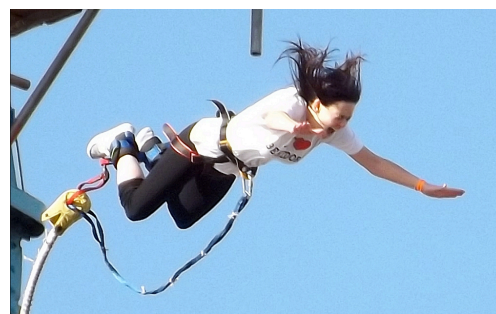


7.3 The Bungee Jump Simulator

A Solidify Understanding Task

As a reward for helping the engineers at the local amusement park select a design for their next ride, you and your friends get to visit the amusement park for free with one of the engineers as a tour guide. This time you remember to bring your calculator along, in case the engineers start to speak in “math equations” again.

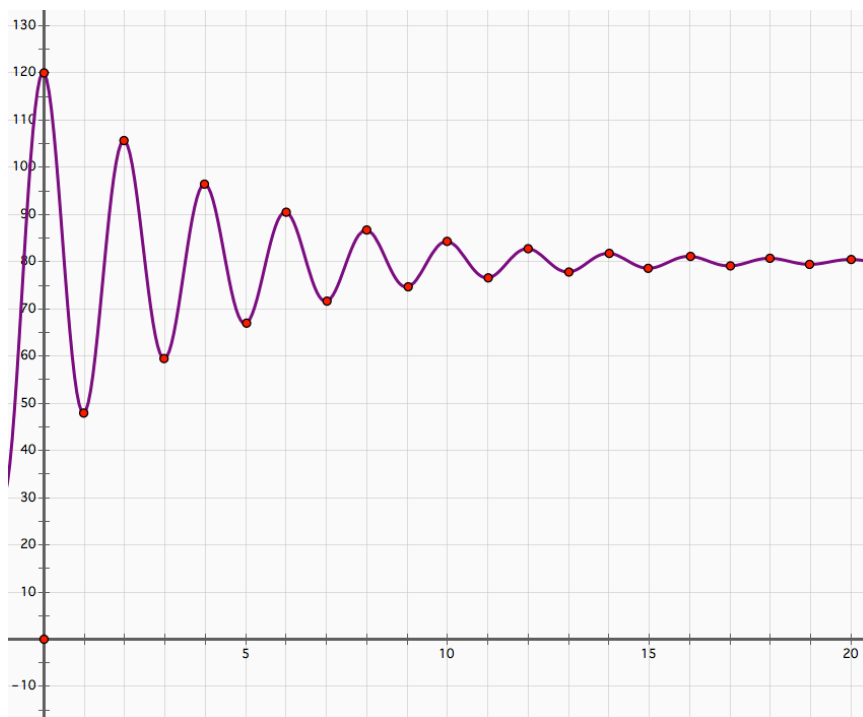


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Sure enough, just as you are about to get in line for the *Bungee Jump Simulator*, your guide pulls out a graph and begins to explain the mathematics of the ride. To prevent injury, the ride has been designed so that a bungee jumper follows the path given in this graph. Jumpers are launched from the top of the tower at the left, and dismount in the center of the tower at the right after their up and down motion has stopped. The cable to which their bungee cord is attached moves the rider safely away from the left tower and allows for an easy exit at the right.

Your tour guide won't let you and your friends get in line for the ride until you have reproduced this graph on your calculator exactly as it appears in this diagram.

1. Work with a partner to try and recreate this graph on your calculator screen. Make sure you pay attention to the height of the jumper at each oscillation, as given in the table.



<i>hor</i>	<i>vert</i>	<i>distance from midline</i>
0	120	40
1	48	32
2	105.6	25.6
3	59.52	20.48
4	96.38	16.38
5	66.89	13.11
6	90.49	10.49
7	71.61	8.39
8	86.71	6.71
9	74.63	5.37
10	84.30	4.30
11	76.56	3.44
12	82.75	2.75
13	77.80	2.20
14	81.76	1.76
15	78.59	1.41
16	81.13	1.13
⋮	⋮	

Record your equation of this graph here:

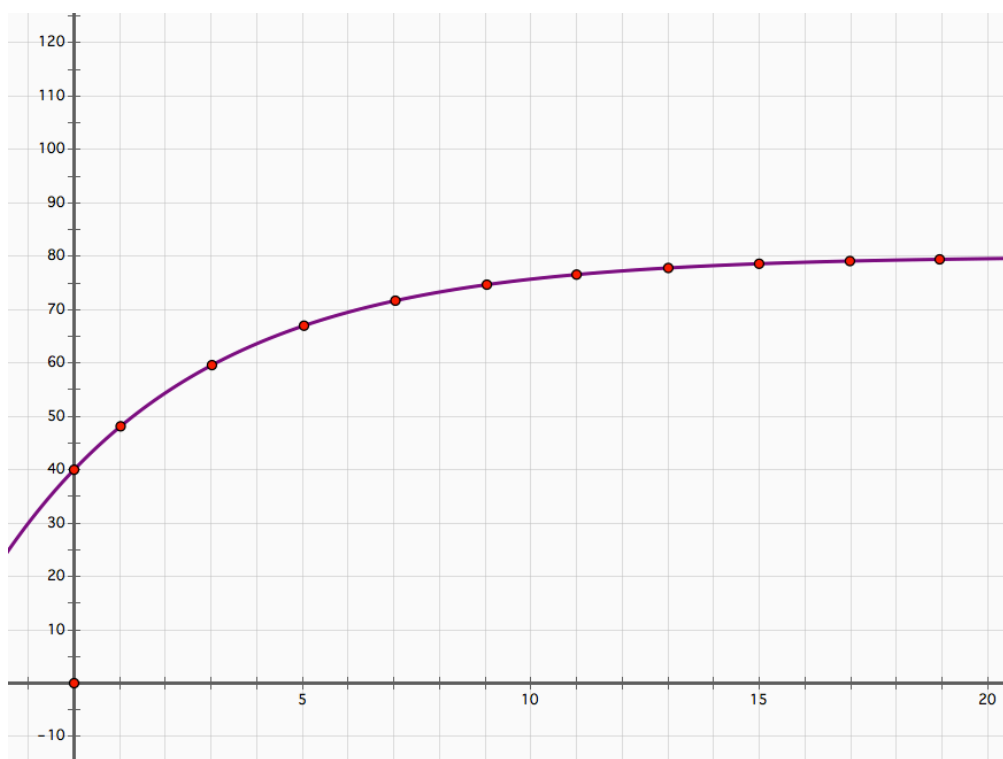


After a thrilling ride on the *Bungee Jump Simulator*, you are met by your host who has a new puzzle for you. “As you are aware,” says the engineer, “temperatures around here are very cold at night, but very warm during the day. When designing rides we have to take into account how the metal frames and cables might heat up throughout the day. Our calculations are based on Newton’s Law of Heating. Newton found that while the temperature of a cold object increases when the air is warmer than the object, the rate of change of the temperature slows down as the temperature of the object gets closer to the temperature of its surrounding.”

Of course the engineer has a graph of this situation, which he says “represents the decay of the difference between the temperature of the cables and the surrounding air.”

Your friends think this graph reminds them of the points at the bottom of each of the oscillations of the bungee jump graph.

- Using the clue given by the engineer, “This graph represents the *decay* of the difference between the temperature of the cables and the surrounding air,” try to recreate this graph on your calculator screen. (Hint: What types of graphs do you generally think of when you are trying to model a growth or decay situation? What transformations might make such a graph look like this one?)



Record your equation of this graph here:

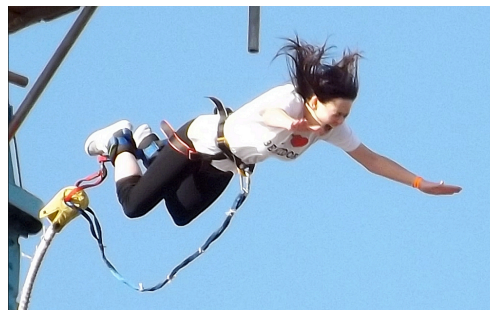


Name _____

Modeling With Functions | 7.3

Ready, Set, Go!**Ready** Topic: Evaluating functions

Evaluate each function as indicated. Simplify your answers when possible. State *undefined* when applicable.



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1. $f(x) = x^2 - 8x$

Find a) $f(0)$ b) $f(-10)$ c) $f(5)$ d) $f(8)$ e) $f(x + 2)$

2. $g(x) = \frac{3x-5}{x}$

Find a) $g(-1)$ b) $g(10)$ c) $g\left(\frac{1}{3}\right)$ d) $g(0)$ e) $g(2x + 4)$

3. $h(x) = \sin(x)$

a) $h(\pi)$ b) $h\left(\frac{3\pi}{2}\right)$ c) $h\left(\frac{11\pi}{6}\right)$ d) $h\left(\frac{5\pi}{4}\right)$ e) $h\left(\cos^{-1}\left(\frac{-1}{2}\right), x < \pi\right)$

4. $w(x) = \tan(x)$

a) $w(\pi)$ b) $w\left(\frac{3\pi}{2}\right)$ c) $h\left(\frac{7\pi}{6}\right)$ d) $h\left(\frac{3\pi}{4}\right)$ e) $h\left(\cos^{-1}\left(\frac{-1}{2}\right), x < \pi\right)$ 

Name _____

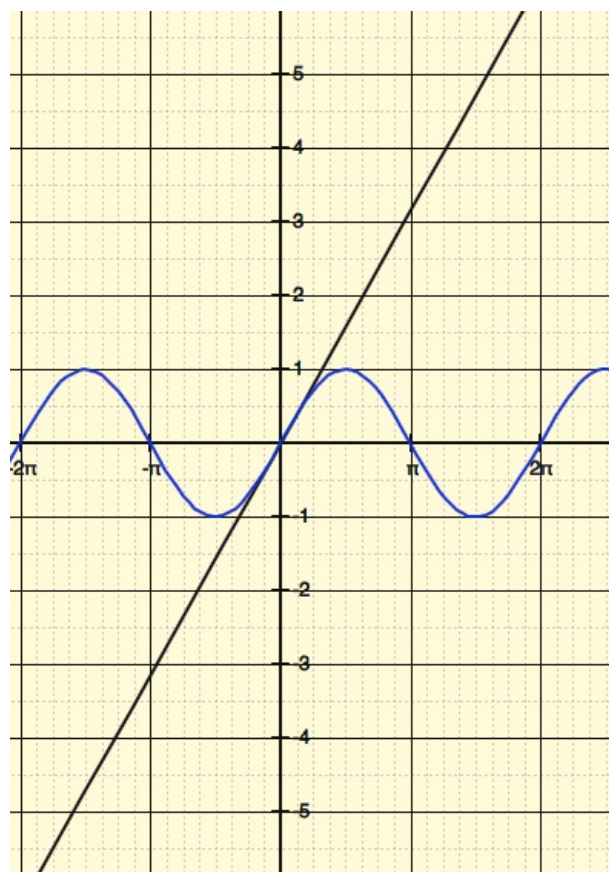
Modeling With Functions | 7.3

Set Topic: Dampening functions

Two functions are graphed. Graph a third function by multiplying the two functions together. Use the table of values to assist you. It may help you to change the function values to decimals.

5.

x	$y_1 = x$	$y_2 = \sin x$	$y_3 = (x)\sin x$
-2π			
$-\frac{3\pi}{2}$			
$-\pi$			
$-\frac{\pi}{2}$			
0			
$\frac{\pi}{2}$			
π			
$\frac{3\pi}{2}$			
2π			



6. After you have graphed y_3 , graph the line $y_4 = -x$. What do you notice about the graph of y_3 in relation to the graphs of y_1 and y_4 ?



Go Topic: Measures of central tendency (Mean, median, mode)

During salary negotiations for teacher pay in a rural community, the local newspaper headlines announced: **Greedy Teachers Demand More Pay!** The article went on to report that teachers were asking for a pay hike even though district employees, including teachers, were paid an average of \$70,00.00 per year, while the average annual income for the community was calculated to be \$55,000 per household. The 65 schoolteachers in the district responded by declaring that the newspaper was spreading false information.

Use the table below to explore the validity of the newspaper report.

Job Description	Number having job	Annual Salary
Superintendent	1	\$258,000
Business Administrator	1	\$250,000
Financial Officer	1	\$205,000
Transportation Coordinator	1	\$185,000
District secretaries	5	\$ 55,000
School Principals	5	\$200,000
Assistant Principals	5	\$175,000
Guidance Counselors	10	\$ 85,000
School Nurse	5	\$ 83,000
School Secretaries	10	\$ 45,000
Teachers	65	\$ 48,000
Custodians	10	\$ 40,000

- Which measure of central tendency (mean, median, mode) do you think the newspaper used to report the teachers' salaries? Justify your answer.
- Which measure of central tendency do you think the teachers would use to support their argument? Justify your answer.
- Which measure gives the clearest picture of the salary structure in the district? Justify.
- Make up a headline for the newspaper that would be more accurate.

