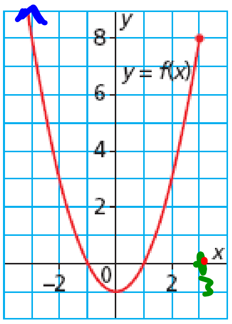
WARM - UP

Determine the domain and range of the graph of each function.

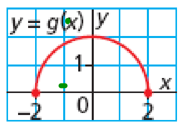
a)



D: $x \leq 3, x \in R$

R: $y \geq -1, y \in R$

b)



$x \mid$

$\in$

D: $\{-2 \leq x \leq 2, x \in R\}$

R: $\{y \mid 0 \leq y \leq 2, y \in R\}$

5.5 Graphs of Relations and Functions

In the workplace, a person's gross pay, P dollars, often depends on the number of hours worked, h.
So, we say P is the *dependent variable*. Since the number of hours worked, h, does not depend on the gross pay, P, we say that h is the *independent variable*.

independent variable (x) →

Hours Worked, h	Gross Pay, P ($)
1	12
2	24
3	36
4	48
5	60

← dependent variable (y)

The values of the independent variable are listed in the first column of a table of values. These elements belong to the ?

The values of the dependent variable are listed in the second column of a table of values. These elements belong to the ?

5.2 Properties of Functions

Using Function Notation:

When a function is represented algebraically, we are given the rule as it applies to some variable. This is called functional notation. To compute the rule applied to any input we simply replace the variable with the input.

$-1^2 = -1$

$(-1)^2 =$

$$\begin{aligned} \text{Given: } f(x) &= x^2 \text{ then} \\ f(5) &= (5)^2 = 25 \\ f(-1) &= (-1)^2 = 1 \\ f(a+b) &= (a+b)^2 = a^2 + 2ab + b^2 \\ f(2y) &= (2y)^2 = 4y^2 \end{aligned}$$

$\Rightarrow y = x^2$

IMPORTANT!! $\boxed{f(x) = x^2}$

This does NOT mean f multiplied by x

Function Notation

- To represent functions, we use symbols like f(x) and g(x).
- The symbol f(x) is read "f of x" and simply means that the expression that follows involves x.
- Basically, f(x) represents where y is a function of the x variable.
- Thus, the notation is convient for making direct substitutions for the x variable.
- For example, if f(x) = 3x - 5, then f(7) = 3(7) - 5 = 16
- May also be represented as a mapping with the notation f : x.

EXAMPLES...

$h(w) = 3w^2 - w - 6$

#1. $If\ f(x) = 3x^2 - x - 6,\ find...$

$a)\ f(5)$

$b)\ f(-4)$

$c)\ f\left(\frac{2}{3}\right)$

(a) $f(5) = 3(5)^2 - (5) - 6$
$= 3(25) - 5 - 6$
$= 75 - 5 - 6$
$= 64$

$(5, 64)$

(b) $f(-4) = 3(-4)^2 - (-4) - 6$
$= 3(16) + 4 - 6$
$= 48 + 4 - 6$
$= 46$

$(-4)^2$

$f\left(\frac{2}{3}\right) = 3\left(\frac{2}{3}\right)^2 - \left(\frac{2}{3}\right) - 6$

$\boxed{a\, b/c}$

$\frac{3}{1}\left(\frac{4}{9}\right) - \frac{2}{3} - \frac{6}{1}$

$= \frac{12}{9} - \frac{6}{9} - \frac{54}{9}$

$= \frac{-48 \div 3}{9 \div 3} = -\frac{16}{3}$

$g(x) = -2x+4$ & $w(y) = y^2 - 2$

ex. ① $g(-3)$

$= -2(-3)+4$
$= 6+4$
$= \underline{10}$

② $w(5) = (5)^2 - 2$
$= 25-2$
$= \underline{23}$

③ $7w(-1) + 3g(0)$

$w(-1) = (-1)^2 - 2$
$= -1$

$g(0) = -2(0)+4$
$= 4$

$7[(-1)^2 - 2] + 3[-2(0)+4]$
$= 7(-1) + 3(4)$
$= 5$

④ $[w(2)]^2 - 3g(-3)$

$(2)^2 - 3(10)$
$4 - 30$
$= -26$

$w(2) = (2)^2 - 2$
$= 4-2$
$= 2$

$g(-3) = -2(-3)+4$
$= 6+4$
$= 10$

ex.

$w[g(1)]$

$g(x) = -2x+4$ & $w(y) = y^2 - 2$

$g(1) = -2(1)+4$
$= 2$

$w(2) = (2)^2 - 2$
$= 4 - 2$
$= 2$

Domain/Range

small ______ Larger

1) D: $\{-3, 2\}$

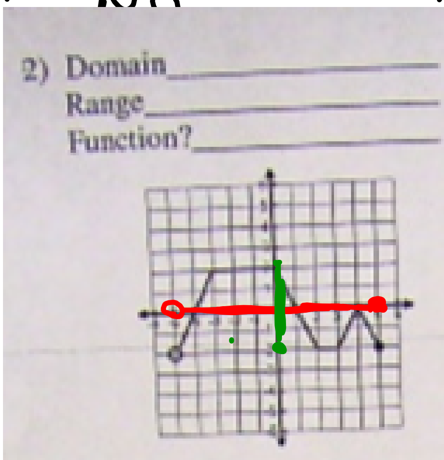
R: $\{y \in R\}$

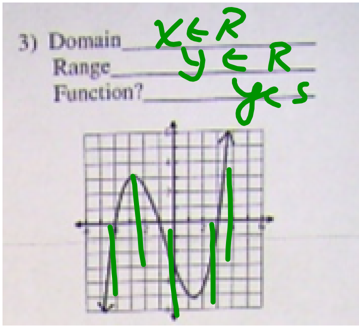
F: No

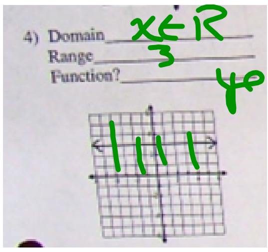
2) D: $-5 < x \leq 5$

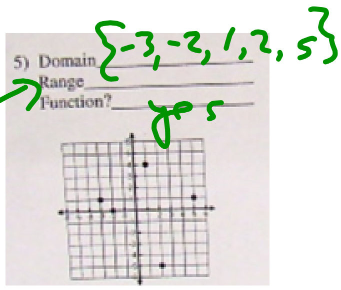
or $5 \geq x > -5$

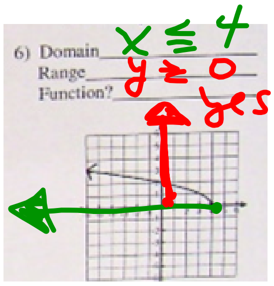
R: $-2 \leq y \leq 2$ yes



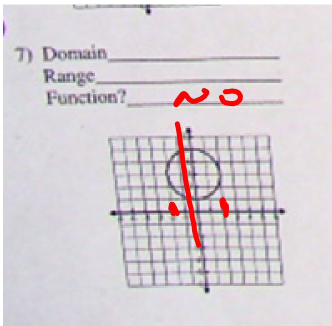






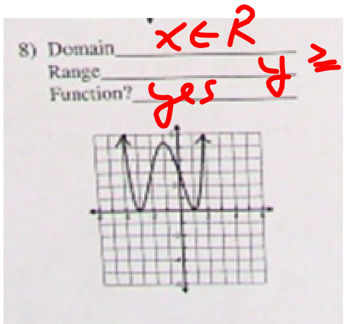


$\{-5, 0, 1, 4\}$



D: $-2 \leq x \leq 2$

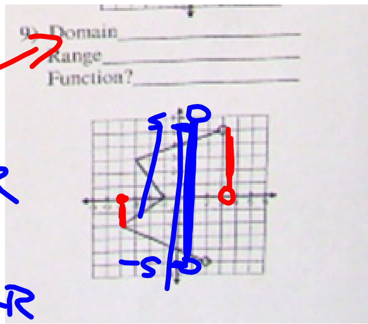
R: $1 \leq y \leq 5$



D: $-4 \leq x < 3, x \in R$

R: $-5 < y < 5, y \in R$

No



10. D: $x \in R$

R: $y \geq -3, y \in R$

or

$-3 \leq y$

yes

11/ D: $x > -4, x \neq -2, 2$

R: $y \leq 1$

yes

12/ $-3 \leq x \leq 3$

$-2 \leq y \leq 4$

No

13. V
14. Q
15. N
16. X
17. U
18. O
19. P
20. M
21. R
22. W
23. S
24. T

#2. *Given that* $f(x) = 2x^2 - 5$ & $g(x) = -3x + 7$, *find...*

$3f(2) - 5g(-1)$

$= 3(3) - 5(10)$

$= 9 - 50$

$= -41$

$f(2) = 2(2)^2 - 5$

$= 8 - 5$

$= 3$

$g(-1) = -3(-1) + 7$

$= 3 + 7$

$= 10$

3/ $h(x) = -3x + 5$ $w(x) = 3 - 2x$
$g(x) = x^2 - 1$ $p(x) = 4x^2$

(a) $2g(-1) + [w(0)]^2$
$2(0) + (3)^2$
$0 + 9$
$= 9$

$g(-1) = (-1)^2 - 1$
$= 0$

$w(0) = 3 - 2(0)$
$= 3$

b) $g[h(\cancel{p(1)})]$ 4

$p(1) = 4(1)^2$
$= 4$

$h(x) = -3x + 5$ $w(x) = 3 - 2x$
$g(x) = x^2 - 1$ $p(x) = 4x^2$

$h(4) = -3(4) + 5$
$= -7$

$g(-7) = (-7)^2 - 1$
$= 49 - 1$
$= 48$

If $h(x) = 4$, Find x
$4 = -3x + 5$
$-1 = -3x$
$\frac{-1}{-3} = \frac{-3x}{-3} \Rightarrow x = \frac{1}{3}$

Practice problems...

Pages 270 - 271
#14, 15, 18, 19

WARM-UP...

Given $f(x)=3x-5$ & $g(x)=2x^2-3x+1$ determine each of the following...

1) $f(4)=7$
2) $f(0)=-5$
3) $f\left(\frac{2}{3}\right)=-3$
4) $g(-3)=28$
5) $g(3.5)=15$
6) $g(f(-1))=153$
7) *Find x when* $f(x)=1$ $x=2$
8) *Find x when* $f(x)=7$ $x=4$

1/ $f(4)=3(4)-5$
$=12-5$
$=7$

2/ $f(0)=3(0)-5$
$=-5$

3/ $f\left(\frac{2}{3}\right)=\cancel{3}\left(\frac{2}{\cancel{3}}\right)-5$
$\frac{6}{3}-5$
$2-5$
$=2-5$
$=-3$

4/ $g(-3)=2(-3)^2-3(-3)+1$
$=18+9+1$
$=28$

5/ $g(3.5)=2(3.5)^2-3(3.5)+1$
$=24.5-10.5+1$
$=15$

6/ $g(f(-1))$ -8
$f(-1)=3(-1)-5$
$=-8$

$g(-8)=2(-8)^2-3(-8)+1$
$=128+24+1$
$=153$

7/ $f(x)=3x-5$ $f(x)=1$
$1=3x-5$
$1+5=3x$
$\frac{6}{3}=\frac{3x}{3}$
$2=x$

$f(1)$

8/ $f(x)=7$
$7=3x-5$
$7+5=3x$
$\frac{12}{3}=\frac{3x}{3}$
$4=x$

Practice Problems...

Worksheet - Function Notation.pdf

SOLUTIONS...

Evaluate at the given number.

1) $f(x) = 3x - 8$
   a. $f(1) = -5$
   b. $f(-3) = -17$
   c. $f(5) = 7$
   d. $f(-6) = -26$
   e. $f(0) = -8$

2) $f(x) = 2 - 4x$
   a. $f(-5) = 22$
   b. $f(-2) = 10$
   c. $f(0) = 2$
   d. $f(4) = -14$
   e. $f(6) = -22$

5) $h(x) = 3x^2 + 7$
   a. $h(-4) = 55$
   b. $h(-2) = 19$
   c. $h(0) = 7$
   d. $h(3) = 34$
   e. $h(5) = 82$

6) $h(x) = 5 - x^2$
   a. $h(-4) = -11$
   b. $h(-1) = 4$
   c. $h(3) = -4$
   d. $h(5) = -20$
   e. $h(-7) = -44$

9) $h(x) = -x^2 + 6x - 4$
   a. $h(-3) = -31$
   b. $h(-1) = -11$
   c. $h(0) = -4$
   d. $h(3) = 5$
   e. $h(6) = -4$

10) $h(x) = 7x - x^2 + 2$
   a. $h(-4) = -20$
   b. $h(-1) = 16$
   c. $h(1) = 30$
   d. $h(4) = 36$
   e. $h(8) = 16$

Number Relations and Functions 10

1. Evaluate the following expressions given the functions below:

$g(x) = -3x + 1$ $\quad f(x) = x^2 + 7$ $\quad h(x) = \frac{12}{x}$ $\quad j(x) = 2x + 9$

a. $g(10) = 29$

b. $f(3) = 16$

c. $h(-2) = -6$

d. $j(7) = 23$

e. $h(0) =$ undefined

f. $g(4) = -11$

g. $f(h(3)) = 23$

h. Find x if $g(x) = 16$ $\quad x = -5$

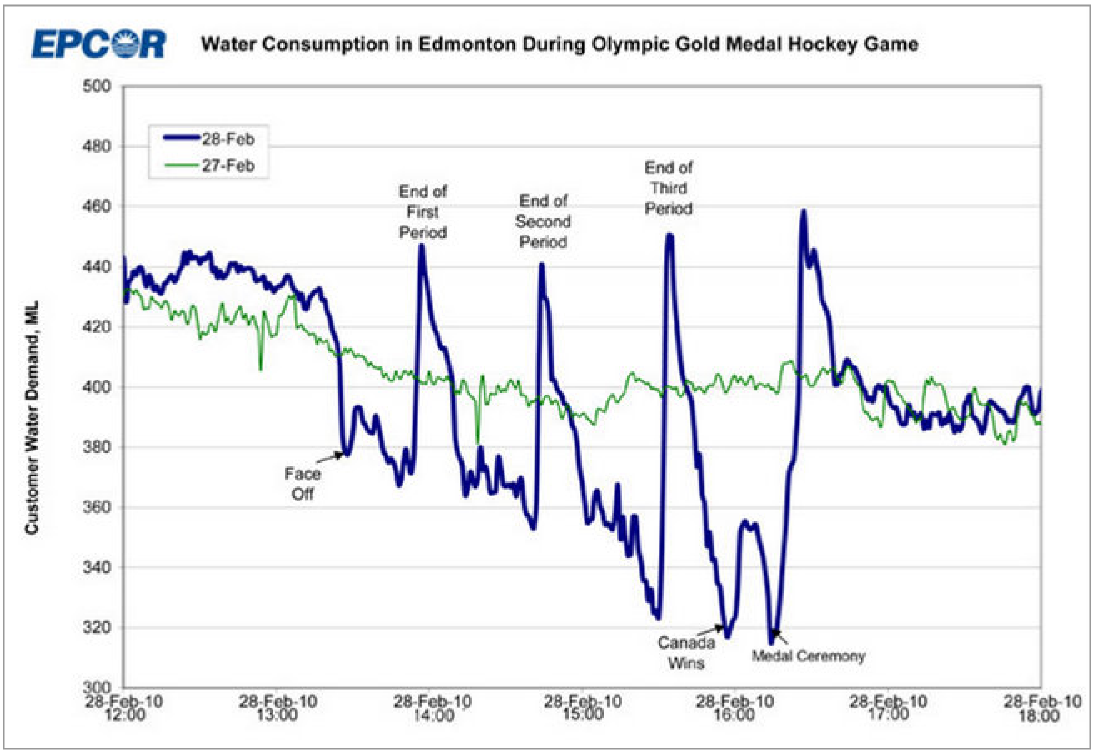
i. Find x if $h(x) = -2$ $\quad x = -6$

j. Find x if $f(x) = 23$ $\quad x = \pm 4$

WARM-UP...

What If Everybody in Canada Flushed At Once?

Written by Pats Papers | Monday, 8 March 2010 2:42 PM

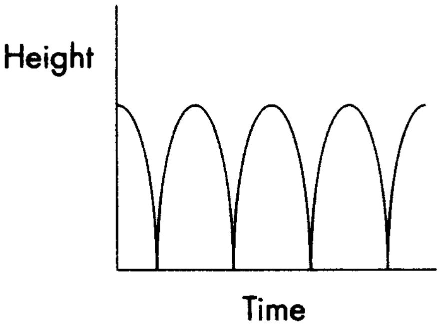


EXAMPLE: Interpreting graphs...

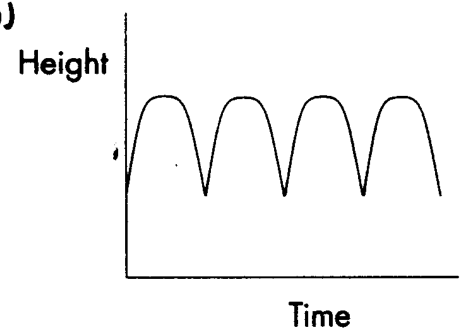
The Height of the Matter

1. Hiro and Francine were playing basketball in their school gym. Describe, in words, what is happening to the basketball for each height-time graph. The first one is done for you.

(a)

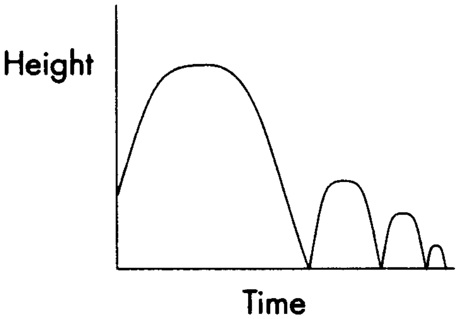


(b)

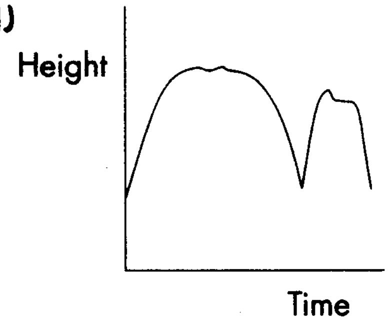


Hiro is bouncing the ball on the floor.

(c)



(d)



5.3 Interpreting and Sketching Graphs

LESSON FOCUS Describe a possible situation for a given graph and sketch a possible graph for a given situation.

Make Connections

In math, a graph provides much information. This graph shows the depth of a scuba diver as a function of time.

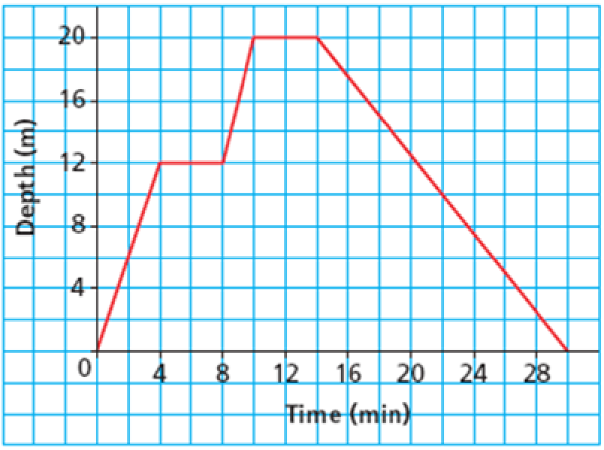
How many minutes did the dive last?

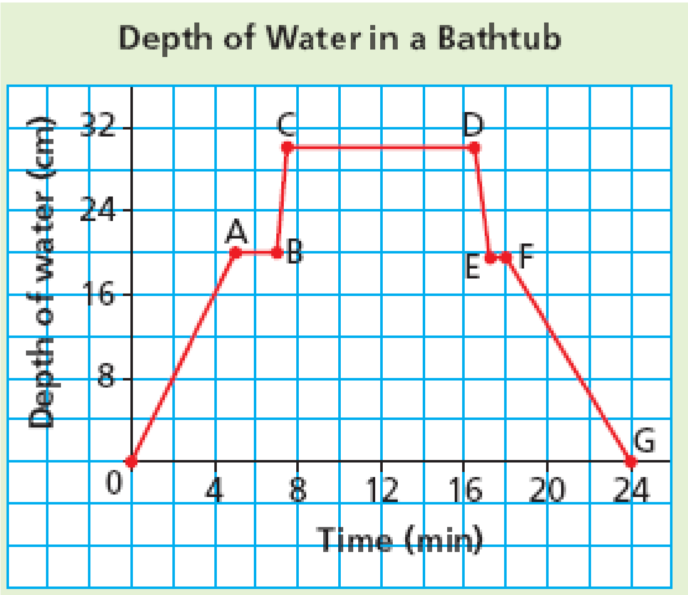
At what times did the diver stop her descent?

What was the greatest depth the diver reached?

For how many minutes was the diver at that depth?

A Scuba Diver's Dive





Given the graph shown at the left, provide a brief explanation of what could possibly be happening at each of the 7 segments labelled on the graph

Start - A: Filling

A - B: Not Running

B - C:

C - D:

D - E:

E - F:

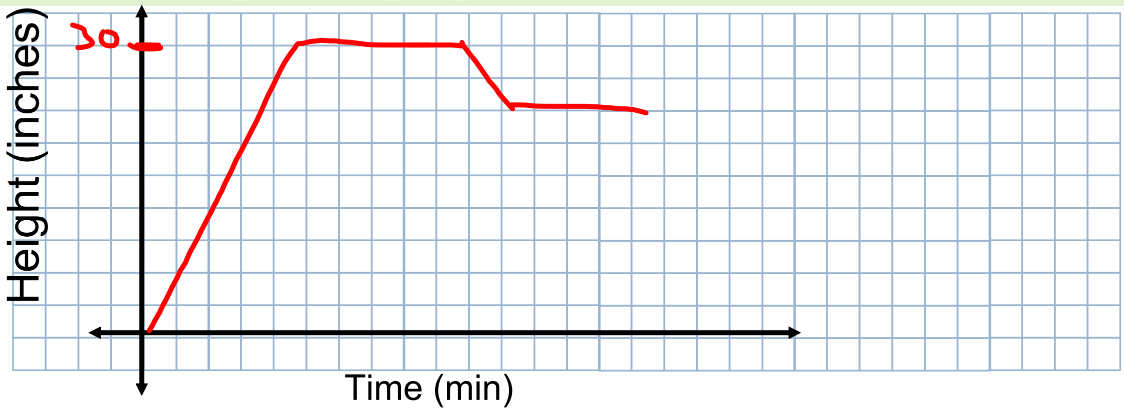
F - G:

Sketch a graph to represent this situation:

You put the plug in the bath and turn on the taps.

You leave the bathroom and return to discover that the bath has overflowed.

You turn off the taps and pull out the plug to let out some water. You put the plug back in.



Practice Problems...

2) p. 281: #3 - 6, 11, 16

Attachments

- Worksheet - Sketching Angles in Radians.doc
- Warm-Up - Intro to Limits.docx
- Review - Factoring.pdf
- Worksheet - Factoring Review.doc
- Worksheet - Function Notation.pdf