2.7 Functions and Function Diagrams

You will need:

- graph paper
- function diagram paper

FUNCTIONS FROM IN-OUT TABLES

Definition: The following tables are called input-output tables, or *in-out tables.*

The number that is put in is x, and y is the number that comes out. Each table has a rule that allows you to get y from x. For example, the rule for the table in problem 1 is *to get y, add three to x.* We say that y can be written *as a function of x:* $y = x + 3$.

Definition: A *function* is a rule that assigns a single output to each input.

For each of the following problems:

a. Copy the table.
b. Describe the rule that allows you to get y from x.
c. Use the rule to find the missing numbers. (In some cases, the missing numbers may be difficult to find; use trial and error and a calculator to make it easier.)
d. Write y as a function of x.

1.

x	y
-5	-2
7	10
5	
	-7

2.

x	y
7	3.8
10	6.8
0	
	10

3.

x	y
5	20
3	12
1	
	-1

4.

x	y
7	40
1	16
-2	4
-5	
	-12

5.

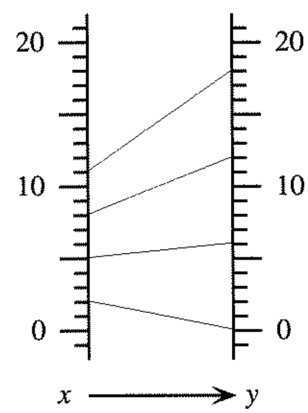
x	y
3	8
4	13
1	-2
7	
	20

6.

x	y
5	15
2	-6
-1	-9
6	
	54

7. **Exploration** Find as many functions as possible that assign the y value 4 to the x value 1.

FUNCTION DIAGRAMS



The figure above shows a function diagram for this table.

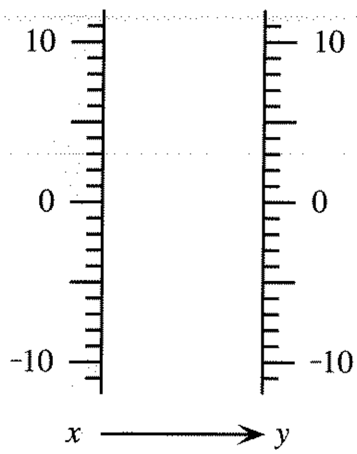
x	y
2	0
5	6
8	12
11	18

8. What is the function illustrated in the previous function diagram?

For each function in problems 9-12:

a. Make a table, using at least five in-out pairs.

b. Make a function diagram, using the scale shown below.



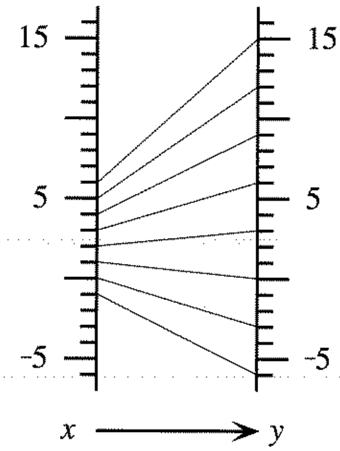
9. $y = x + 2$ 10. $y = x - 2$

11. $y = 2x$ 12. $y = x/2$

13. Make a function diagram for each of the tables in problems 1, 2, and 3. You will have to decide what scale to use on the x- and y-number lines. (For each problem, use the same scale on both number lines.)

Function diagrams are an important way of understanding functions. We will use them throughout this course.

I SEE WHERE YOU'RE COMING FROM



The following problems are about the above function diagram. Assume that more in-out lines could be added, following the same pattern.

14. Find the output when the input is:
a. 0 b. 5 c. -5

15. Find the output when the input is:
a. 99 b. -100 c. 1000

16. Find the output when the input is:
a. 1/2 b. 1/3 c. 1/6

For the following problem, you may need to use trial and error.

17. Find the input when the output is:
a. 0 b. 5 c. -5
d. 99 e. -100 f. 1000

UPS AND DOWNS

Each line in a function diagram connects an input point on the x-number line to its output point on the y-number line. We use the notation (x, y) to refer to such a line. Notice that in the previous diagram some of the lines go up, and some go down. For example: (5, 12) goes up, and (0, -3) goes down.

18. If you were to draw additional lines in the function diagram, could you correctly draw one that goes neither up nor down? Where would it start?

19. In describing the diagram, one might say 5 goes to 12, "moving" up 7 units. Which point "moves" down 5 units?

20. Find a point that moves

a. up 3 units; b. down 3 units;
c. up 6 units; d. down 4 units.

21. Use trial and error to find a point that moves

a. up 99 units;
b. down 100 units.

22. **Generalization** If you know of a point that moves up n units in the previous diagram, how would you find a point that moves down n units? Write a full explanation.

DISCOVERY *SURFACE AREA OF A BOX*

The volume of a box is given by the formula

volume = length · width · height.

23. Write the surface area of a box as a function of length, width, and height. Compare your function with the ones found by some of your classmates.