

## 7.6 Different Combinations

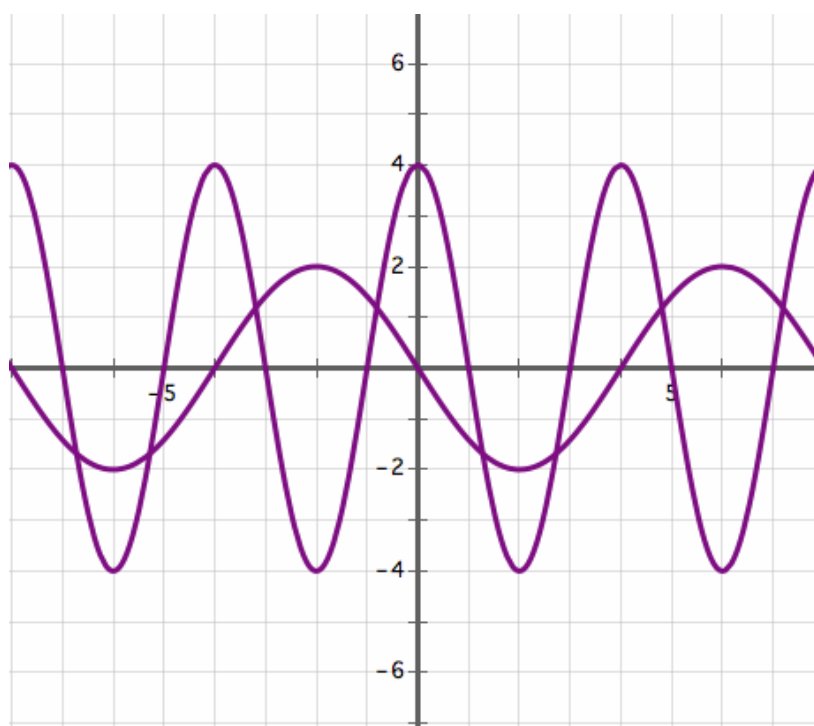
### *A Practice Understanding Task*

We have found the value of being able to combine different function types in various ways to model a variety of situations. In this task you will practice combining functions when they are described in different ways: graphically, numerically or algebraically.

1. Add the following two functions together graphically. That is, do not write the algebraic rules for each individual function, add them together, and then graph the result. See if you can produce the resulting graph by just working with the points on the two graphs and considering what happens when two functions are combined using the operation of addition.



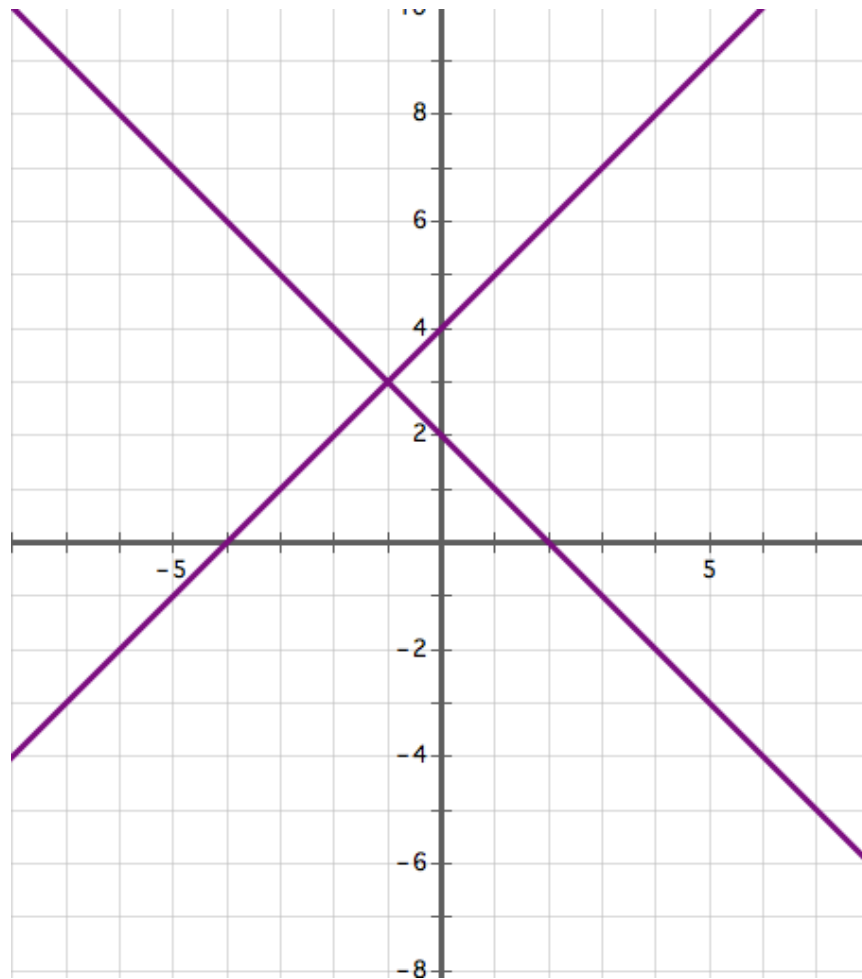
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What points are most helpful in determining the shape of the resulting graph, and why?



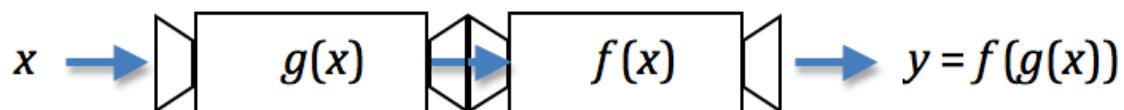
2. Multiply the following two functions together graphically. That is, do not write the algebraic rules for each individual function, multiply them together, and then graph the result. See if you can produce the resulting graph by just working with the points on the two graphs and considering what happens when two functions are combined using the operation of multiplication.



What points are most helpful in determining the shape of the resulting graph, and why?



3. In a previous task we used the following diagram to illustrate function composition. Draw a similar type of diagram to illustrate what happens when two functions are combined by addition or multiplication. Your diagram should clearly show how the output values are obtained for specific input values.



4. Functions  $f$  and  $g$  are defined numerically in the following table. No other points exist for these functions other than the points given. Find the output values for each of the other combinations of functions indicated. Fill in as many points as are defined based on the given data. Use the same input values for all functions.

$x$	$f(x)$	$g(x)$	$(f+g)(x)$	$f^1(x)$	$g(f(x))$	$f(g(x))$
0	0	-3				
1	2	-2				
2	4	-1				
3	6	0				
4	8	1				
5	10	2				
6	12	3				
7	14	4				
8	16	5				



5. Remember the race between the tortoise and the hare? Well, their friends and families have come to cheer them on, and have positioned themselves at various places along the course. Because rabbits are quick and eager to know the outcome of the race, more of them have congregated towards the end of the course. Because turtles are slow and more anxious to cheer their champion off to a good start, more of them have congregated at the beginning of the race. In fact, the density (or amount of animals/meter) of turtles and rabbits along the course as a function of the distance from the starting line is given by the following functions.

**The tortoise:**  $a(d) = 243 \cdot \left(\frac{1}{3}\right)^{\frac{1}{20}d}$  ( $a$  is in turtles per meter,  $d$  in meters)

**The hare:**  $a(d) = 2^{\frac{1}{10}d}$  ( $a$  is in rabbits per meter,  $d$  in meters)

The distance from the starting line, as a function of the elapsed time since the start of the race, is given for the tortoise and the hare by the following functions.

**The tortoise:**  $d(t) = 2^t$  ( $d$  in meters,  $t$  in seconds)

**The hare:**  $d(t) = t^2$  ( $d$  in meters,  $t$  in seconds)

The tortoise and the hare are anxious to know how many of their friends and family they are passing at any instant in time along the race.

- Create functions for the tortoise and for the hare that will calculate the number of turtles or rabbits they will pass at any time,  $t$ , after the race begins. Include a reasonable domain for each function.
- If the race is 100 meters long, create a function that will tell how many spectators, rabbits and turtles, are watching at any distance away from the start of the race?
- Who is passing the most friends and families, the tortoise or the hare, 5 seconds after the race began?



Name \_\_\_\_\_

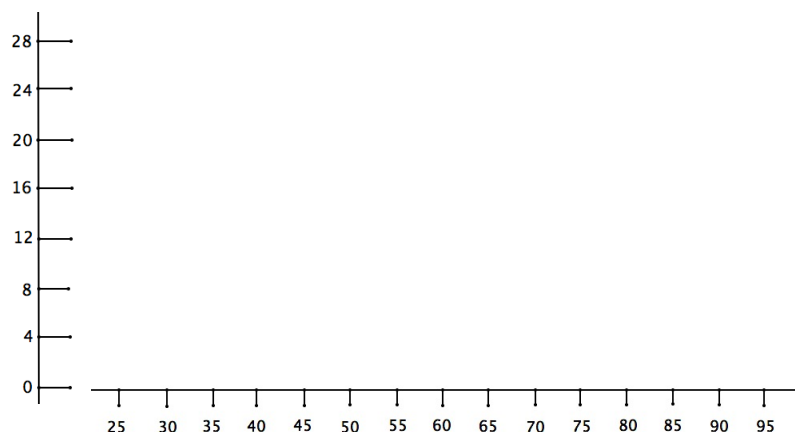
## Modeling With Functions | 7.6

## Ready, Set, Go!

**Ready** Topic: Histograms

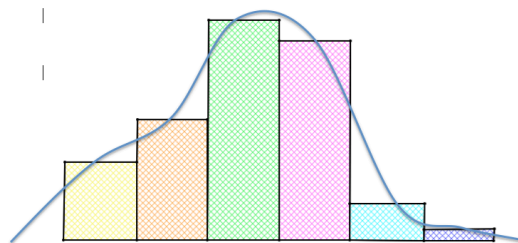
One hundred forty-four college freshmen were given a math placement exam with 100 possible points. The results show that 56 different scores were made, ranging from 24 to 96. The scores were grouped in intervals as shown in the following table:

1. Make a histogram of the grouped data in the chart. Note: The midpoint of each cell is given in the horizontal axis. The sides of the cells will match the score interval. Frequency is the vertical height.



Score interval	Midpoint of interval	Frequency of interval
92.5 - 97.5	95	2
87.5 - 92.5	90	4
82.5 - 87.5	85	10
77.5 - 82.5	80	13
72.5 - 77.5	75	21
67.5 - 72.5	70	26
62.5 - 65.5	65	18
57.5 - 62.5	60	15
52.5 - 57.5	55	12
47.5 - 52.4	50	8
42.5 - 47.5	45	3
37.5 - 42.5	40	3
32.5 - 37.5	35	4
27.5 - 32.5	30	4
22.5 - 27.5	25	1

2. Locate the midpoint at the top of each cell and connect each consecutive midpoint with straight line segments. The resulting figure is called a *frequency polygon*. If you smooth the line segments out into a smooth curve, you will create a *frequency curve*. Make a frequency curve on your histogram. It should look something like the figure on the right.



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Name \_\_\_\_\_

## Modeling With Functions | 7.6

## Set

Topic: Identifying the 2 functions that make up a composite function

Find functions  $f$  and  $g$  so that  $f \circ g = H$ .

3.  $H(x) = \sqrt{x^2 + 5x - 4}$

4.  $H(x) = \left(3 - \frac{1}{x}\right)^2$

5.  $H(x) = (3x - 7)^4$

6.  $H(x) = |5x^2 - 78|$

7.  $H(x) = \frac{2}{3-x^5}$

8.  $H(\theta) = (\tan \theta)^2$

9.  $H(\theta) = \tan(\theta^2)$

10.  $H(x) = \sqrt{\frac{1}{6x}}$

11.  $H(x) = 9(4x - 8) + 1$

## Go

Topic: Finding function values given the graph

Use the graph to find all of the missing values.

12.  $f(\blacksquare) = 8$

13.  $g(\blacksquare) = 5$

14.  $f(\blacksquare) = -1$

15.  $g(\blacksquare) = 0$

19.  $f(-1) = \underline{\hspace{2cm}}$

20.  $g(0) = \underline{\hspace{2cm}}$

16.  $f(x) = g(x)$

17.  $f(x) - g(x) = 0$

18.  $f(x) * g(x) = 0$

19.  $f(2) + g(2) = \blacksquare$

20.  $f(0) - g(0) = \blacksquare$

