**5.2 – Properties of Functions**

The set of the 1st elements of a relation is its ***domain***. The set of the related 2nd elements of a relation is its ***range.*** When listing the domain and range, do not repeat any elements if they appear more than once.

A ***function*** is a special type of relation where each element in the domain is associated with **EXACTLY ONE** element in the range.

**Example 1: Identifying Functions**

Determine if each relation below is a function.

Is the # of players on a team for

 5 baseball

 6 basketball

 9 hockey

 11 soccer

 volleyball

The domain is {5, 6, 9, 11} and the range is {baseball, basketball, hockey, soccer, volleyball}. Since there are two arrows from the 6 in the 1st set, the relation **is not** a function.

Has this # of players on a team

 Baseball 5

 Basketball 6

 Hockey 9

 Soccer 11

 Volleyball

The domain is {baseball, basketball, hockey, soccer, volleyball} and the range is {5, 6, 9, 11}. Since each element in the domain matches up with exactly one element in the range, this is a function.

This table shows the masses of different numbers of Canadian quarters.

|  |  |
| --- | --- |
| **Number of Quarters, *n*** | **Mass (g), *m*** |
| 1 | 4.4 |
| 2 | 8.8 |
| 3 | 13.2 |
| 4 | 17.6 |
| 5 | 22.0 |

The mass of the quarters, *m*, depends on the number of quarters, *n*. We say that *m* is the ***dependent variable*** and *n* is the ***independent variable.***

**Example 2: Describing Functions**

This table shows samples costs for a pay-as-you-go cell phone plan.

|  |  |
| --- | --- |
| **Number of Minutes, *n*** | **Cost ($), *m*** |
| 10 | 2 |
| 20 | 4 |
| 30 | 6 |
| 40 | 8 |
| 50 | 10 |

a) Why is this relation also a function?

No two numbers in the 1st column are the same.

b) Identify the dependent variable and the independent variable.

The cost, *C*, depends on the number of minutes, *n*. So, cost is the dependent variable and the number of minutes is the independent variable.

c) Write the domain and range.

Domain: {10, 20, 30, 40, 50...}

Range: {2, 4, 6, 8, 10...}

We can write an equation that represents a function using ***function notation.*** For example, to show that C = 15 + 2*n* represents a function, we write: *C(n)* = 15 + 2*n*

We say that “*C* of *n* is equal to 15 + 2n.” This notation shows that *C* is the dependent variable and that *C* depends on *n.*

**Example 3: Using Function Notation to Find Values**

Carmen works for a research company in a shopping mall. The equation *P* = 5*n* + 30 represents her daily pay, *P*, in dollars, when she conducts *n* surveys.

a) Describe the function. Write the equation using function notation.

Carmen’s pay is a function of the number of surveys she conducts. In function notation: *P(n)* = 5*n* + 30

b) Find the value of *P*(8). What does this number represent?

*P(n)* = 5*n* + 30

*P*(8) = 5(8)+ 30

*P*(8) = 70

This means that when Carmen conducts 8 surveys, she earns $70.

c) Find the value of *n* when *P*(*n*) = 90. What does this number represent?

*P(n)* = 5*n* + 30

90 = 5*n* + 30

5*n* = 60

*n* = 12

This means that when Carmen conducts 12 surveys, she earns $90.