4.01 *Graphing a Line*

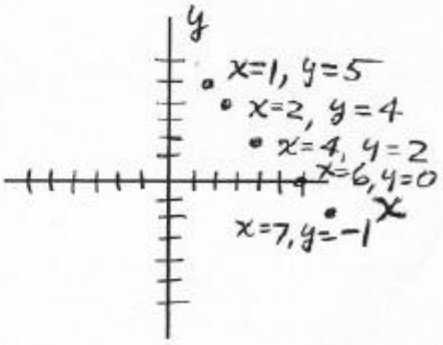
Dr. Robert J. Rapalje

Up to this point the equations you have graphed have been one dimensional. You have solved **linear equations**--that is, equations with the variable raised to the first power like $X + 4 = 6$, and you have solved **quadratic equations**--that is, equations with the variable raised to the second power like $X^2 - 3X + 2 = 0$. It was easy to express the solutions to these types of equations, since linear equations usually have only one solution (quadratic equations up to two solutions).

Now consider an equation with **two variables**, like $X + Y = 6$. Since there are two variables, each solution will have two parts, an "X" part and a "Y" part. One solution would be X=1 and Y=5. Another solution would be X=2 and Y=4. Other solutions would be X=4 and Y=2, X=6 and Y=0, X=7 and Y=-1, X=1.5 and Y=4.5, etc. As you can see, the number of solutions is infinite--considering the negative and fractional values, there is no way to list all the solutions. It is helpful to find a few of the solution values of X and Y, and put them in a table for convenience, as shown at the right.

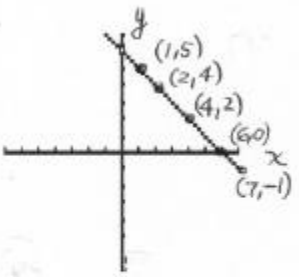
X	Y
1	5
2	4
4	2
6	0
7	-1
1.5	4.5

When you were solving a linear "X" type equation, you could graph the solution on a horizontal numberline. Now that you have equations in "X" and "Y" it will be helpful to graph the "X" values along a horizontal numberline, as before, and then construct a vertical line to measure the "Y" values. In this way each pair of X and Y values represents a point and may be graphed as shown at the right. The X-axis is always horizontal, and the Y-axis is always vertical. The intersection of the X and Y axes (where X=0 and Y=0) is called the **origin**. To graph each point, always begin at the origin, and count the X value to the right (or the left if X is negative); from there count the Y value up (down if Y is negative), and then put the point.



Instead of having to label the points for example with "X=4 and Y=2", we shorten the notation using parentheses (4,2), where the first number is always the X value, and the second number is always the Y value (alphabetical order!)

Did you notice that all of the solution points you graphed for X + Y = 6 lie on a straight line? Does that tell you about other points that you did not actually graph? Notice that the graph does not stop with the last point graphed, but continues in either direction, as signified by the arrows on the ends of the line.



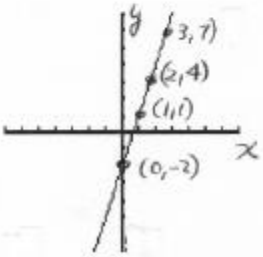
As another example, use the equation **Y = 3X - 2**. Let X equal any numbers you select, and use the equation to find the corresponding values of Y.

For example, if you let X=0, then Y=-2. Next let X=1, then Y=3·1-2, so Y=1.

Next,let X=2, then Y=3·2-2, so Y=4.

Next,let X=3, then Y=3·3-2, so Y=7.

The graph of these points also forms a straight line.



While not every equation in X and Y will be a straight line graph, it is true that every graph in which the X and Y terms are raised to the first power (linear) will be a straight line. The simplest approach to graphing a line (even simpler than graphing calculators!) is point plotting. Just select a value of X (any value of X you choose!) and from the equation find the corresponding value of Y. And how many points does it take? For straight lines, two points will be enough (perhaps a third point to check). For graphs that are not straight lines, more points may be needed, depending upon your own insight and experience.

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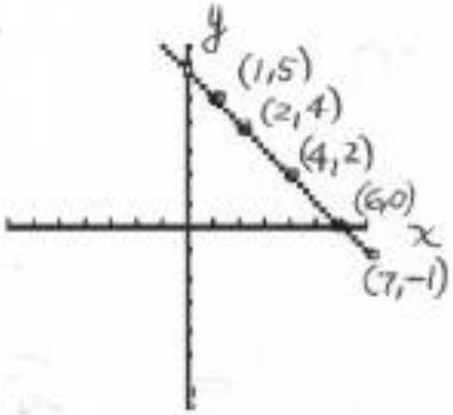

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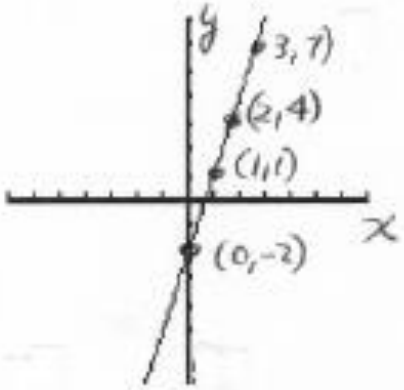

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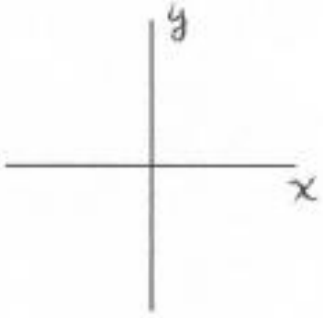
After graphing straight lines by point plotting, you will pursue additional graphing techniques, including **slope-intercept method, X and Y-intercept method, non-linear methods,** and of course, the use of the **graphing calculator.**

EXERCISES. **Complete the following table of values and graph the line. If table values are not given, make up a few values of your own. Use a graphing calculator if you have one.**

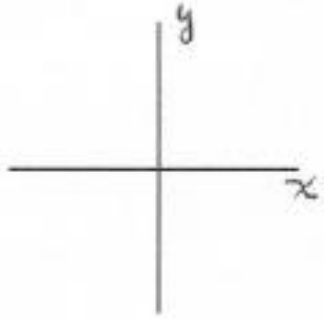
1. Y = 1X + 2

X	Y
0	2
1	3
2	
-1	



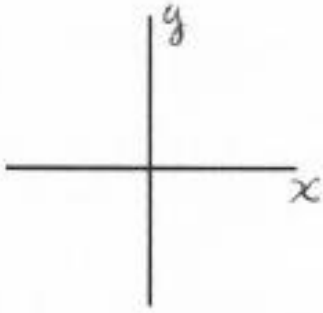
2. Y = 2X + 2

X	Y
0	2
1	
2	
-1	



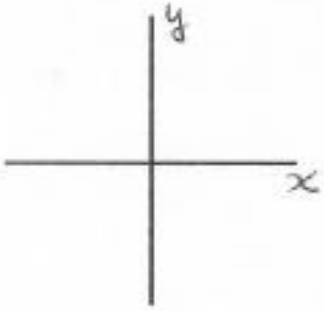
3. Y = 3X + 2

X	Y
0	
1	
-1	
-2	



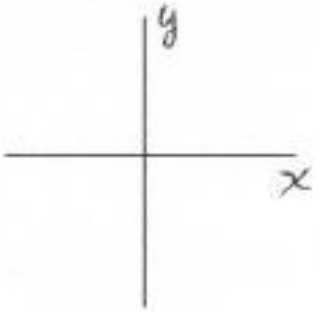
4. Y = -1X + 2

X	Y
0	
1	
2	
-1	



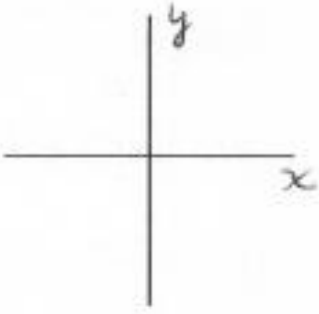
5. Y = -2X + 2

X	Y

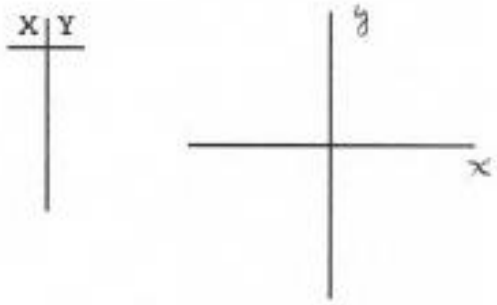


6. Y = -3X + 2

X	Y

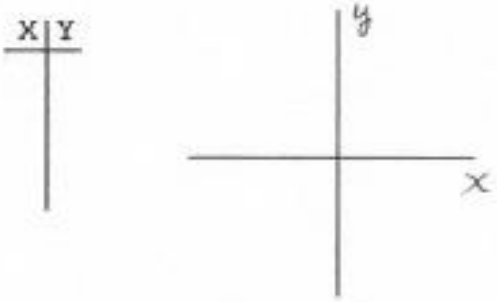


7. Y = X + 4

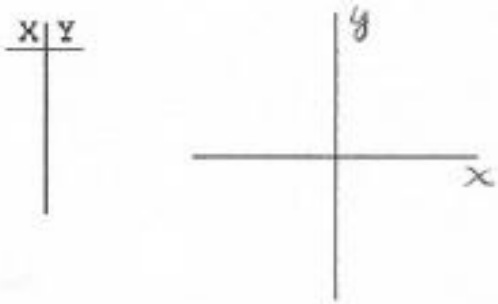


8. Y = 2X + 4

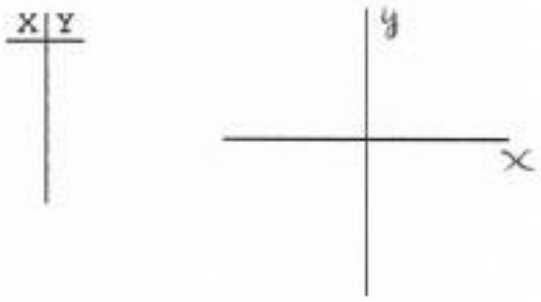
9. Y = -X + 4



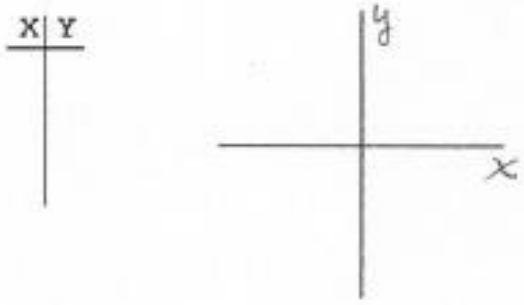
10. Y = -2X + 4



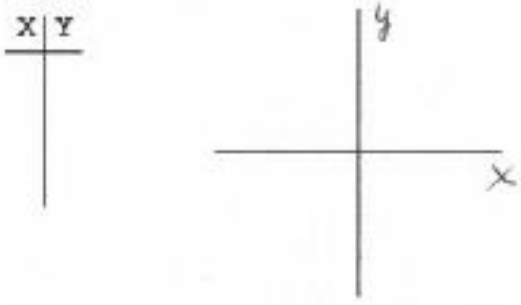
11. Y = X - 2



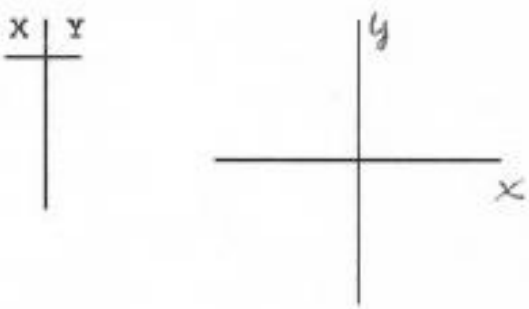
12. Y = 2X - 2



13. Y = -2X - 2



14. Y = -X - 2

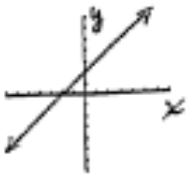


CHAPTER FOUR

ANSWERS 4.01

p.311-312:

1.



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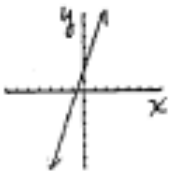

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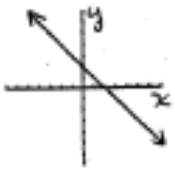

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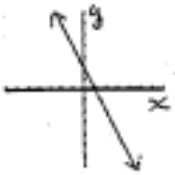

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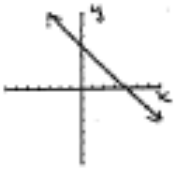

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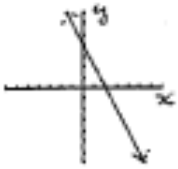

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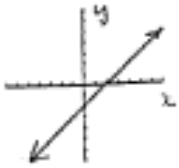

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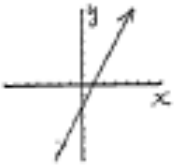

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