

1: Functions --- Answers

1. Symbolic (e.g. $y = 2x + 7$), graphical (e.g. gas prices over time), numerical (e.g. table of data, such as test scores), and verbal (e.g. an explanation of how the circumference of a circle increases as the diameter increases).
2.
 - a) No. The definition of a function is that for every valid input there is one and only one output.
 - b) Yes, that does not violate the definition of a function. For example in the function $y = x^2$, the inputs -2 and 2 both have the same output 4 .
3. If a vertical line passes through a graph at more than one point, that means there are two distinct y -values (outputs) for one x -value (input). Thus the graph violates the definition of a function.
4. If a horizontal line passes through a graph at more than one point, this means that two distinct x -values (inputs) have the same y -value (output). This does not violate the definition of a function.
5.
 - a) This is a function since nobody has (or at least should have) more than one social security number.
 - b) This is not a function since some people have more than one major.
 - c) This is a function since each input has exactly one output.
 - d) This is a function since for every possible input there will be only one output.
 - e) This is not a function since the graph fails the vertical line test.
6.
 - a) Domain: positive real numbers with a length unit.
Range: positive real numbers with cubic units.
 - b) Domain: non-negative real numbers with units of volume.
Range: non-negative real numbers with units of money.
 - c) Domain: years between say 1895 and 2004.
Range: positive real numbers with units of money say between \$4000 and \$50,000.
 - d) Domain: days of the month of December, between 1 and 31.
Range: real numbers with temperature units say between -30 and 100 degrees F.
7. A symbolic representation.
8. 265,916,993 people
9. 2,026,688 people. This seems quite a bit low considering the graph on page 2.
10. The output row.
11. Division by zero and a negative number under a square root sign.
12.
 - a. Domain: all real numbers. Range: all real numbers.
 - b. Domain: all positive real numbers. Range: all positive real numbers.

- 13.
- Domain: all real numbers. Range: All real numbers greater than or equal to -2 .
 - Domain: all real numbers except $x = 10$. Range: all real numbers except $f(x) = 0$.
 - Domain: $0 \leq x \leq 6$. Range: $0 \leq y \leq 16$.
 - Domain: $\{0, 2, 4, 6\}$. Range: $\{-1, 1, 2\}$
 - Domain is hours, $0 \leq h \leq 168$. Range is pay in dollars, $\$0 \leq p \leq \1218 .
 - Domain: $M \geq 0$. Range: $F \geq 0$. (unless you assign a negative value for a distance "behind" a starting point)
14. When 2 is put into the function f , the output is 1.
- 15.
- 4
 - 16
 - $3a^2 + 4$
 - $3(x + 1)^2 + 4$
- 16.
- -8
 - 0
 - 8
17. Answers will vary. Another example is the rule to determine the total cost gasoline pumped into your car depends of what grade of fuel is purchased.
- 18.
- Answers will vary. The company may be enticing customers to pay a higher monthly charge for the possibility of more hours at a better rate.
 - \$20
 - 45 hours