Unit 6: Lesson 01

Linear function definition
Plotting points and verifying with a graphing calculator

A linear function is one in which *x* and *y* and are both raised to the **1 power.**

Linear functions always produce a **straight line** when graphed.

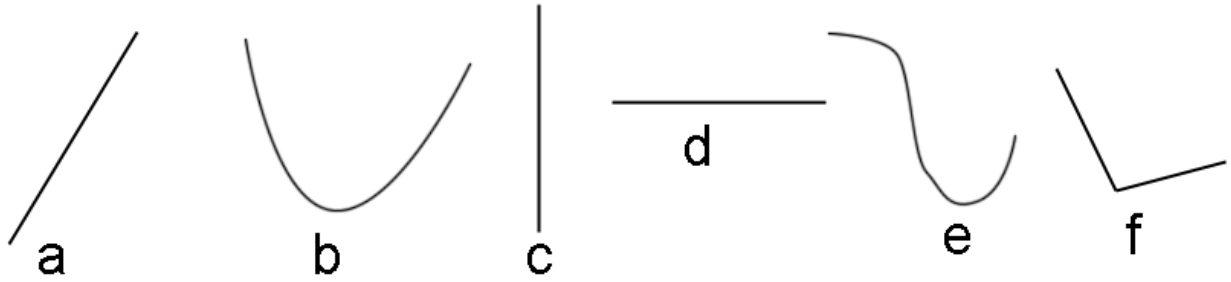
Example 1: Is y = 3x + 13 a linear function? Why?

Yes. Both x and y are both understood to be raised to the 1 power.

Example 2: Is $y = 3x^2 + 9$ a linear function? Why?

No, because x is raised to the 2 power.

Example 3: Of the following graphs, which represent linear functions?



a & d (note that c is not even a function…fails vert. line test)

When we are given a linear function, instead of something like

y = 4x + 2,

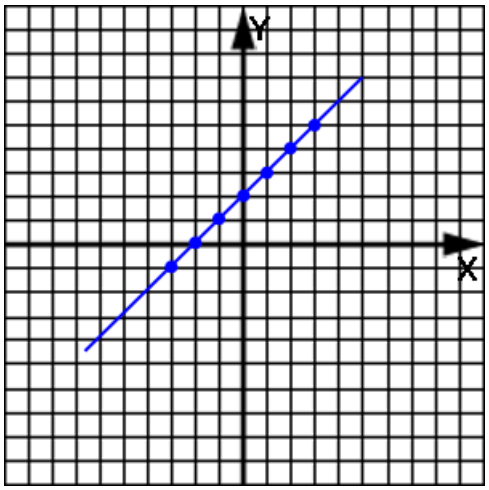
we will often be given the equivalent form in functional notation:

f(x) = 4x + 2

Both ***y* and f(x) are the same** and can be used interchangeably.

Example 4: Fill in the chart to produce the *y* values for the linear function f(x) = x + 2 corresponding to the domain { -3, -2, -1, 0, 1, 2, 3 }. Plot each point and then connect the points with a best fitting graph.

x	f(x) = x + 2	y
-3	*f(-3) = -3 + 2 =*	*-1*
-2	*f(-2) = -2 + 2 =*	*0*
-1	*f(-1) = -1 + 2 =*	*1*
0	*f(0) = 0 + 2 =*	*2*
1	*f(1) = 1 + 2 =*	*3*
2	*f(2) = 2 + 2 =*	*4*
3	*f(3) = 3 + 2 =*	*5*



Example 5: If the graph produced in Example 5 above is extended forever in both directions, the given domain is ignored, and assuming **all** points are used:

What would be the new domain of the function f(x)?

All real x's

What would be the new range of the function f(x)?

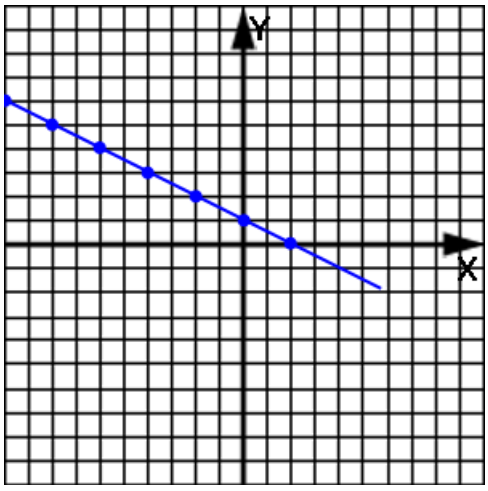
All real y's

What is the apparent shape of the graph?

A line

Example 6: Fill in the chart to produce the *y* values for the linear function f(x) = (-½)x + 1 corresponding to the domain { -10, -8, -6, -4, -2, 0, 2 }. Plot each point and then connect the points with a best fitting graph.

x	f(x) = (-½)x + 1	y
-10	*f(-10) = (-½)(-10) + 1 =*	*6*
-8	*f(-8) = (-½)(-8) + 1 =*	*5*
-6	*f(-6) = (-½)(-6) + 1 =*	*4*
-4	*f(-4) = (-½)(-4) + 1 =*	*3*
-2	*f(-2) = (-½)(-2) + 1 =*	*2*
0	*f(0) = (-½)(0) + 1 =*	*1*
2	*f(2) = (-½)(2) + 1 =*	*0*



Example 7: If the graph produced in Example 6 above is extended forever in both directions, the given domain is ignored, and assuming **all** points are used:

What would be the new domain of the function f(x)?

All real x's

What would be the new range of the function f(x)?

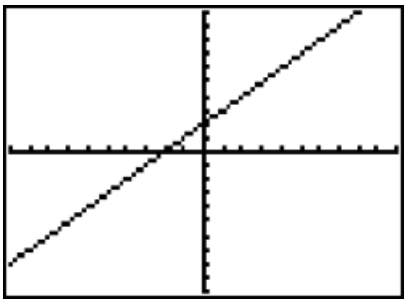
All real y's

What is the apparent shape of the graph?

A line

Example 8: We will now verify with a graphing calculator that the graph we produced in Example 4 is correct.

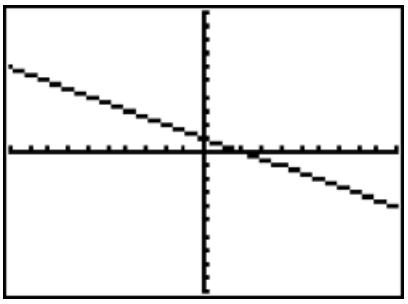
Using the linear function f(x) = x + 2, enter the *x* + 2 part as **Y1** and with the **ZOOM** button, specify 6. ZSTANDARD ZOOM. Press the **GRAPH** button and make a sketch of the calcultor display here.



If you are not famaliar with how to graph a function on a graphing calculator, see **Calculator Appendix D** and an associated video.

Example 9: We will now verify with a graphing calculator that the graph we produced in Example 6 is correct.

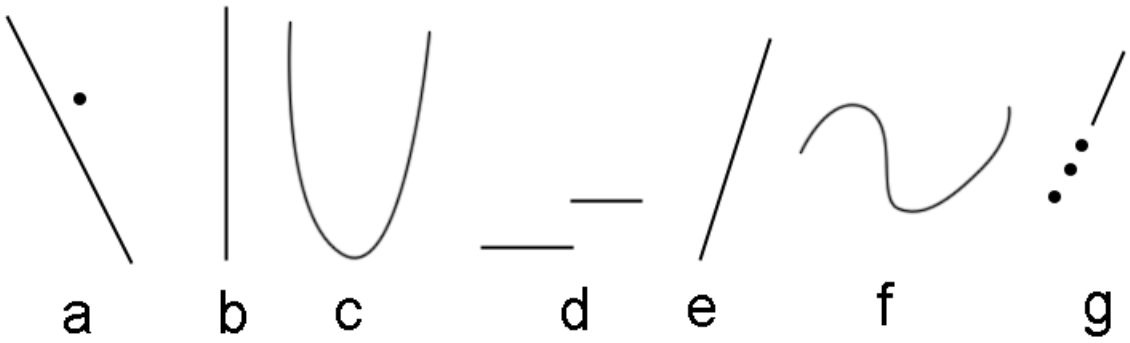
Using the linear function f(x) = (-½)x + 1, enter the (-½)x + 1 part as **Y1** and with the **ZOOM** button, specify **6. ZSTANDARD ZOOM**. Press the **GRAPH** button and make a sketch of the calcultor display here.



Assignment: In problems 1- 6, state whether the function would produce a line when graphed. Give the reason for your choice.

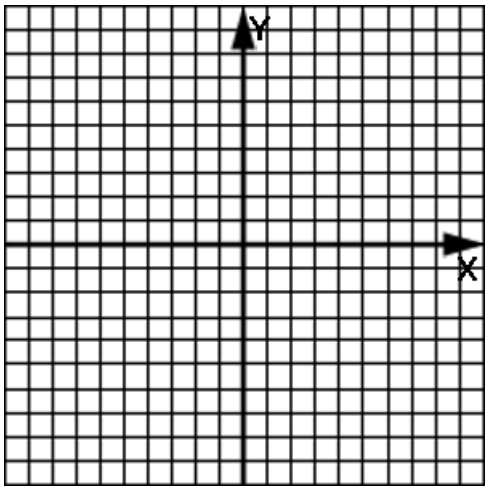
1. $y = -8x/2 + 11$	2. $f(x) = x^3 - 3$
3. $x^2 + y^2 = -20$	4. $9x - 2y = 0$
5. $2f(x) + 8x = 19$	6. $2[f(x)]^2 + 8x = 19$
7. Which of problems 1-6 are linear functions?	8. When a linear function is given in terms of f(x), with what variable do we commonly replace f(x)?

9. Which of the following graphs depict linear functions? Assume that the domain is "all real *x.*" (Hint: It not only has to be linear, it must also be a **function**.)



10. Fill in the chart to produce the *y* values for the linear function f(x) = 2x + 1 corresponding to the domain { -5, -3, -1, 0, 1, 3, 4 }. Plot each point and then connect the points with a best fitting graph.

x	**f(x) = 2x + 1**	**y**
-5		
-3		
-1		
0		
1		
3		
4		

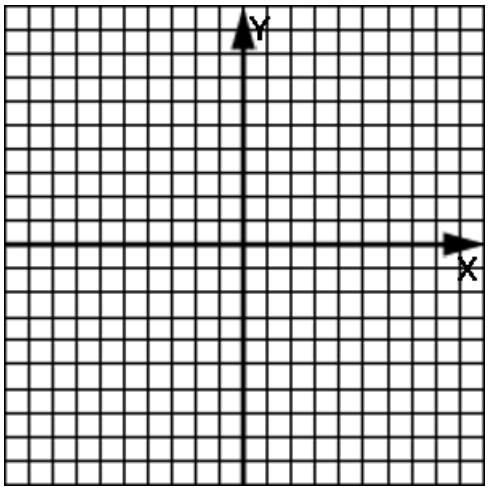


11. Disregarding the domain given above for problem 7, what would be the domain for this function if the graph is extended forever in both directions and **all** points on the line are used?

12. Disregarding the domain given above for problem 7, what would be the range for this function if the graph is extended forever in both directions and **all** points on the line are used?

13. Fill in the chart to produce the *y* values for the linear function f(x) = (-1/3)x + 2 corresponding to the domain { -9, -6, -3, 0, 3, 6, 9 }. Plot each point and then connect the points with a best fitting graph.

x	**f(x) = (-1/3)x + 2**	**y**
-9		
-6		
-3		
0		
3		
6		
9		



14. Use a graphing calculator to graph problem 7. Make a sketch of the calculator display.

15. Use a graphing calculator to graph problem 13. Make a sketch of the calculator display.