Lesson 16: Function Composition

Classwork

**Example 1**

Consider the tables from the opening scenario.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Depth of Free Diver During Descent | | | | | | | | | |
| seconds of descent | 20 | 40 | 60 | 80 | 100 | 120 | 140 | 160 | 180 |
| depth in meters of diver | 15 | 32 | 44 | 65 | 79 | 90 | 106 | 120 | 133 |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Atmospheric Pressure and Ocean Depth | | | | | | | | | |
| depth in meters of diver | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
| pressure in on diver | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

* 1. Do the tables appear to represent functions? If so, define the function represented in each table using a verbal description.
  2. What are the domain and range of the functions?
  3. Let’s define the function in the first table as and the function in the second table as . Use function notation to represent each output, and use the appropriate table to find its value:
     1. depth of the diver at 80 seconds
     2. pressure of the diver at a depth of meters
  4. Explain how we could determine the pressure applied to a diver after seconds of descending.
  5. Use function notation to represent part (d), and use the tables to evaluate the function.
  6. Describe the output from part (e) in context.

**Example 2**

Consider these functions:

NameCalendar Date

Assign each enrolled student to his or her birthday.

NameName

Assign each person to his or her biological father.

Describe the action of each composite function. Determine which composite functions make sense.

Exercises 1–2

1. Let and . Write an expression that represents each composition:
2. Suppose a sports medicine specialist is investigating the atmospheric pressure placed on competitive free divers during their descent. The following table shows the depth, , in meters of a free diver seconds into his descent. The depth of the diver is a function of the number of seconds the free diver has descended,

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| seconds | 10 | 35 | 55 | 70 | 95 | 115 | 138 | 160 | 175 |
| depth in meters | 8.1 | 28 | 45 | 55 | 76.0 | 91.5 | 110 | 130 | 145 |

The pressure, in atmospheres, felt on a free diver, , is a function of his or her depth, .

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| meters | 25 | 35 | 55 | 75 | 95 | 115 | 135 | 155 | 175 |
|  | 2.4 | 3.5 | 5.5 | 7.6 | 9.6 | 11.5 | 13.7 | 15.5 | 17.6 |

* 1. How can the researcher use function composition to examine the relationship between the time a diver spends descending and the pressure he or she experiences? Use function notation to explain your response.
  2. Explain the meaning of in context.
  3. Use the charts to approximate these values, if possible. Explain your answers in context.

Problem Set

1. Determine whether each rule described represents a function. If the rule represents a function, write the rule using function notation, and describe the domain and range.
   1. Assign to each person his or her age in years.
   2. Assign to each person his or her height in centimeters.
   3. Assign to each piece of merchandise in a store a bar code.
   4. Assign each deli customer a number ticket.
   5. Assign a woman to her child.
   6. Assign to each number its first digit.
   7. Assign each person to his or her biological mother.
2. Let people people

Assign to each person his or her biological mother.

people people

Assign to each person his or her biological father.

people people

Assign to each person the first letter of his or her name.

people people

Assign to each person his or her age in years.

Which of the following compositions makes sense? For those that do, describe what the composite function is doing.

1. Let
2. Let .
3. Let
4. Let
   1. Show that .
   2. Does ? Graph them on the same coordinate plane.
5. Given the chart below, find the following:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

1. Suppose the strep throat virus is spreading in a community. The following table shows the number of people, , that have the virus days after the initial outbreak. The number of people who have the virus is a function of the number of days, .

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| days |  |  |  |  |  |  |  |
| number of people infected |  |  |  |  |  |  |  |

There is only one pharmacy in the community. As the number of people who have the virus increases, the number of boxes of cough drops, , sold also increases. The number of boxes of cough drops sold on a given day is a function of the number of people who have the virus, , on that day.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| number of people infected |  |  |  |  |  |  |  |  |  |  |  |  |  |
| number of boxes of cough drops sold |  |  |  |  |  |  |  |  |  |  |  |  |  |

* 1. Find , and state the meaning of the value in the context of the strep throat epidemic. Include units in your answer.
  2. Fill the chart below using the fact that .

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| (days) |  |  |  |  |  |  |  |
| number of boxes of cough drops sold |  |  |  |  |  |  |  |

* 1. For each of the following expressions, interpret its meaning in the context of the problem, and if possible, give an approximation of its value.