MCF3MI

Unit 1: Functions

UNIT 1: FUNCTIONS – ESSENTIAL LEARNINGS

You will have at least three opportunities to demonstrate the essential learnings in this course. The first opportunity will occur during the unit with formative quizzes and homework checks. Your second opportunity will be on the unit test. Your third opportunity will be on the exam. You need to demonstrate all essential learnings to earn this credit.

Please take the opportunity to keep track of the essential learnings you've demonstrated during this unit using the checklist below.

Essential Learnings: Demonstrate an Understanding of Functions	***Homework***	***Associated Lessons***
☐ Distinguish between functions and non-functions, both linear and quadratic	*pg. 12 – 13* #1 - 7	Lesson 1.1
☐ Substitute into and evaluate linear and quadratic functions using function notation	*pg. 13 – 14* #8 – 11, 16	Lesson 1.2
☐ Describe the domain and range of a variety of functions using proper set notation, including real world restrictions	*pg. 20 – 22* #1 – 3, 5, 6, 8, 10	Lesson 1.3
Unit Review:	*pg. 54 – 55* #1 – 6 *pg. 56 – 57* #1, 6, 7, 8	

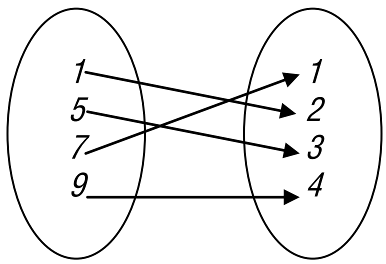
Functions and Relations

A. Relations

A **relation** is defined as an identified *pattern* or *relationship* between two variables. Relations can be represented in various ways: as a set of **{ordered pairs}**, a **table of values**, a **graph**, an **equation**, or a **mapping diagram**.

Ex. 1: Different Representations of Relations

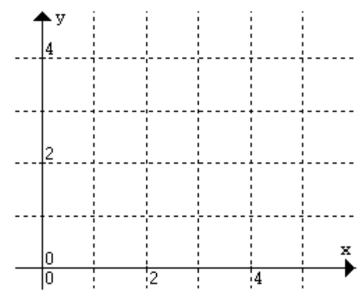
a) { (1,2), (5,3), (9,4), (7,1) }
…as a **mapping** diagram



b) { (1,3), (4,2), (3,2), (6,5) }
… as a **table of values**

x	*y*

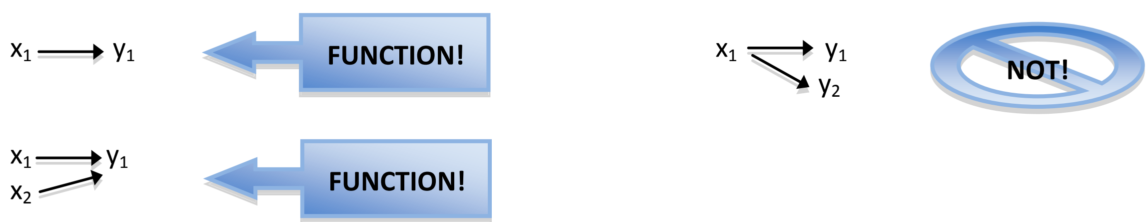
c) { (1,4), (3,2), (5,4), (3,1) }
… as a **scatter plot**



B. Functions

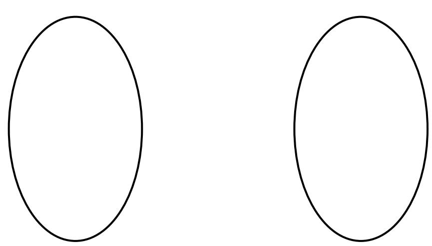
A **function** is a type of relation between two variables, an *input* variable and an *output* variable, in which each value of the *input* variable corresponds to exactly **ONE** value of the *output* variable. It can also be thought of as a **rule** that associates each *x* value with only **ONE** *y*-value. (***Note***: More than one *x*-value can correspond to the same *y*-value.)

∴ A relation is **NOT** a function if *one x value has 2 different y-values associated* with it.



Ex. 2: In the examples above, 1a) and 1b) **are functions**.

Example 1c) is **not** a function since the *x*-value 3 is associated with ***two*** *y*-values… *y* = 1 and *y* = 2
To visualize this, complete a **MAPPING** diagram for example 1c)



C. The Vertical Line Test (or VLT!)

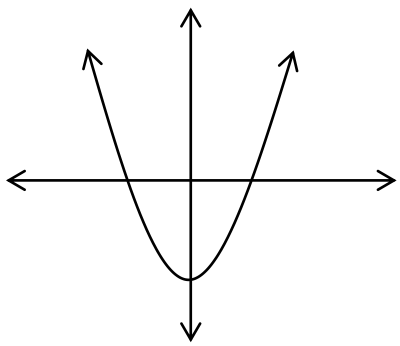
An easy way of determining whether or not a relation is a function is to use its graph and the <u>Vertical Line Test</u>.

The **<u>Vertical Line Test</u>** states that a relation is a function if you can draw a vertical line that passes through **ZERO** points or **ONE** point on the graph of the relation.

$\therefore$ A relation ***fails*** the vertical line test if the line intersects the graph at **more than one** point!

Ex. 3: Let's look at some examples below…

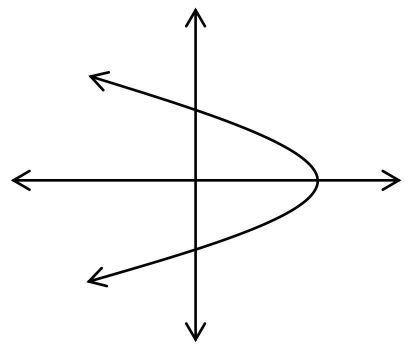
Parabola Opening Up



Does this pass the Vertical Line Test? YES / NO

Therefore, is this relation a function? YES / NO

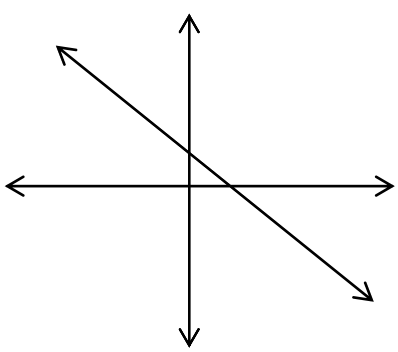
Parabola Opening to the Left



Does this pass the Vertical Line Test? YES / NO

Therefore, is this relation a function? YES / NO

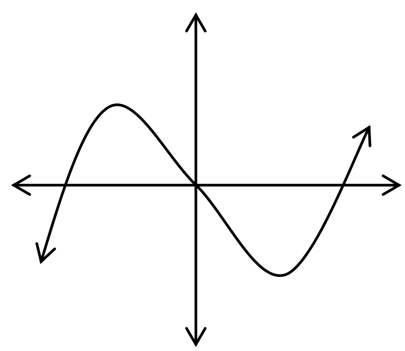
Straight ***Line***



Does this pass the Vertical Line Test? YES / NO

Therefore, is this relation a function? YES / NO

Sine Function (you'll see this later)



Does this pass the Vertical Line Test? YES / NO

Therefore, is this relation a function? YES / NO

Let's examine the examples from the textbook as well. Open your books to page 10 …

HW: p. 12-13 #1-7

A

For help with questions 1 to 4, refer to Example 1.

1. Determine if each relation is a function.

a)

x	y
-2	0
-1	1
0	2
1	3
2	4

b)

Perimeter	Area
5	2
10	3
15	9
10	6
5	4

c)

r	C
0	0
1	6.28
2	12.56
3	18.84
4	25.12

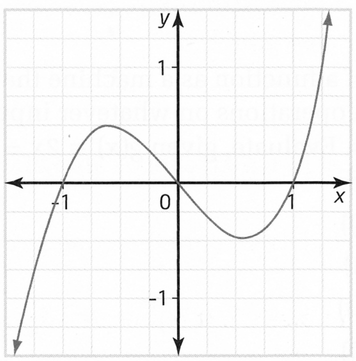
d)

x	y
0	0
1	2 or -2
4	4 or -4
9	6 or -6
16	8 or -8

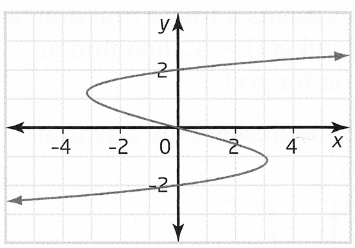
2. Refer to question 1. For those relations that are not functions, explain why.

3. Determine if each relation is a function.

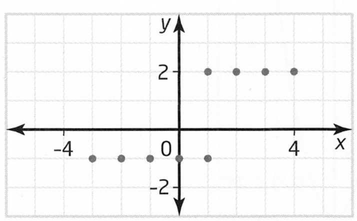
a)



b)



c)



4. Refer to question 3. For those relations that are not functions, explain why.

5. A relation can be expressed as a set of ordered pairs. Determine if each set of ordered pairs is a function. How do you know?

a) {(1, 1), (2, 4), (3, 9), (4, 16)}

b) {(−2, 0), (0, 2), (0, −2), (2, 0)}

c) {(1, 1), (2, 1), (3, 1), (4, 1), (5, 1), (6, 1)}

6. Refer to part c) of question 5.

a) Plot the points on a coordinate grid.

b) Explain how plotting the points helps determine if the relation is a function.

Connect and Apply

B

7. Is the relation $3x + 4y = 12$ a function? Give reasons for your answer.

8. Evaluate, given $f(x) = 6x - 9$.

a) $f(4)$ **b)** $f(-5)$ **c)** $f\left(\frac{1}{2}\right)$

9. Evaluate, given $g(x) = x^2 + 3x + 2$.

a) $g(-2)$ **b)** $g(0)$ **c)** $g(3.14)$

10. The height h, in metres, of a ball t seconds after being thrown is modelled by the function $h(t) = -4.9t^2 + 9.8t + 1$. A graph of Height versus Time shows the path of the ball.

a) Describe in words the meaning of $h(2)$ in this context.

b) What is the height of the ball at the instant it is thrown?

c) Describe how you can estimate when the ball will land. Give more than one method, if possible. Estimate the answer.

Chapter Problem

Answers may vary. For example: Assume that research results are accurate.
For a ticket price of \$20, the revenue will be:
$\$20 \times 10\,000 = \$200\,000$
For a ticket price of \$10, the revenue will be:
$\$10 \times 15\,000 = \$150\,000$
$\$200\,000 - \$150\,000 = \$50\,000$

A ticket price of \$10 will not be likely as the revenue of the concert will be decreased by \$50 000.

1.1 Identify Functions, pages 6 - 14

1. a) function **b)** not a function
c) function **d)** not a function

2. b) Answers may vary. For example: Some x-values, such as 5, are mapped onto more than one y-value, 2 and 4 in this case.

d) Answers may vary. For example: Some x-values, such as 1, are mapped onto more than one y-value, 2 and -2 in this case.

3. a) function
b) not a function
c) not a function

4. b) Answers may vary. For example: For some x-values, a vertical line intersects the graph at more than one point. So, the relation is not a function.

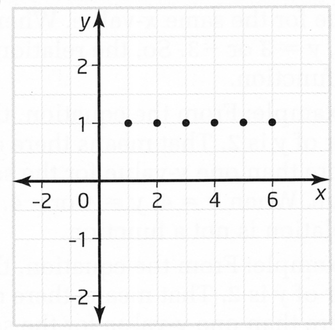
c) Answers may vary. For example: For $x = 1$, there are two y-values, -1 and 2. So, the relation is not a function.

5. a) Answers may vary. For example: Each x-value is mapped onto only one y-value. So, the relation is a function.

b) Answers may vary. For example: For $x = 0$, there are two y-values, 2 and -2. So, the relation is not a function.

c) Answers may vary. For example: Each x-value is mapped onto only one y-value. So, the relation is a function.

6. a)



b) Answers may vary. For example: I can move the edge of the ruler across the graph (vertical line test) to determine if the relation is a function.

7. Answers may vary. For example: The relation $3x + 4y = 12$ is a function. The graph of the relation is a straight line in which each x-value is mapped onto only one y-value.

8. a) 15 **b)** -39 **c)** -6

9. a) 0 **b)** 2 **c)** 21.2796

10. a) Answers may vary. For example: $h(2)$ represents the height of the ball, in metres, 2 s after it is being thrown.

b) 1 m

c) Answers may vary. For example: When the ball lands, its height is 0 m. That is, $h(t) = 0$.
Method 1: Use a graph.
Draw a graph for the function $h(t) = -4.9t^2 + 9.8t + 1$.
Estimate the value of t for $h(t) = 0$ from the graph.
Method 2: Use systematic trial.
The ball will land approximately 2.1 s after it is being thrown.

11. a) 0 **b)** 0 **c)** 3

12. Answers may vary.

13. Answers may vary.

What is a Function?

Name: ______________________________ **Date:** ____________________

Definition

Rules

Function

Examples

Non-Examples

Function Notation

A. Recall

A **relation** is defined as an identified *pattern* or *relationship* between two variables. Relations can be represented in various ways: as a set of **{ordered pairs}**, a **table of values**, a **graph**, an **equation**, or a **mapping diagram**.

A **function** is a type of relation between two variables, an *input* (or **independent)** variable and an *output* (or **dependent)** variable, in which each *input* value corresponds to exactly **ONE** *output* value.

B. Function Notation

Since we are dealing with functions, and not all relations represent functions, we're going to use a special type of notation when writing equations that represent functions. It's called **FUNCTION NOTATION**!

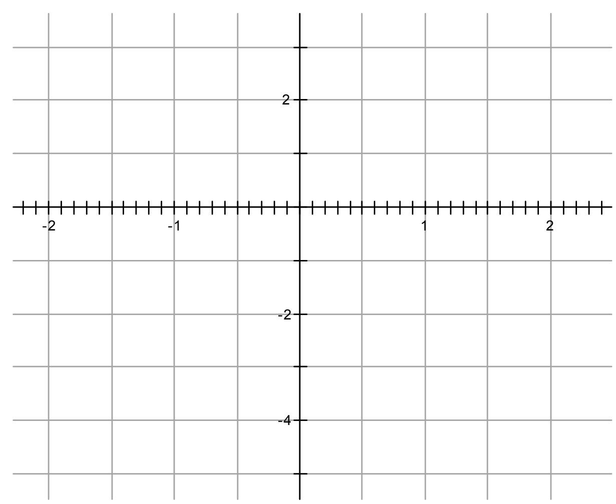
Equation	Function Notation
$y=3x+1$	$f(x)=3x+1$
$y=3t^2-2t+1$	$g(t)=3t^2-2t+1$
$y=x^3-2x^2+1$	$h(x)=x^3-2x^2+1$
$y=t^2-21$	$v(t)=t^2-21$

"*f(x)*" is read "*f of x*" or "*f at x*". It represents the height of the function at a given independent (x) variable.

Using **function notation** is similar to using equations involving ***x*** and ***y*** values. To find a ***y***-value given an ***x***-value simply requires ***substitution***. Thus, we can write ordered pairs (*x, f(x)*) which are the same as (*x, y*) since *y = f(x).*

Ex. 1: Complete a *table of values* for the **function** *f(x)* = 2*x*-1 and **graph**.

x	*f(x)* = 2*x* - 1	(*x* , *f(x)*)
-2		(,)
-1		(,)
0		(,)
1		(,)
2		(,)



Ex. 2: Find *f(2)* if $f(x)=x^2-2x+1$ (we are looking for the "*y*-value" when *x* = 2)

Ex. 3: Given the function $g(x) = 4x - 5$, find…

a) g(☺) b) g(5) c) 2[g(5)]

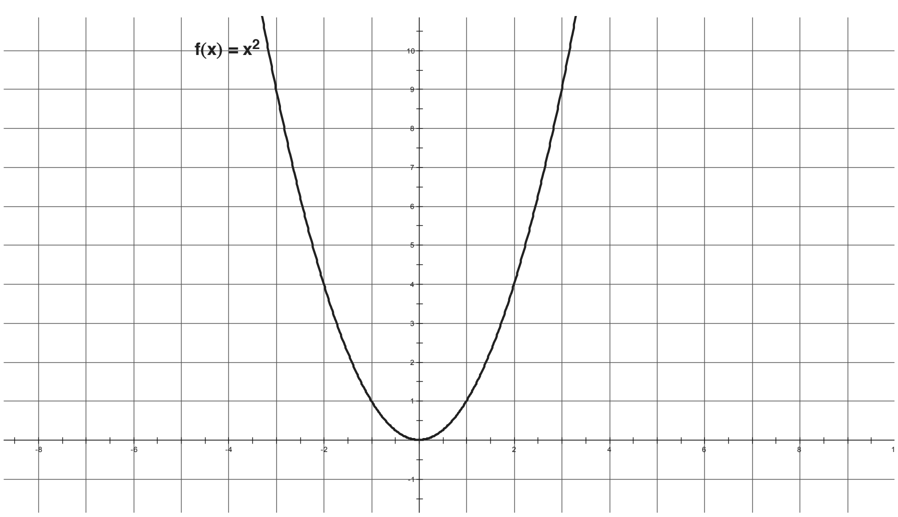
Ex. 4: Given the function $h(x) = x^2 - 2x + 3$, find…

a) h(♥) b) h(-1) c) 3[h(0)]

Ex. 5: Given the function $p(x) = 3x + 5$, find **x** when…

a) $p(x) = 2$ b) $p(x) = 0$ c) $p(x) = -4$

Ex. 6: Find the required values using the graph of $f(x) = x^2$ below.



a) $f(2)$ = ________

b) $f(-1)$ = ________

c) $f(0)$ = ________

d) $f(x) = 9$, x = ________________

e) $f(x) = 1$, x = ________________

HW: p. 13-14 #8-11, 16

Plus: Given the function $d(t) = 2t - 7$, find **t** when…

a) $d(t) = 3$ b) $d(t) = 0$ c) $d(t) = -9$

Answers: *a) t = 5 ∴ d(5) = 3* *b) t = 7/2 ∴ d(7/2) = 0* *c) t = − 1 ∴ d(− 1) = − 9*

Connect and Apply

B

7. Is the relation $3x + 4y = 12$ a function? Give reasons for your answer.

8. Evaluate, given $f(x) = 6x - 9$.

a) $f(4)$ **b)** $f(-5)$ **c)** $f\left(\frac{1}{2}\right)$

9. Evaluate, given $g(x) = x^2 + 3x + 2$.

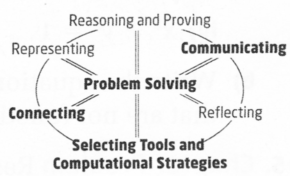
a) $g(-2)$ **b)** $g(0)$ **c)** $g(3.14)$

10. The height h, in metres, of a ball t seconds after being thrown is modelled by the function $h(t) = -4.9t^2 + 9.8t + 1$. A graph of Height versus Time shows the path of the ball.

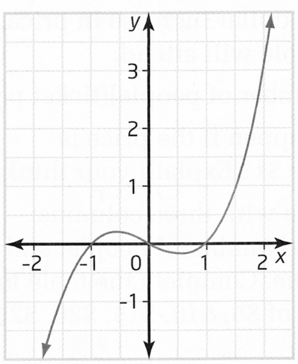
a) Describe in words the meaning of $h(2)$ in this context.

b) What is the height of the ball at the instant it is thrown?

c) Describe how you can estimate when the ball will land. Give more than one method, if possible. Estimate the answer.



11. The graph represents a function $f(x)$.



Use the graph to evaluate.

a) $f(-1)$

b) $f(0)$

c) $f(2)$

Extend

C

16. Think of a function as a machine that will perform operations on whatever input it receives. Evaluate, given $g(x) = 2x - 3$ and $f(x) = x^2$.

a) $g(f(2))$

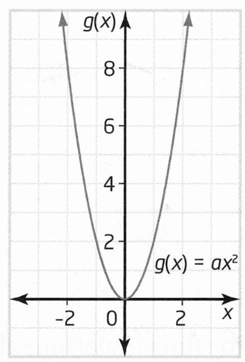
b) $f(f(3))$

c) $g(g(4))$

d) $f(g(5))$

17. If $g(x)$ represents a linear function, and $g(0) = 3$ and $g(1) = 5$, then find an expression for $g(x)$.

18. The graph represents the function $g(x) = ax^2$.



a) Find the value of a.

b) Find the value of $g(5)$.

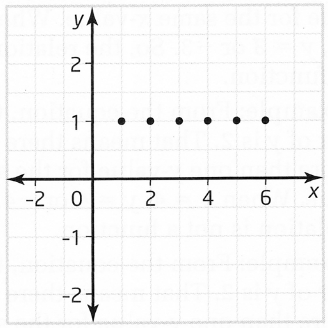
c) Find the value of $g(g(2))$.

19. The equation for a relation is $4x^2 + 9y^2 = 36$.

a) Is the relation a function? Give reasons for your answer.

b) **Use Technology** Explain how you can graph the relation, using a graphing calculator and using pencil and paper.

6. a)



b) Answers may vary. For example: I can move the edge of the ruler across the graph (vertical line test) to determine if the relation is a function.

7. Answers may vary. For example: The relation $3x + 4y = 12$ is a function. The graph of the relation is a straight line in which each x-value is mapped onto only one y-value.

8. a) 15 **b)** −39 **c)** −6

9. a) 0 **b)** 2 **c)** 21.2796

10. a) Answers may vary. For example: $h(2)$ represents the height of the ball, in metres, 2 s after it is being thrown.

b) 1 m

c) Answers may vary. For example: When the ball lands, its height is 0 m. That is, $h(t) = 0$.

Method 1: Use a graph.
Draw a graph for the function $h(t) = -4.9t^2 + 9.8t + 1$.
Estimate the value of t for $h(t) = 0$ from the graph.

Method 2: Use systematic trial.
The ball will land approximately 2.1 s after it is being thrown.

11. a) 0 **b)** 0 **c)** 3

12. Answers may vary.

13. Answers may vary.

14. Answers may vary.

a) i) From the equation, the power of y is 2. That means there can be more than one y-value for the same x-value. When $x = 5$, $y = 3$ or -3. So, the relation is not a function.

ii) For example: From the equation, the power of y is 2. That means there can be more than one y-value for the same x-value. When $x = 4$, $y = 4$ or -4. So, the relation is not a function.

iii) For example: From the equation, the power of y is 2. That means there can be more than one y-value for the same x-value. When $x = 5$, $y = 2$ or -2. So, the relation is not a function.

iv) For example: From the equation, the power of y is 2. That means there can be more than one y-value for the same x-value. When $x = 0$, $y = 1$ or -1. So, the relation is not a function.

b) Answers may vary. For example: $y^2 = 2x + 4$; $4x^2 + y^2 = 36$

15. a) Answers may vary. For example: If the price is decreased by \$1, there may be 1000 more people attending the concert.
The new revenue will then be:
\$19 × 11 000 = \$209 000
\$209 000 − \$200 000 = \$9000
This is \$9000 more than the revenue for a ticket price of \$20.

b)

Ticket Price (\$)	Number of People	Total Revenue (\$)
5	25 000	125 000
10	20 000	200 000
15	15 000	225 000
20	10 000	200 000
25	5000	125 000
30	0	0

c) \$176 000

16. a) 5 **b)** 81 **c)** 7 **d)** 49

17. $2x + 3$

18. a) 2 **b)** 50 **c)** 128

19. a) Answers may vary. For example: Some x-values are mapped onto more than one y-value. When $x = 0$, $y = 2$ or -2. So, the relation is not a function.

Domain and Range

A. Sets of Numbers

In order to understand domain and range, we need to understand the sets of numbers that can inhabit our relation:

N : denotes the set of ***natural*** numbers, which include all positive counting numbers but NOT zero;
N = {1, 2, 3, . . .}

W : denotes all ***whole*** numbers, including positive counting numbers and zero;
W = {0, 1, 2, 3, . . .}

I : denotes the set of ***integers***, which includes all positive and negative whole numbers, as well as zero;
I = {-3, -2, -1, 0, 1, 2, 3, . . .}

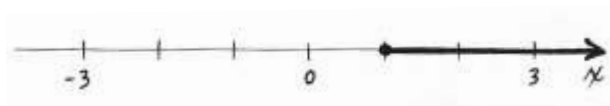
R : denotes the set of all ***real*** numbers, including all integers; fractions/rational numbers (terminating decimals and repeating decimals); and irrational numbers (non-terminating, non-repeating decimals)

B. Domain

The domain of a relation is the set of all ______________________ (___) elements of a relation. The domain describes the values that are acceptable for the **independent** variable.

Domains can be communicated in ***words***, using a ***number line***, or as a ***set*** (giving a *list* of numbers or using *inequality* statements). To create a set, you need to know proper set notation.

Ex. 1: Given the number line …



Words: ____

Set Notation: Domain = $\{ x \mid x \in R, x \geq 1 \}$

Ex. 2: Given the number line …

Words: ____

____

Set Notation: ____

Ex. 3: Given the number line …

Words: ____

____

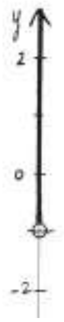
Set Notation: ____

C. Range

The range of a relation is the set of all ______________________ (___) elements of a relation. The range describes the values that are acceptable for the **dependent** variable.

Ranges can also be communicated in ***words***, using a ***number line***, or as a ***set***.

Ex. 4 Given the number line …

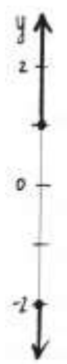


Words: ____

____

Set Notation: ____

Ex. 5 Given the number line …



Words: ____

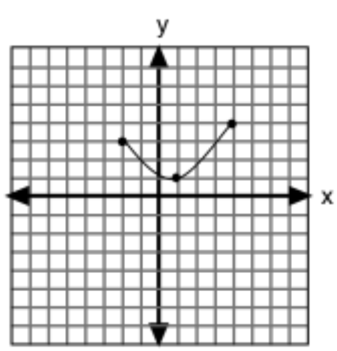
____

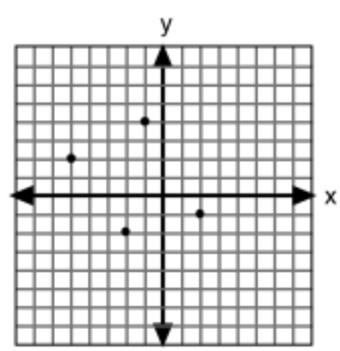
Set Notation: ____

D. Bringing Domain and Range Together

Now that we've worked with domain and range separately, let's bring them together!

Ex. 6: Use *set notation* to describe the domain and range of the following relations:



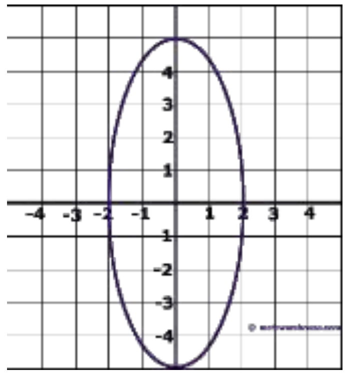


x	y
–4	–5
–3	–8
–2	–11
–1	–14

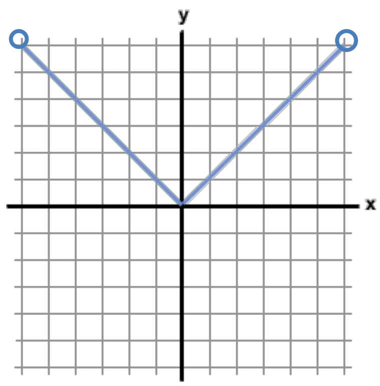
D = ____________________________ *D* = ____________________________ *D* = ____________________________

R = ____________________________ *R* = ____________________________ *R* = ____________________________

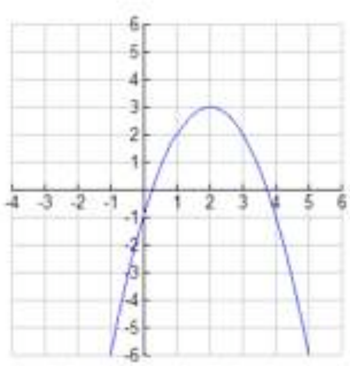
Ex. 7: Describe the domain and range of the following relations in the manner indicated:



Domain – words:	
Domain – set notation:	
Range:	
Function (with reason)?	



Domain – number line:	
Domain – set notation:	
Range – words:	
Range – set notation:	



Domain – words:	
Domain – set notation:	
Range – set notation:	
Function (with reason)?	

Ex. 8: Write the domain and range for the following relations:

a) $y = 2x$

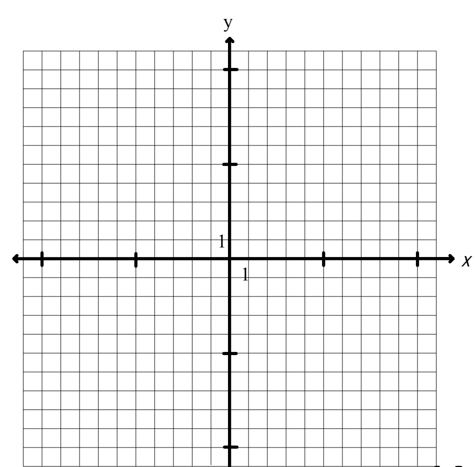
D = ______________________________

R = ______________________________

b) $y = x^2 + 1$

D = ______________________________

R = ______________________________



Now, let's look at some additional examples from the text . . . open your books to page 17. ☺

HW: p. 20-22 #1-3, 5-6, 8, 10

A

For help with questions 1 to 3, refer to Example 1.

1. Write the domain for each relation.

a) $\{(0, 0), (1, 0), (2, 0), (3, 1), (4, 1), (5, 1)\}$

b) $f(x) = x^2$

c) $x + y = 10$

2. For each relation in question 1, write the range.

3. For a circle of radius 5 and centred at the origin, express the domain and range in words and as intervals.

Connect and Apply

B

5. A ball is launched upward. Its height h, in metres, t seconds after launching is modelled by the function $h = 19.6t - 4.9t^2$.

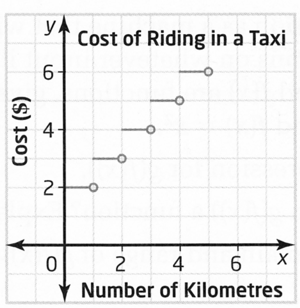
a) Create a table of values relating t and h.

b) From the table, find the maximum height of the ball.

c) From the table, determine how long the ball is in the air.

d) Write the domain and range of the function.

6. The graph shows the cost of riding in a taxi. The pattern continues. The open dot at the right end of a line segment means that the point is not on the graph.



a) What is the cost of a 4.3-km taxi ride?

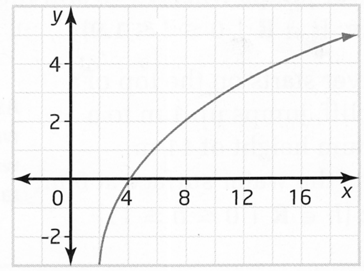
b) What does the open dot at the end of each line segment mean in this context?

c) Will a 3-km taxi ride cost \$4 or \$5? Explain.

d) Explain why the graph represents a function.

e) Write the domain and range of the function.

d)



8. **Chapter Problem** Research results for a concert show that 10 000 people will attend the concert if the price is \$20 per ticket. For each dollar increase in price, 1000 fewer people will attend. Since Revenue = (number of people)(ticket price), the function that models the revenue of the concert is: $R(x) = (10\,000 - 1000x)(20 + x)$, where x represents the dollar increase in ticket price.

a) Is it possible that $x = -1$? What does it mean in this context?

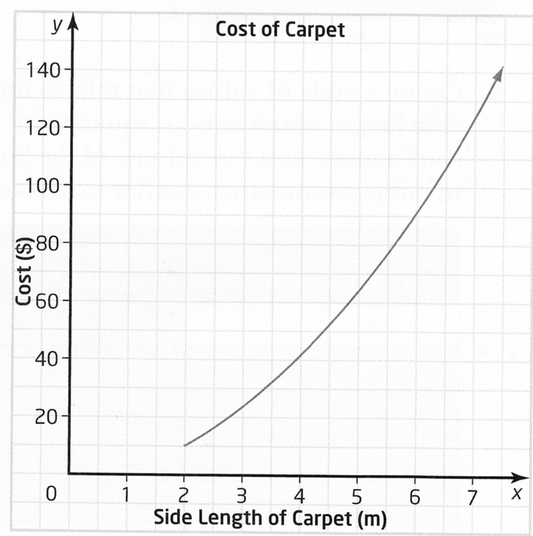
b) Is it possible that $x = -5$? What must be considered when changing the price?

c) What is the meaning of $R(10)$ in this context? Evaluate $R(10)$.

d) Write the domain of the function R.

9. Sketch a graph for the function $g(x) = 2x^2 + 9$. Describe in words the domain and range of the graph. Explain your thinking.

10. The graph shows the cost of square carpets from a retail store.



a) Write the domain and range of the graph.

b) In context of the question, describe any restriction on the range of the quadratic function that models the cost.

1.2 Domain and Range, pages 15 - 22

1. a) Domain: $\{0, 1, 2, 3, 4, 5\}$
b) Domain: $\{x \mid x \in \mathbf{R}\}$
c) Domain: $\{x \mid x \in \mathbf{R}\}$
d) Domain: $\{x \in \mathbf{R} \mid x \geq 2\}$

2. a) Range: $\{0, 1\}$
b) Range: $\{f(x) \in \mathbf{R} \mid f(x) \geq 0\}$
c) Range: $\{y \mid y \in \mathbf{R}\}$
d) Range: $\{y \in \mathbf{R} \mid y \geq -3\}$

3. In words: The domain is the set of real numbers between -5 and 5 inclusive. The range is the set of real numbers between -5 to 5 inclusive.
As intervals: Domain: $\{x \in \mathbf{R} \mid -5 \leq x \leq 5\}$
Range: $\{y \in \mathbf{R} \mid -5 \leq y \leq 5\}$

5. a) Answers may vary. For example:

t	*h*
0	0
1	14.7
2	19.6
3	14.7
4	0

b) 19.6 m
c) 4 s
d) Domain: $\{t \in \mathbf{R} \mid 0 \leq t \leq 4\}$;
Range: $\{h \in \mathbf{R} \mid 0 \leq h \leq 19.6\}$

6. a) $6.00
b) Answers may vary. For example: The open dot at the end of each line segment means that when the number of kilometres reaches the next whole number, the cost will jump to the next higher level.
c) Answers may vary. For example: A 3-km ride will cost $5. When the number of kilometres reaches 3, the cost of the ride will jump to the next higher level of $5.
d) Answers may vary. For example: The graph represents a function because each number of kilometres travelled is mapped onto only one cost.
e) Domain: $\{x \in \mathbf{R} \mid x \geq 0\}$;
Range: $\{y \in \mathbf{I} \mid y \geq 2\}$

8. a) Answers may vary. For example: Yes, it is possible that $x = -1$. In this case, the ticket price is decreased by $1.
b) Answers may vary. For example: Yes, it is possible that $x = -5$. In this case, the ticket price is decreased by $5. When changing the ticket price, the total revenue must be considered.
c) $R(10)$ represents the revenue when the ticket price is increased by $10; $R(10) = 0$
d) Domain: $\{x \in \mathbf{I} \mid -19 \leq x \leq 9\}$

9. Diagrams may vary. The domain is the set of real numbers. The range is the set of real numbers greater than or equal to 9.

10. a) The domain is the set of real numbers greater than or equal to 2. The range is the set of real numbers greater than or equal to 10.
b) Answers may vary. For example: Since the smallest unit in cost is $0.01. The range has to be restricted. The range is the set of real numbers greater than or equal to 10 and with no more than 2 decimal places when written as decimals.

Review for Unit 1 Test

Representative Questions for Review:

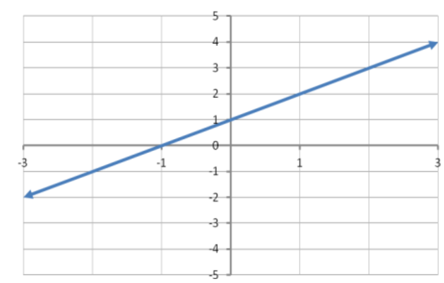
1) For each of the relations below, indicate i) whether it is or is not a function, ii) a reason for your decision, and iii) the domain and range written in set notation.

a) $y = 3x^2 - 4$

b)

x	*y*
2	− 7
0	− 5
2	− 3
4	− 1
6	1

c)



2) Given $f(x) = x^2 - 4x + 4$, find:

a) $f(3)$

b) $f(x) = 0$

Textbook review questions:

p. 54-55 #1-6

p. 56-57 #1, 6, 7, 8

1.1 Identify Functions, pages 6–14

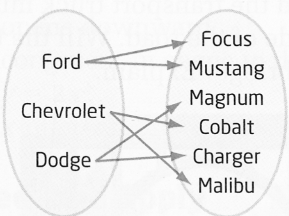
1. Is each relation a function? How do you know?

a)

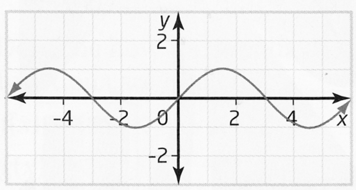
x	y
2	0
1	1
0	2
1	3
2	4

b) $y = x^2 - 4$

c)



d)



2. Evaluate, given $f(x) = x^2 - 10x + 25$.

a) $f(3)$ **b)** $f(-5)$ **c)** $f\left(\frac{1}{2}\right)$

3. The height $h(t)$, in metres, of a ball t seconds after being thrown is modelled by the function $h(t) = -4.9t^2 + 20t$.

a) Describe in words the meaning of $h(2)$ in this context.

b) What is the height of the ball 3 s after it is thrown?

1.2 Domain and Range, pages 15–22

4. Describe in words the domain and range of $y = 2x + 1$. Explain your thinking.

5. A parabola opens down and its vertex is located at $(-5, 10)$. Write the domain and range.

6. A catering company charges \$50 plus \$10 per person for a dinner with a maximum of 20 people. The catering cost can be modelled by the function $C(x) = 10x + 50$, where x represents the number of people. Write the domain and range of this function.

1. Which relation is not a function?

A $\{(1, 2), (2, 3), (3, 3), (4, 2)\}$

B $y = 2x - 9$

C $x^2 - 5 = y^2$

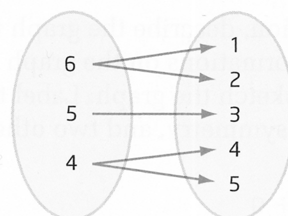
D $y = 1$

6. Determine if each relation is a function. Justify your answer.

a)

x	y
-3	12
-2	10
-1	8
0	6
1	4
2	2
3	0

b)



7. Write the domain and range of each relation. Sketch a graph to help.

a) $y = 2x - 1$

b) $y = 2x^2 - 1$

8. The surface area, in square centimetres, of a cylinder with a height of 5 cm is given by the function $S(r) = 2\pi r^2 + 10\pi r$.

a) What is the meaning of $S(5)$ in this context?

b) Evaluate $S(5)$.

Chapter 1 Review, pages 54 - 55

1. a) Answers may vary. For example: No; For $x = 1$, there are two y-values, 1 and 3.

b) Yes; Each x-value is mapped onto only one y-value.

c) No; There are two arrows starting from each element in the left set of data in the mapping diagram.

d) Yes; Each x-value is mapped onto only one y-value.

2. a) 4

b) $f(-5) = 100$

c) $f\left(\frac{1}{2}\right) = 20\frac{1}{4}$

3. a) Answers may vary. For example: $h(2)$ represents the height of the ball, in metres, 2 s after it has been thrown.

b) 15.9 m

4. Answers may vary. For example: The graph of $y = 2x + 1$ is a straight line so the x- and y-coordinates can be any real numbers. Domain: $\{x \mid x \in \mathbf{R}\}$; Range: $\{y \mid y \in \mathbf{R}\}$

5. Domain: $\{x \mid x \in \mathbf{R}\}$; Range: $\{y \in \mathbf{R} \mid y \leq 10\}$

6. Domain: $\{x \in \mathbf{I} \mid 0 < x \leq 20\}$; Range: $\{60, 70, 80, \ldots, 230, 240, 250\}$

Chapter 1 Practice Test, pages 56-57

1. C

2. B

3. D

4. D

5. B

6. a) Answers may vary. For example: Yes; Each x-value is mapped onto only one y-value.

b) Answers may vary. For example: No; Some x-values, such as 4 and 6, are mapped onto two y-values.

7. a) Domain: $\{x \mid x \in \mathbf{R}\}$; Range: $\{y \mid y \in \mathbf{R}\}$

b) Domain: $\{x \mid x \in \mathbf{R}\}$; Range: $\{y \in \mathbf{R} \mid y \geq -1\}$

8. a) $S(5)$ represents the surface area, in square centimetres, of the cylinder with a height of 5 cm and a radius of 5 cm.

b) approximately 314 cm^2