1. Determine whether each relation is a function and find the domain and the range.

a) $\{(1,\ 2),\ (2,\ 3),\ (3,\ 2),\ (4,\ 5),\ (5,\ 4),\ (6,\ 1),\ (8,\ 2)\}$

b) $\{(-1,\ 2),\ (-2,\ -3),\ (3,\ 2),\ (5,\ 5),\ (5,\ 4),\ (-2,\ 1),\ (6,\ 2)\}$

c) $\{(1,\ 2),\ (2,\ 3),\ (3,\ 2),\ (4,\ 4),\ (5,\ 4),\ (6,\ 1),\ (7,\ 2),\ (-1,\ 2)\}$

2. Given $g(x) = -2x^2 + x + 6$, find:

a) $g(0)$ *b)* $g(-4)$ *c)* $g(2)$ *d)* $g(x+1)$

3. For $f(x) = \dfrac{2x-3}{x-4}$, determine

a) $f(0)$ *b)* $f(3)$ *c)* $f(x+h)$ *d)* $f(-4)$

4. Solve the following equations:

a) $6x^2 - 17x + 12 = 0$

b) $3(x-3)^2 = -84$

c) $7x = 3 - 6x^2$

d) $3(x-3)^{3/2} = 8$

e) $2x^2 + 12x + 3 = 0$

f) $x^2 + x + 2 = 0$

g) $\sqrt[3]{5x+7} = -2$

h) $\sqrt{4x+5} = 2x - 5$

i) $4x - 5 = 16x^3 - 20x^2$

j) $4x^4 - x^2 - 3 = 0$

k) $x - 2\sqrt{x} + 1 = 0$

l) $x^{2/3} + x^{1/3} - 12 = 0$

m) $x^{1/2} - 4x^{1/4} + 3 = 0$

n) $2|5 - 3m| - 4 = 20$

5. Solve the following inequalities and express the solutions in interval notation.

a) $2(y+7) > 2(4y+1) - 3y$

b) $\dfrac{x}{5} + \dfrac{1}{3} \le \dfrac{x}{2} + 1$

c) $-13 \le 7 + 4x < 17$

d) $|3z+1| - 9 > -2$

e) $|6x+3| < -3$

f) $|6x+3| \ge -7$

g) $2x^2 - 9x + 4 \le 0$

h) $-x^2 < 5x$

i) $2x^2 - 3x - 2 > 0$

j) $x^3 + x^2 \ge 48x$

k) $\dfrac{3-x}{x+5} \ge 0$

l) $\dfrac{x-2}{x+3} \le 4$

6. For $f(x) = -x^2 + 6x - 5$, find

a) Find the vertex point
b) Find the line of symmetry
c) State whether there is a maximum or minimum value *and* find that value
d) Find the zeros of $f(x)$
e) Find the range and the domain of the function.
f) Graph the function and ***label.***
g) On what intervals is the function increasing? Decreasing?

7. For $g(x) = x^2 + x - 6$, find

a) Find the vertex point
b) Find the line of symmetry
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g) On what intervals is the function increasing? Decreasing?

8. The height of a projectile fired upward from the ground with an initial velocity of 128 *ft./s* is given by $s = -16t^2 + 128t$, where *s* is the height in *feet* and *t* is the time in *seconds*. Find the times at which the projectile will be 192 *feet* above the ground.

9. A rancher has 360 *yd.* of fencing with which to enclose two adjacent rectangular corrals, one for sheep and one for cattle. A river forms one side of the corrals. Suppose the width of each corral is *x* yards.

a) Express the total area of the two corrals as a function of *x*.
b) Find the domain of the function.
c) Find the maximum area
d) Find the dimensions that maximize the corrals area

10. A projectile is fired vertically upward, and its height $s(t)$ in feet after *t* seconds is given by the function defined by $s(t) = -16t^2 + 800t + 600$

a) From what height was the projectile fired?
b) After how many seconds will it reach its maximum height?
c) What is the maximum height it will reach?

11. A ball is thrown upwards, and its height s at time t can be determined by the function $s(t) = -16t^2 + 48t + 8$, where s is measured in feet above the ground and t is the number of seconds of flight. Find:

a) The time it takes the ball to reach its maximum height.
b) The maximum height the ball attains.

12. The period T of the pendulum is the time it takes the pendulum to complete one swing from left to right and back. For a pendulum near the surface of Earth

$$T = 2\pi \sqrt{\frac{L}{32}}$$

Where T is measured in *seconds* and L is the length of the pendulum in *feet*. Find the length of a pendulum that has a period of 4 *seconds*.

13. If a projectile is launched from ground level with an initial velocity of 96 *ft* per *sec*, its height in feet t *seconds* after launching is s *feet*, where

$$s = -16t^2 + 96t$$

When will the projectile be greater than 80 *feet* above the ground?

14. You can rent a car for the day from Company ***A*** for \$29.00 plus \$0.12 a *mile*. Company ***B*** charges \$22.00 plus \$0.21 a *mile*. Find the number of miles m per day for which it is cheaper to rent from Company ***A***.

Solution

1. $a)$ *Function*; $Domain = \{1,2,3,4,5,6,8\}$ $Range = \{1,2,3,4,5\}$

$b)$ *Not a function*; $Domain = \{-2,-1,1,3,5,6\}$ $Range = \{-3,1,2,4,5\}$

$c)$ *Function*; $Domain = \{-1,1,2,3,4,5,6,7\}$ $Range = \{1,2,3,4\}$

2. $a)\ 6$ $b)\ -30$ $c)\ 0$ $d)\ -2x^2 - 3x + 5$

3. $a)\ \frac{3}{4}$ $b)\ -3$ $c)\ \frac{2x+2h-3}{x+h-4}$ $d)\ \frac{11}{8}$

4.

$a)\ x = \left\{\frac{4}{3}, \frac{3}{2}\right\}$

$b)\ x = 3 \pm 2i\sqrt{7}$

$c)\ x = \left\{-\frac{3}{2}, \frac{1}{3}\right\}$

$d)\ x = 3 + \frac{4}{\sqrt[3]{9}}$ *or* $x = 3 + \frac{4}{3}\sqrt[3]{3}$

$e)\ \frac{-6 \pm \sqrt{30}}{2}$

$f)\ -\frac{1}{2} \pm \frac{\sqrt{7}}{2}i$

$g)\ x = -3$

$h)\ x = 5$

$i)\ x = \left\{\frac{5}{4}, \pm\frac{1}{2}\right\}$

$j)\ x = \left\{\pm 1, \frac{\pm i\sqrt{3}}{2}\right\}$

$k)\ x = 1$

$l)\ x = \{-64,\ 27\}$

$m)\ x = 1,\ 81$

$n)\ m = \left\{-\frac{17}{3}, \frac{7}{3}\right\}$

5.

$a)\ (-\infty, 4)$

$b)\ \left[\frac{20}{9}, \infty\right)$

$c)\ \left[-5,\ \frac{5}{2}\right)$

$d)\ (2, \infty)$

$e)$ *No Solution*

$f)\ (-\infty,\ \infty)$

$g)\ \left[\frac{1}{2},\ 4\right]$

$h)\ (-\infty,\ -5) \cup (0,\ \infty)$

$i)\ \left(-\infty, -\frac{1}{2}\right) \cup (2, \infty)$

$j)\ \left[\frac{-1-\sqrt{193}}{2},\ 0\right] \cup \left[\frac{-1+\sqrt{193}}{2},\ \infty\right)$

$k)\ (-5,\ 3]$

$l)\ \left(-\infty,\ -\frac{14}{3}\right] \cup (-3,\ \infty)$

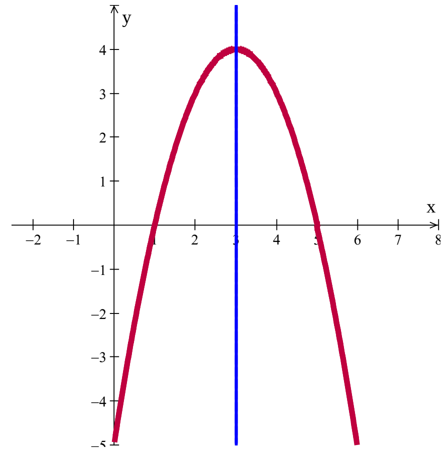
6. Vertex: $x = -\frac{b}{2a}$ $\quad f(x) = -x^2 + 6x - 5$

$$= -\frac{6}{2(-1)}$$

$$= 3$$

$$y = f(3) = -(3)^2 + 6(3) - 5$$

$$= 4$$



Vertex point: $(3, 4)$

Axis of symmetry: $x = 3$

Maximum point @ $(3, 4)$

x-intercept: $x = 1, 5$

y-intercept: $y = -5$

Domain: $(-\infty, \infty)$

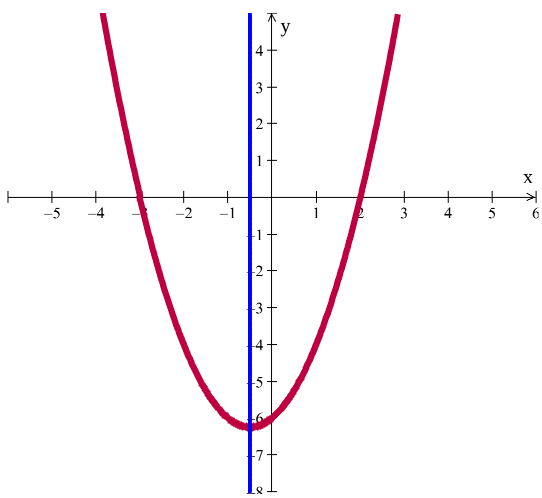
Range: $(-\infty, 4]$

Increasing: $(-\infty, 3)$

Decreasing: $(3, \infty)$

7. Vertex: $x = -\frac{1}{2(1)} = -\frac{1}{2}$

$$y = f\left(-\frac{1}{2}\right) = \left(-\frac{1}{2}\right)^2 + \left(-\frac{1}{2}\right) - 6 = -\frac{25}{4}$$



Vertex point: $\left(-\frac{1}{2}, -\frac{25}{4}\right)$

Axis of symmetry: $x = -\frac{1}{2}$

Maximum point @ $\left(-\frac{1}{2}, -\frac{25}{4}\right)$

x-intercept: $x = -3, 2$

y-intercept: $y = -6$

Domain: $(-\infty, \infty)$

Range: $\left[-\frac{25}{4}, \infty\right)$

Increasing: $\left(-\frac{1}{2}, \infty\right)$

Decreasing: $\left(-\infty, -\frac{1}{2}\right)$

8. $t = 2$ and 6 *sec*. height 192 *ft*

9. *a*) $A(x) = 360x - 3x^2$ *b*) Domain: $0 < x < 120$ *c*) 10800 yd^2 *d*) 60 by 180 *yd*.

10. *a*) Height = 600 *ft*. ($t = 0$) *b*) $t = 25$ sec. *c*) Max. Height: 10,600 *feet*.

11. *a*) $t = 1.5$ secs *b*) Max height is 44 *feet*.

12. $L = \frac{128}{\pi^2}$ *feet*

13. $(1,\ 5)$

14. $\frac{700}{9}$ *days*