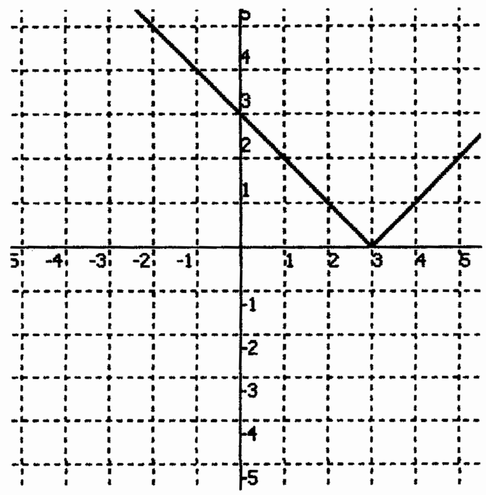
8) $y = |2-x| - 1$

10) $y = 2|x| - 1$

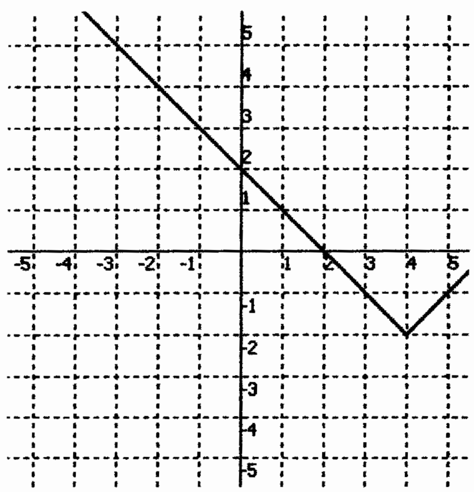
1) x = 3
2) y = 0 when x=3
3) Answers vary. Choose x < 3, e.g. x=2
y=1
4) Answers vary. Choose x > 3, e.g. x=4.
y=1
5) $y = |x-3|$

x	y	(x,y)
-1	4	(-1,4)
0	3	(0,3)
1	2	(1,2)
2	1	(2,1)
3	0	(3,0)
4	1	(4,1)
5	2	(5,2)
6	3	(6,3)

6)

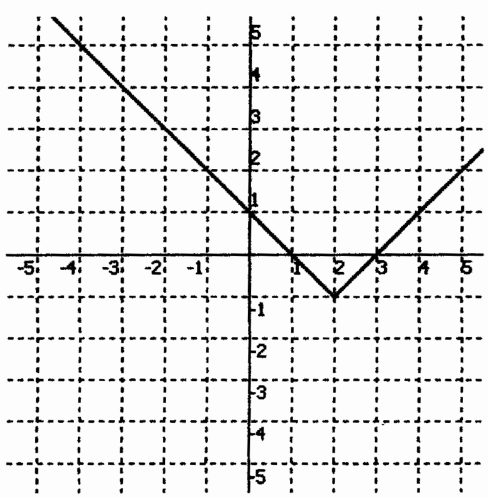


7)



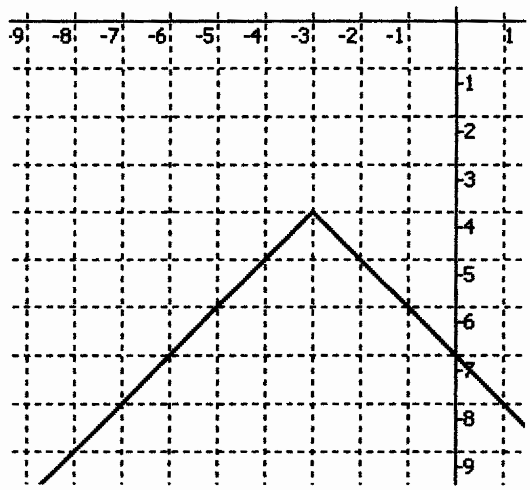
The critical point is (4,-2).

8)



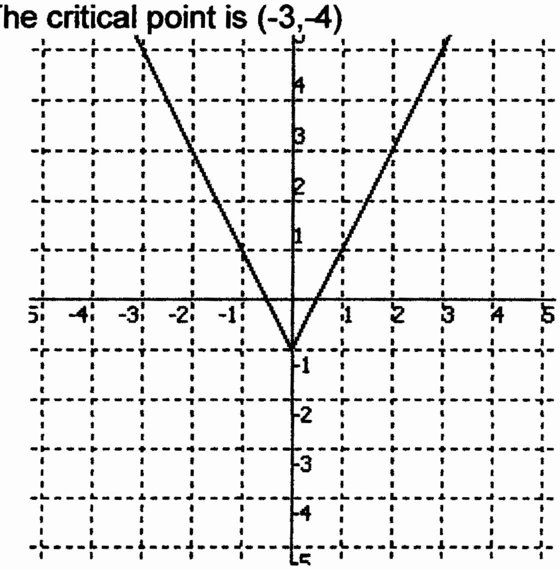
The critical point is (2, -1).

9)



The critical point is (-3,-4)

10)



The critical point is (0,-1)

Rev 12-2-11

Name ______________________________

Date ______________________________

TI-84+ GC 15 Settings and Basic Graph

Objectives: Before graphing, set the options in MODE and clear the Y= menu
Recognize the error message for turning off plots
Input a function using Y=
Review the slope-intercept form for the equation of a line
Learn the size of the standard window and zoom to it
Graph quadratic, cubic, square root and absolute value functions

If someone else has used your calculator before you, the settings may not be what you need. So before we graph anything, let's check.

Press [MODE] to open a window with nine menus, one menu on each row (across).
On each row, the word or symbol with white letters on a black background is currently selected.

Use the [▲] or [▼] buttons to move up and down among the menus, and the [►] or [◄] buttons to move across a menu. Your cursor is a flashing dark area.

When you have moved the cursor to the option you want, press [ENTER] to select it. Check each of the nine rows to make your screen match this image:

Here's a summary of what each menu does and what you should select for now.

NORMAL SCI ENG	numerical notation for calculations
FLOAT 0 1 2 3 4 5 6 7 8 9	number of decimal places (or significant figures) displayed
RADIAN **DEGREE**	units used for trigonometric functions
FUNC PAR POL SEQ	type of equation: function, parametric, polar, or sequence
CONNECTED DOT	whether to use solid or dotted lines for graphs
SEQUENTIAL SIMUL	whether to plot multiple graphs one at a time or simultaneously
REAL a+bi *re^θi*	real or complex numbers and which complex format
FULL HORIZ G-T	to split the screen into two screens and which two
SET CLOCK	set the date and time and the format it is displayed

"Float" means that the decimal point is permitted to display in any location.
If you select "Set Clock", you will enter a different menu of options that sets the clock's time, date, and appearance.

Press [CLEAR] to exit the MODE menu when you are done.

The first time you use your GC to graph, check two more things.

Open the menu of functions to be graphed, press [Y=]. (This button is at the top, in the separate row of buttons just below the screen.) Here's what my screen looked like:

```
Plot1 Plot2 Plot3
\Y1=3X²+2X-1
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

First, clear any functions that may be there by pressing [CLEAR] [ENTER] for each existing function.

```
Plot1 Plot2 Plot3
\Y1=
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

Second, check that Plot1, Plot2, and Plot3 are <u>NOT</u> selected. Press [▲] (and [▶] If needed) to move your cursor to that plot, and then press [ENTER] to turn it off. Make sure all three plots are turned off. When you are done, your screen should look like this:

```
Plot1 Plot2 Plot3
\Y1=
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

You are now ready to graph.

It's easy to overshoot and turn on a plot accidentally. If you do, you'll see this error screen when you try to graph:

```
ERR:INVALID DIM
1:Quit
```

This error screen means "Turn off Plots in Y=."

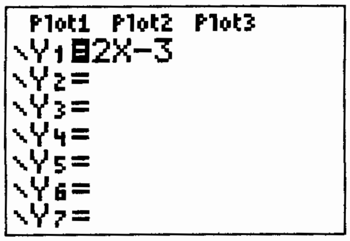
TI-84+ GC 15 Settings and Basic Graph, page 3

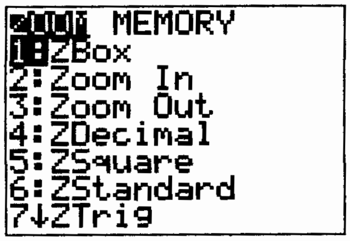
Example 1: Graph $y = 2x - 3$ in the GC graphing window.

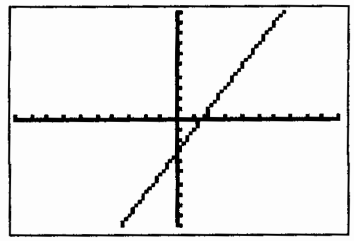
Open the Y= page: [Y=] .

Type the function to be graphed: [2] [X,T,Θ,n] [−] [3] [ENTER]

Graph in a standard window: [ZOOM] [6]







1. CAUTION: Always use the graphing variable x [X,T,Θ,n] when typing functions into the Y= menu. Some versions of the GC will give a wrong graph (but no error message!) if you use the storage location [ALPHA] [STO▸] (which is also the letter x) instead of [X,T,Θ,n] .

2. The GC does not put numbers on the axes. You have to know that each tick mark in the standard window represents one unit, so the standard window shows the x-axis from -10 to +10 and shows the y-axis from -10 to +10.

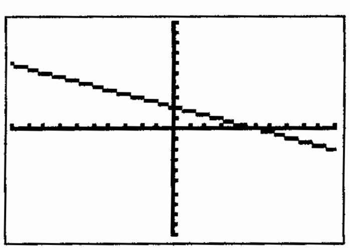
3. The GC will continue to use the same "window" (set of axes) until you change it.
So you can press [GRAPH] instead of [ZOOM] [6] when your previous window is acceptable.

4. To exit the graphing window and return to the calculating window,
press [CLEAR] ,or press QUIT, which is [2nd] [MODE] .

5. You can use the editing keys DEL, INS and type-over when putting functions in the Y= menu.

Example 2: Graph $y = -\frac{2}{5}x + 2$ on the GC.

[Y=] [CLEAR] [(−)] [2] [÷] [5] [X,T,Θ,n] [+] [2] [GRAPH]



The GC can plot graphs using the Y= menu or the DRAW menu. The DRAW menu makes pretty pictures, but we can't do many of the useful graphing calculations with these pictures, so it's not very useful.

As you've probably noticed, the Y= menu requires that the equation be solved for y!

Recall: An <u>equation of a line</u> (or <u>linear equation in two variables)</u> can be appear in several forms:

$y = mx + b$ Slope-intercept form, where *m* is the slope and $(0, b)$ is the y-intercept.

$Ax + By = C$ Standard form

$y - y_1 = m(x - x_1)$ Point-slope form, where *m* is the slope and (x_1, y_1) is a point on the line.

Example 3: Write the equation $4x + 3y = 12$ in slope-intercept form by solving for y.

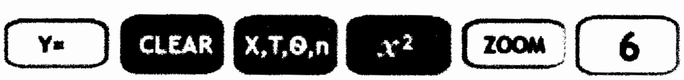
Subtract 4x from both sides: $3y = -4x + 12$

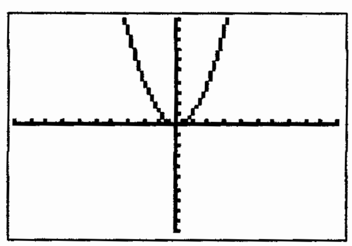
Divide all terms by 3: $\frac{3y}{3} = \frac{-4x}{3} + \frac{12}{3}$

Simplify: Answer: $\boxed{y = -\frac{4}{3}x + 4}$

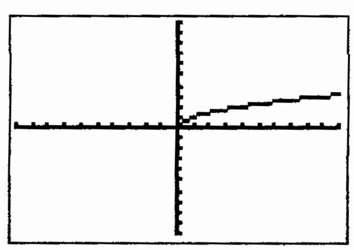
All the operators and expressions can be used in the Y= menu, too.

Example 4: Graph $y = x^2$ on the GC.





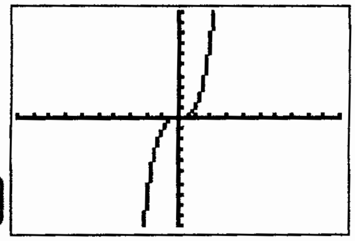
Example 5: Graph $y = \sqrt{x}$ on the GC.



TI-84+ GC 15 Settings and Basic Graph, page 5

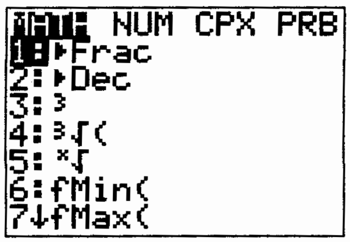
Example 6: Graph $y = x^3$ on the GC.

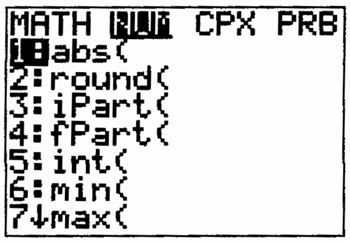
[Y=] [CLEAR] [X,T,θ,n] [^] [3] [ZOOM] [6]



Absolute value is found under the MATH menu, in the NUM sub-menu:

Press [MATH], then [▶] to see the NUM sub menu

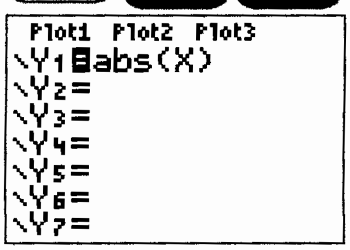


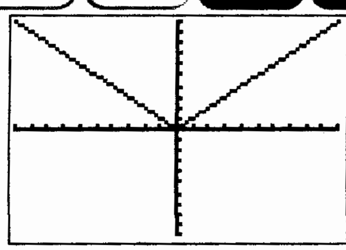


Press [ENTER] to select absolute value. Be sure to close the parentheses.

Example 7: Graph $y = |x|$ on the GC.

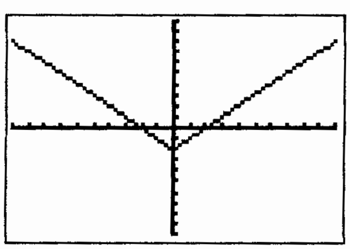
[Y=] [CLEAR] [MATH] [▶] [ENTER] [X,T,θ,n] [)] [ZOOM] [6]





Example 8: Graph $y = |x| - 2$ on the GC.

[Y=] [CLEAR] [MATH] [▶] [ENTER] [X,T,θ,n] [)] [−] [2] [ZOOM] [6]



TI-84+ GC 15 Settings and Basic Graph, page 6

Practice:

1) Write the equation $3x-2y=6$ in slope-intercept form by solving for (or isolating) y.

Graph each of the following functions on the GC using a standard window.

2) $y=-2x-7$

3) $y=\frac{2}{3}x-5$

4) $y=-7$

5) $3x-2y=6$

6) $4x+\frac{2}{3}y=\frac{8}{3}$

7) $4x+3y=12$

8) $y=2x^2$

9) $y=\frac{1}{2}x^2$

10) $y=x^2+1$

11) $y=(x-1)^2$

12) $y=\sqrt{x}-2$

13) $y=\sqrt{x-2}$

14) $y=-x^3$

15) $y=\frac{1}{2}x^3$

16) $y=|x|+3$

17) $y=|x+3|$

Name ____________________________

Date ____________________________

TI-84+ GC 16 Linear vs. Nonlinear Graphs, Zoom Out and Zoom In

Objectives: Identify linear and nonlinear functions
Recognize basic graph shapes
Learn limitations of relying on GC standard window
Use Zoom Out to enlarge the graphing window
Use Zoom In to shrink the graphing window

Facts about linear equations or linear functions:
1. Expressions are degree 1. (Exponents are 1; no variables are multiplied together and no variables in denominators; no absolute values, radicals, logarithms or trig functions of variables.)
2. The shape of the graph will be a line.
3. Find the slope and y-intercept by writing in slope-intercept (y=mx+b) form.
4. Use slope (rise over run) for graphing additional points.
5. Recognize the equation of a vertical line (x=#) or horizontal line (y=#).
6. Plot at least two points and connect them using a straight edge.

All equations or functions that aren't linear are called non-linear. There are more types of non-linear functions and equations than linear ones. You will learn the algebraic expression, shape, characteristics, and method of graphing for each type of non-linear equation that is taught.

Example 1: Is $3x-4y=2$ linear or non-linear?
The exponents are both (invisible) 1, the variables are in numerators and not multiplied together.
Answer: linear

Example 2: Is $\frac{3}{4}x-\frac{4}{5}y=\frac{1}{2}$ linear or non-linear?
The exponents are both (invisible) 1, the variables are in numerators and not multiplied together.
Answer: linear

Example 3: Is $\frac{1}{x}+y=7$ linear or non-linear?
The exponent on x, if written in the numerator, would be -1. Answer: non-linear

Example 4: Is $x^2-y=8$ linear or non-linear?
The exponent on x is 2, giving a degree 2 expression. Answer: non-linear

Example 5: Is $xy=3$ linear or non-linear?
The variables are multiplied together, giving a degree 2 expression. Answer: non-linear

Example 6: Is $y=2x^3-3x+7$ linear or non-linear?
The expression is degree 3. Answer: non-linear

Example 7: Is $y=|3x-7|$ linear or non-linear?
The expression contains an absolute value of a variable. Answer: non-linear

NOTE: If the expressions are different, then the graphs will be different.

CAUTION: If the expression to be graphed is non-linear, then the graph is NOT a line.

It's best to know the shape of each graph from the expressions. The GC graphs may be deceptive if you don't know what to expect. Enlarging or shrinking the graphing window can help.

To Zoom Out (make the graphing window four times larger):

Step 1: press [ZOOM] [3],
Step 2: move the Zoom cursor to the new center of the graph (if necessary), and
Step 3: press [ENTER] to re-draw the graph with the new window.

NOTE: Zoom Out (and Zoom In) do not change the scales Xscl and Yscl, so the tick marks become close together (or further apart).

Zoom Out makes the axes look like thick lines from too many tick marks.

After zooming, choose Xscl and Yscl so that the number of ticks is useful. Try numbers that divide evenly into Xmax and Ymax.

If the origin is the center, the number of ticks resulting from a scale is:
Xmax / Xscl = number of ticks on x-axis from origin to right edge
Ymax / Yscl = number of ticks on y-axis from origin to top edge

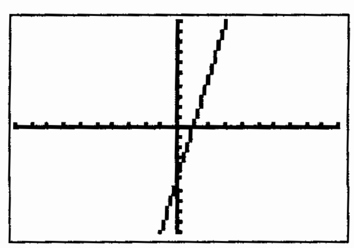
2-10 ticks between the center and the edge of the graph usually work well.

Example 8: Graph $y = 5x - 5$ in an appropriate window on the GC.

$y = 5x - 5$ is a linear expression, so its graph should be a line.

[Y=] [CLEAR] [5] [X,T,Θ,n] [−] [5] [ZOOM] [6] [ENTER]

The standard window is sufficient.

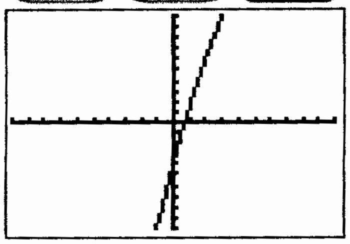
Answer: 

Remember this graph and its equation as you continue to the next examples.

Example 9: Graph $y = -\frac{30}{77}x^2 + \frac{445}{77}x - \frac{295}{77}$ in an appropriate window on the GC.

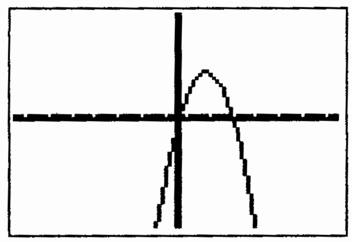
This is a degree 2 nonlinear equation, so its graph should be a parabola.

[Y=] [CLEAR] [(−)] [3] [0] [÷] [7] [7] [X,T,θ,n] [x^2] [+] [4]
[4] [5] [÷] [7] [7] [X,T,θ,n] [−] [2] [9] [5] [÷] [7]
[7] [ZOOM] [6]

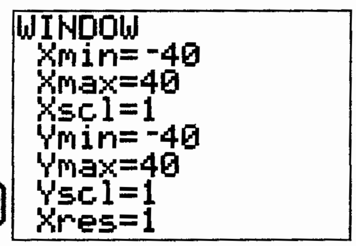


Note: the GC window is showing only part of the graph, since it (again) looks like the line in the previous example. If we stop here, we have the wrong graph.

Zoom out to see more of the graph: [ZOOM] [3] [ENTER]

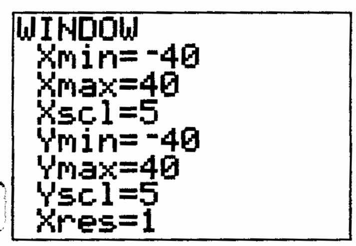


Notice the new window still has 1 for Xscl and Yscl: [WINDOW]

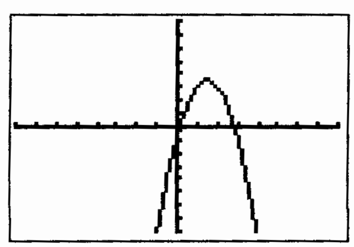


Change the scales so the tick marks will be helpful. For example, scale 5 will make 40/5= 8 ticks (or scale 10 will make 40/10= 4 ticks). Let's use Xscl=5 and Yscl=5.

[WINDOW] [▼] [▼] [5] [▼] [▼] [▼] [5]



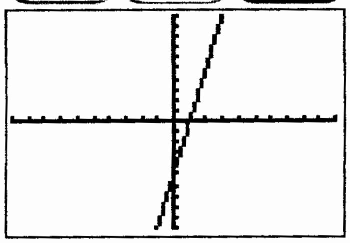
Return to the graph: [GRAPH]

Answer: 

Sometimes it's helpful to use Zoom Out more than once.

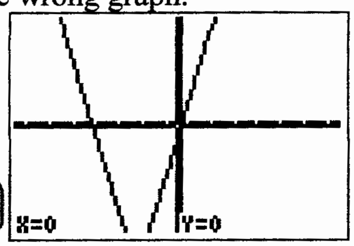
Example 10: Graph $y = |5x + 50| - 55$ in an appropriate window on the GC.

This is a non-linear expression with an absolute value, so its graph should be a V-shape.



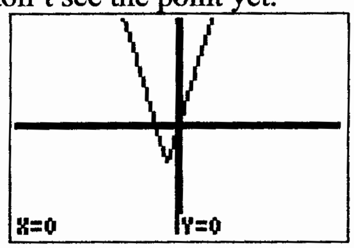
Note: the GC window is showing only part of the graph, since it looks like the same line as the previous example. If we stop now, we have the wrong graph.

Zoom out:

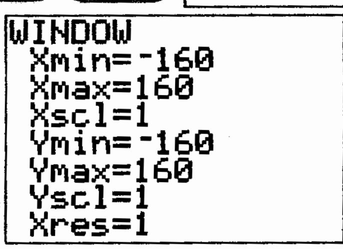


We're starting to see the V-shape, but we don't see the point yet.

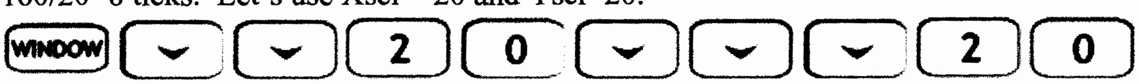
Zoom out again:

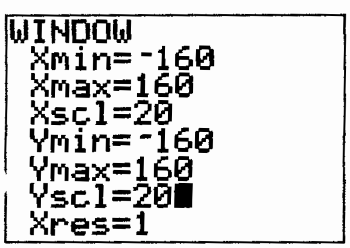


Notice the window:



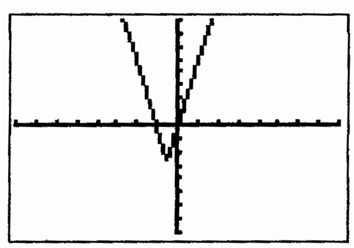
Change the scales. If we use 10, we'll have 160/10=16 ticks. But if we use scale 20, we'll have only 160/20=8 ticks. Let's use Xscl = 20 and Yscl=20.





Return to the graph:

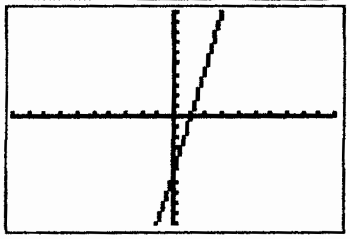
Answer:



Example 11: Graph $y=-\frac{1}{84}x^3+\frac{19}{154}x^2+\frac{4469}{924}x-\frac{408}{77}$ in an appropriate window on the GC.

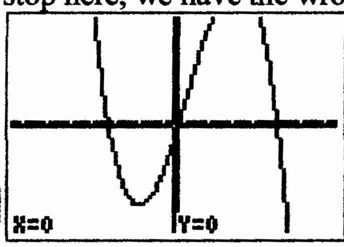
This is a degree 3 nonlinear equation, so its graph should be the shape of a rounded N (or backward N, or sometimes nearly smoothed out in the middle).

Y= CLEAR (−) X,T,θ,n ^ 3 ÷ 8 4 + 1 9
÷ 1 5 4 X,T,θ,n x^2 + 4 4 6 9 ÷
9 2 4 X,T,θ,n − 4 0 8 ÷ 7 7 ZOOM
6

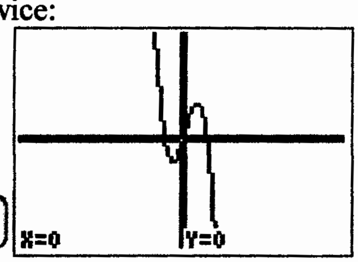


Note: the GC window is showing only part of the graph, since it (again) looks like the same lines in the previous examples. If we stop here, we have the wrong graph. So zoom out twice:

ZOOM 3 ENTER



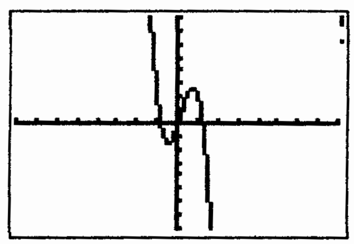
ZOOM 3 ENTER



Change Xscl to 20 and Yscl to 20:

WINDOW ⌄ ⌄ 2 0 ⌄ ⌄ ⌄ 2 0 GRAPH

Answer:

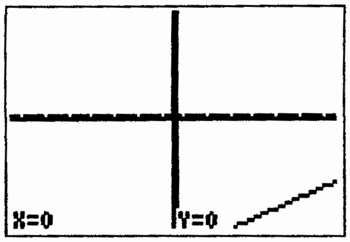


Sometimes the graph doesn't show in a standard window.

Example 12: $y=\frac{2}{3}x-50$

Y= CLEAR 2 ÷ 3 X,T,θ,n − 5 0 ZOOM 6 ENTER

Zoom Out. [ZOOM] [3] [ENTER]

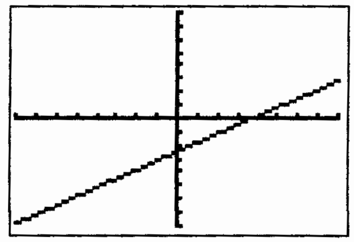


Again: [ZOOM] [3] [ENTER]

Change Xscl and Yscl:

[WINDOW] [▼] [▼] [2] [0] [▼] [▼] [▼] [2] [0] [GRAPH]

Answer:



Sometimes it's helpful to have a "magnifying glass", or a smaller window to see closer up. To get a smaller window (one-fourth the size), use Zoom In:

Step 1: Press [ZOOM] [2]

Step 2: move the Zoom cursor to the new center of the graph (if necessary), and

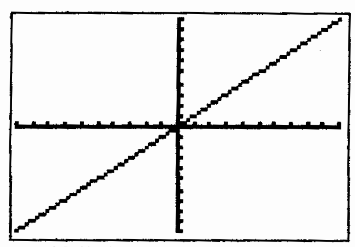
Step 3: press [ENTER] to re-draw the graph with the new window.

Zoom In does not change Xscl or Yscl, so the tick marks become further apart.

Example 13: Graph $y = x$ in the standard window. Then graph $y = x - .2$ Are these graphs the same or different? Zoom In on the graph of $y = x - .2$ to check.

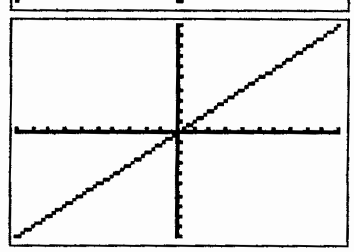
[Y=] [CLEAR] [X,T,Θ,n] [ZOOM] [6]

Answer:

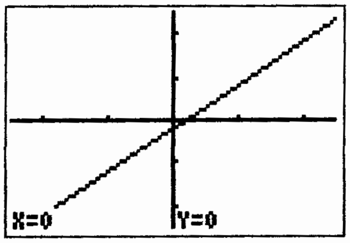


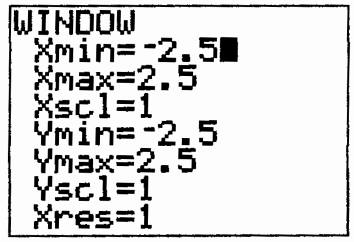
[Y=] [X,T,Θ,n] [−] [.] [2] [ZOOM] [6]

Answer:



Example 13, continued:

ZOOM 2 ENTER Answer: 

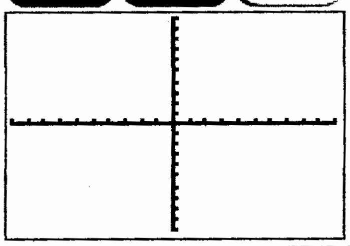
WINDOW 

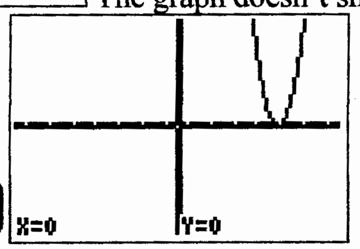
Answer: The graphs are different because the equations are different. $y = x$ passes through the origin, but $y = x - .2$ passes below the origin.

Occasionally, you may need to Zoom Out, then Zoom In on a different part of the graph.

Example 14: Graph $y = (x-25)^2 - .2$ in an appropriate window on the GC.

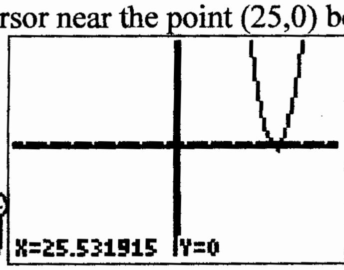
Y= CLEAR (X,T,Θ,n − 2 5) x^2 − . 2

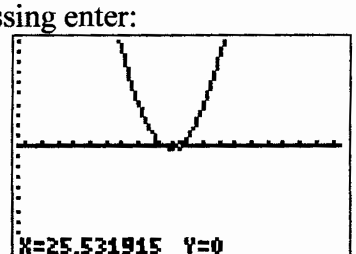
ZOOM 6  The graph doesn't show!

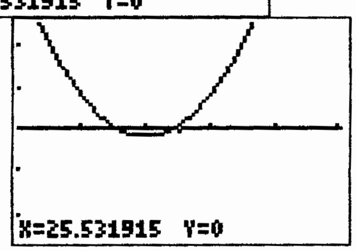
Zoom Out. ZOOM 3 ENTER 

Now we've found the graph.

Zoom In, but move the cursor near the point (25,0) before pressing enter:

ZOOM 2 ▸ 

ENTER 

Zoom In again. ZOOM 2 ENTER Answer: 

Practice

Linear or non-linear?

1) $y = \frac{2}{3}x - 5$
2) $y = \frac{1}{x} - \frac{3}{5}$
3) $y = x^2 + 9$
4) $\frac{1}{6}y = \frac{3}{2}x + \frac{1}{2}$
5) $xy - 4 = 2x + 7y$
6) $y = x^3 + 8x - 1$
7) $y = |6x + 5|$
8) $y = \sqrt{x - 3}$
9) $x^2y + y^2x = 7$
10) $\frac{2}{x} + y = 3$
11) $y - 3 = 4(x + 2)$
12) $x = y + 3$
13) $x = 3$
14) $y = 7$
15) $y = 0$
16) $y = 3(x - 2)^2 + 1$ Hint: FOIL first.

Identify the shape of the graph from the expression, then graph in an appropriate window on the GC. Zoom Out or Zoom In if necessary.

17) $y = -\frac{2}{3}x + 5$
18) $y = -\frac{2}{3}x + 50$
19) $y = x^2 - 25$
20) $y = x^2 + 25$
21) $y = 2|x + 15| - 7$
22) $y = x^3 - 15$
23) $y = (x - 12)^2 - 0.2$
24) $y = (x + 22)^3 - 0.2$

Name ____________________

Date ____________________

TI-84+ GC 17 Changing the Window

Objectives: Adjust Xmax, Xmin, Ymax, and/or Ymin in Window menu
Understand and adjust Xscl and/or Yscl in Window menu

The GC's standard graphing window shows the x-axis from -10 to 10 and the y-axis from -10 to 10.

If the entire graph or an important point on the graph is not visible, we need to change the window.

To do this, use the [WINDOW] menu to change the smallest and/or largest x and/or y values on the axes of the graphing window. Here's the menu:

```
WINDOW
 Xmin=-10
 Xmax=10
 Xscl=1
 Ymin=-10
 Ymax=10
 Yscl=1
 Xres=1
```

Xmin = smallest x-value on the x-axis (the left side of the graphing screen)
Xmax = largest x-value on the x-axis (the right side of graphing screen)
Ymin = smallest y-value on the y-axis (the bottom of the graphing screen)
Ymax = largest y-value on the y-axis (the top of the graphing screen)
Xscl = scale on the x-axis, the distance between two adjacent tick marks on the x-axis
Yscl = scale on the y-axis, the distance between two adjacent tick marks on the y-axis

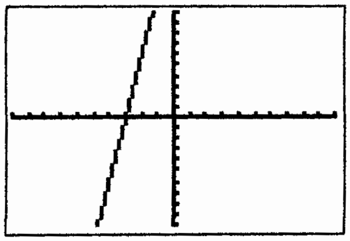
To change any of these, use [▼] to move to the desired line, press [CLEAR] to remove the existing value, and type the new value you want.

Don't forget to use [(-)] for negative numbers (not [−]).

When all the changes are done, press [GRAPH] to see the new graphing window.

Example 1: Graph $y = 6x + 18$ on your GC using a standard window. Is the x-intercept visible in the standard window? Is the y-intercept visible in the standard window?

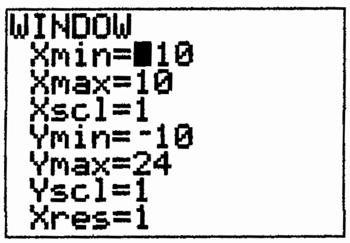
[Y=] [CLEAR] [6] [X,T,θ,n] [+] [1] [8] [ENTER] [ZOOM] [6]

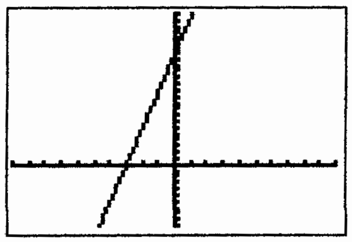
Answer: 

The x-intercept (-3,0) is visible. The y-intercept (0,18) is not visible because the y-coordinate of the y-intercept is larger than +10. The y-intercept is off the top of the graphing window.

Example 2: Change the graphing window so that the y-intercept of $y = 6x + 18$ is visible in the GC window.

There are many acceptable values, but all of them involve increasing the Ymax value so that it is larger than the y-coordinate of (0,18). For this example, Ymax will be 24.

Answer: 



Notice that the tick marks on the y-axis are now closer together, so that all the values from -10 to +24 are shown. The x-axis is unchanged.

It's possible for one, two, three, or all four window dimensions to be wrong for your graph.

When an important point is not visible on the graph, ask:

1. Is the x-coordinate of the important point larger than Xmax?
   (Or, is the important point off the right side of the screen?) If yes, increase Xmax.

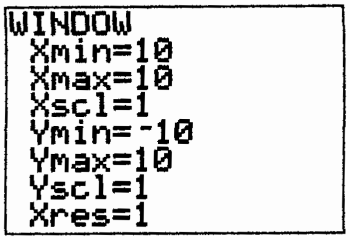
2. Is the x-coordinate of the important point smaller than Xmin?
   (Or, is the important point off the left side of the screen?) If yes, increase Xmin.

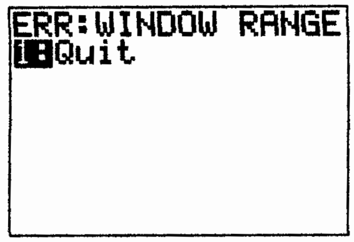
3. Is the y-coordinate of the important point larger than Ymax?
   (Or, is the important point off the top of the screen?) If yes, increase Ymax.

4. Is the y-coordinate of the important point smaller than Ymin?
   (Or: is the important point off the bottom of the screen?) If yes, increase Ymin.

When you have the correct dimensions, all the x-coordinates of the desired points should be between Xmin and Xmax. Similarly, all the y-coordinates of the desired points should be between Ymin and Ymax.

Example 3: CAUTION: Do not set Xmax (or Ymax) to something less than or equal to Xmin (or Ymin).

For example: 

gives this error: 

NOTE: You can use DEL, INS, and type-over to edit the window dimensions. If the window comes out crazy-looking or gives an error, check for missing negatives or digits leftover from the previous entry.

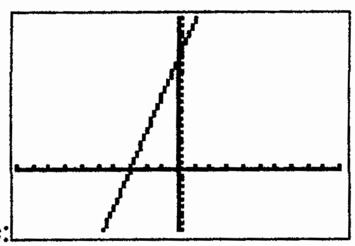
We can increase the space between tick marks by changing the scales, Xscl and/or Yscl.

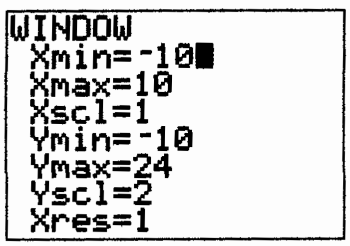
Example 4: Change Yscl in the graph of $y = 6x + 18$ so tick marks are every 2 units instead of every 1 unit.

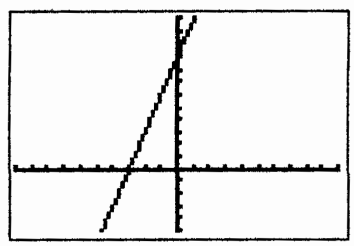
Since the tick marks are so close together in our graph, it would be difficult to look at the graph and count ticks to find the coordinates of the y-intercept.

Press 

, move to Yscl, and change it to 2.

Before: 



After: 

The y-intercept is still (0,18), but it's 9 tick marks up instead of 18 tick marks.
We could also have used Yscl=3, or even Yscl=6; because these divide evenly into 18.

When choosing a window, we want: - Use what we know about the function to check the graph - Make all important values of the function are visible. - Hide most invalid values of the function. - Set tick marks to be easy to count and calculate.

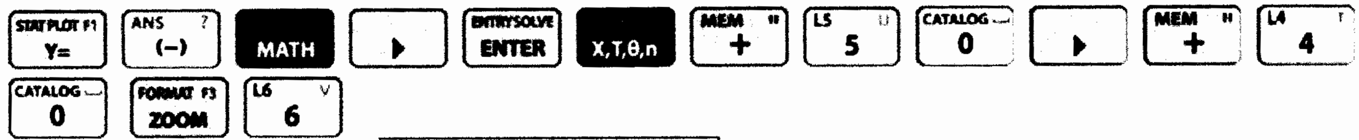
Example 5: If Xscl = 0.71, list the values of the first five ticks. Is this a usable choice for Xscl?

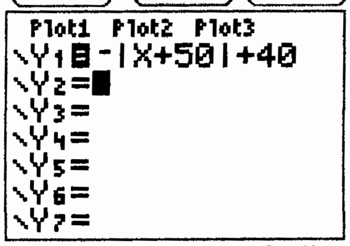
Answer: Each tick is a multiple of 0.71, so the first five ticks are 0.71, 1.42, 2.13, 2.84, and 3.55. These are not easy to see or to calculate, so this is not a good choice for Xscl.

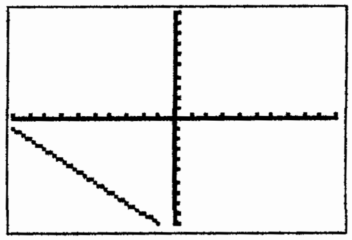
Example 6: If Xscl = 5, list the values of the first five ticks. Is this a usable choice for Xscl?

Answer: Each tick is a multiple of 5, so the first five ticks are 5, 10, 15, 20, 25.
These are easy to calculate, and if appropriate for the function, could be a good choice for Xscl.

Example 7: Graph $y = -|x+50| + 40$ in the standard window. Use information about absolute value functions to determine if the important values of the function are visible. Is this a good window choice? If not, determine useful window values and graph $y = -|x+50| + 40$.







An absolute value of a linear expression should give a V shape, but we are only seeing a line. This is not a good window choice.

Step 1: Notice the 50, 40, and negative. If you know shifts, recognize that $x+50$ has moved the graph *left* 50 units, making the point of the V in QII or QIII. Imagine or sketch this before continuing.

The negative makes every *y*-coordinate its opposite, turning the V upside down to make a tent ∧. Imagine or sketch this before continuing.

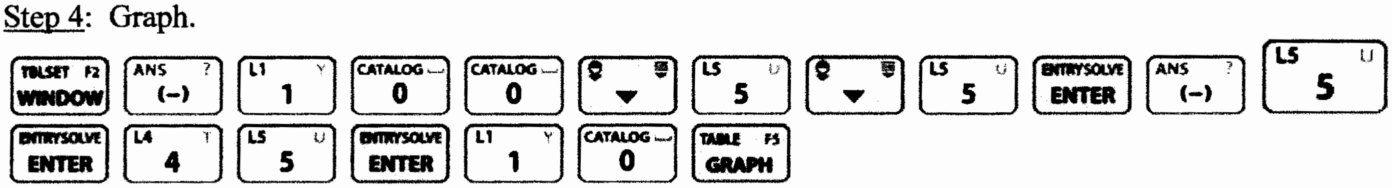
The +40 moves the *y*-coordinates up 40 units, so the point of the tent is in QII, with coordinates $(-,+)$. Imagine or sketch this before continuing. You may want to check a table of values in your GC.

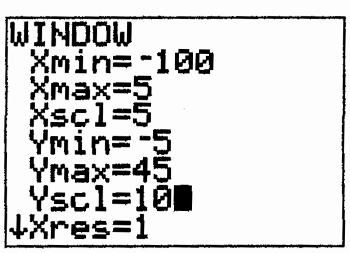
Step 2: Find Xmin, Xmax, and Xscl. If the point of the tent is $(-50,40)$, the graph continues *left*, and Xmin must be smaller than -50. Because the point is moved up 40 units, the x-intercept is even further left, or -90. We'll use Xmin = -100. Imagine or sketch this before continuing. We don't need positive values of x, so use Xmax = 5, so including the origin as a point of reference.

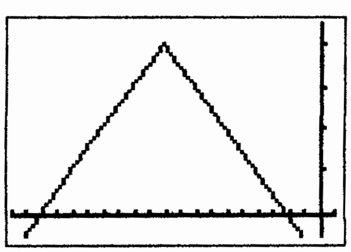
To determine Xscl, subtract Xmax – Xmin = $5-(-100)=105$, which is divisible by 5. $105/5 = 21$ ticks, the same number as in a standard graphing window. Xscl = 5.

Step 3: Find Ymin, Ymax, and Yscl. In QII, we need *y*-values which are positive, including the value y=40. Let's choose Ymax = 45 and Ymin =-5 (to include the origin as a point of reference). Subtract Ymax – Ymin = $45-(-5)=50$, which is divisible by 5. $50/5 = 10$. Yscl = 10, fewer ticks than the standard window.

Step 4: Graph.







Practice:

1) What is the y-coordinate of any x-intercept on any graph? Answer: ____________

2) What is the x-coordinate of any y-intercept on any graph? Answer: ____________

The next five questions use $11x - y = 22$ and its graph.

3) Use algebra to find the x-intercept of $11x - y = 22$ and the y-intercept of $11x - y = 22$.

Answer: ____________

4) Use algebra to isolate y so that you can graph $11x - y = 22$ in your GC.

Answer: ____________

5) Graph $11x - y = 22$ using a standard window on your GC. Which intercept is not visible?

Answer: ____________

6) Change the graphing window so that the y-intercept of $11x - y = 22$ is visible in the GC window. What Ymin value did you use?

Answer: ____________

7) Choose a new Yscl so that there are fewer tick marks. What Yscl value did you use?

Answer: ____________

The next five questions use $x + 4y = 20$ and its graph.

8) Use algebra to find the x-intercept of $x + 4y = 20$ and the y-intercept of $x + 4y = 20$.

Answer: ____________

9) Use algebra to isolate y so that you can graph $x + 4y = 20$ in your GC.

Answer: ____________

10) Graph $x + 4y = 20$ using a standard window on your GC. Which intercept is not visible?

Answer: ____________

11) Adjust the window so that both the x-intercept and y-intercept of $x + 4y = 20$ are visible in your GC window. Which dimension(s) must be changed?

Answer: ____________

12) Adjust Xscl and/or Yscl so that fewer tick marks are used. What values did you use?

Answer: ____________

The next five questions use $2x - 5y = -30$ and its graph.

13) Use algebra to find the x-intercept of $2x - 5y = -30$ and the y-intercept of $2x - 5y = -30$.

Answer: ____________

14) Use algebra to isolate y so that you can graph $2x - 5y = -30$ in your GC.

Answer: ____________

15) Graph $2x - 5y = -30$ using a standard window on your GC. Which intercept is not visible?

Answer: ____________

16) Adjust the window so that both the x-intercept and y-intercept are visible in your GC window. Which dimensions must be changed?

Answer: ____________

17) Adjust Xscl and/or Yscl so that fewer tick marks are used. What values did you use?

Answer: ____________

The next five questions use $3x + 4y = -48$ and its graph.

18) Use algebra to find the x-intercept of $3x + 4y = -48$ and the y-intercept of $3x + 4y = -48$.

Answer: ____________

19) Use algebra to isolate y so that you can graph $3x + 4y = -48$ in your GC.

Answer: ____________

20) Graph $3x + 4y = -48$ using a standard window on your GC. Which intercept(s) is(are) not visible?

Answer: ____________

21) Adjust your GC window so that both intercepts are visible. Which dimension(s) must be changed?

Answer: ____________

22) Adjust Xscl and Yscl so that there are fewer tick marks. What values did you choose?

Answer: ____________

TI-84+ GC 17 Changing the Window page 7

For the next problems, use the graph to decide how to adjust the window dimensions and scale so that all intercepts are visible. For your answers, write the values you chose for the window.

23) $4x-3y=48$

Xmin = **Xmax** = **Xscl** = **Ymin** = **Ymax** = **Yscl** =

24) $x+y=15$

Xmin = **Xmax** = **Xscl** = **Ymin** = **Ymax** = **Yscl** =

25) $x-2y=-30$

Xmin = **Xmax** = **Xscl** = **Ymin** = **Ymax** = **Yscl** =

26) $y=x^2-15$

Xmin = **Xmax** = **Xscl** = **Ymin** = **Ymax** = **Yscl** =

27) $y=\sqrt{x-11}$

Xmin = **Xmax** = **Xscl** = **Ymin** = **Ymax** = **Yscl** =

28) $y=|x-14|$

Xmin = **Xmax** = **Xscl** = **Ymin** = **Ymax** = **Yscl** =