SOLUTIONS 1

CHAPTER 1: Introduction to Quadratic Equations

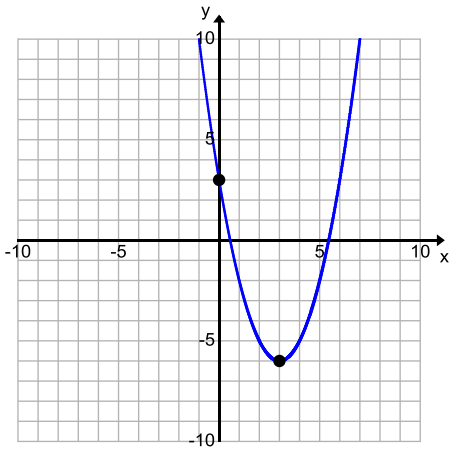
1. Simplify.

(a) $\left(ab^4\right)\left(a^{-3}b^4\right)$
$= a^{-2}b^8$

(b) $\left(-x^2\right)^5\left(2x^3\right)^6$
$= -x^{10}2^6x^{18}$
$= -x^{28}(64)$
$= -64x^{28}$

(c) $(x+5y^2)(-2x^2-3y^3)$
$= -2x^3-3xy^3-10x^2y^2-15y^5$

2. (a) Graph $y = x^2 - 6x + 3$.



(b) vertex = $(3,-6)$
axis of symmetry: $x = 3$
y-intercept: 3
x-intercept(s): *(found using the Quad Formula)*

$$x = \frac{6+\sqrt{24}}{2} \quad \text{and} \quad x = \frac{6-\sqrt{24}}{2}$$
$$\doteq 5.44 \qquad \doteq 0.55$$

direction of opening: up

3. State the domain and range for the following functions.

(a)
$D = \{x \in R\}$
$R = \{y \in R \mid y \le 1\}$

(b)
$D = \{x \in R\}$
$R = \{y \in R\}$

4. Determine whether the following relations are functions. State the domain and range.

(a)
NOT a function
$D = \{1,5,6\}$
$R = \{2,3\}$

(b)
NOT a function
$D = \{2,3,5\}$
$R = \{0,3,8\}$

(c)
IS a function
$D = \{0,1,2,3\}$
$R = \{0,2,4,8\}$

5. If $f(x)=3(x-2)^2+1$, determine

(a) $f(-1)$

$$f(x)=3(x-2)^2+1$$
$$f(-1)=3(-1-2)^2+1$$
$$=3(-3)^2+1$$
$$=3(9)+1$$
$$=28$$

(b) $f(x+1)$

$$f(x)=3(x-2)^2+1$$
$$f(x+1)=3(x+1-2)^2+1$$
$$=3(x-1)^2+1$$
$$=3(x^2-2x+1)+1$$
$$=3x^2-6x+3+1$$
$$=3x^2-6x+4$$

6. In words, describe the transformations to the graph $f(x)=x^2$ to get $g(x)$, if $g(x)=\frac{1}{2}(x+4)^2-3$.

The quadratic function $f(x)=x^2$ has been;

- horizontally translated 4 units to the left
- vertically compressed by a factor of $\frac{1}{2}$
- vertically translated down 3 units.

7. What conclusion can you make if the same value appears when calculating:

(a) the "1st difference"?

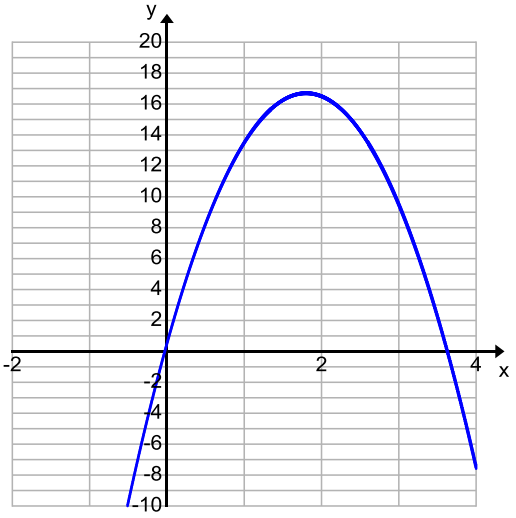
The function is a line (ie…. It is linear)

(b) the "2nd difference"?

The function is a quadratic.

8. A football is kicked from a height of 0.5 m. The height of the football is modeled by the the function $h(t)=-5t^2+18t+0.5$, where t is time in seconds and $h(t)$ is height in metres.

(a) Graph the function.



(b) State Domain and Range for this application in set notation.

$$D=\{x\in R\}$$
$$R=\{y\in R \mid y\le 16.7\}$$

(c) At what time does the football reach maximum height? Show your work.

$$\begin{aligned} h(t) &= -5t^2 + 18t + 0.5 \\ &= -5(t^2 - 3.6t + 3.24) + 0.5 + 16.2 \\ &= -5(t - 1.8)^2 + 16.7 \end{aligned}$$

The football reaches maximum height after 1.8 seconds.

(d) For how many seconds is the football in the air? Show your work.

$$a = -5,\ b = 18,\ c = 0.5$$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$t = \frac{-18 \pm \sqrt{(-18)^2 - 4(-5)(0.5)}}{2(-5)}$$

$$t = \frac{-18 \pm \sqrt{324 + 10}}{-10}$$

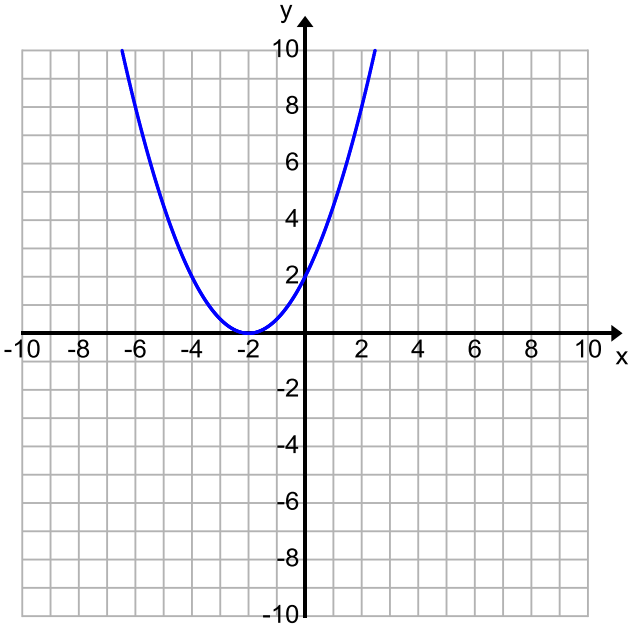
$$t = \frac{-18 + \sqrt{334}}{-10} \text{ and } t = \frac{-18 - \sqrt{334}}{-10}$$

$$t = -0.03 \text{ and } t = 3.63$$

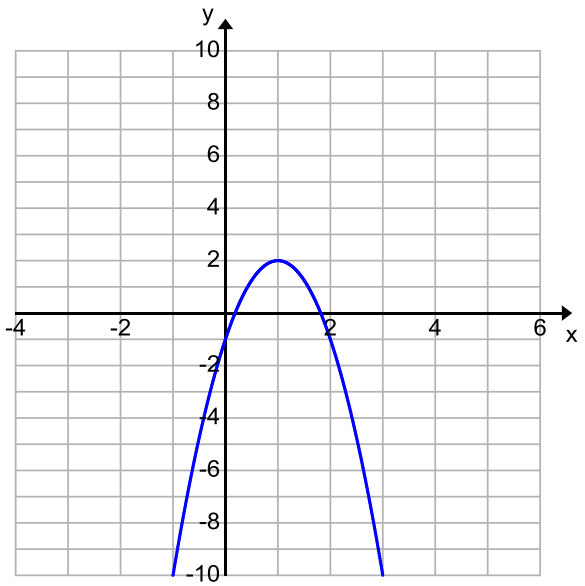
The football is in the air for approx. 3.6 seconds.

9. Graph each of the following STEP BY STEP and then state domain and range.

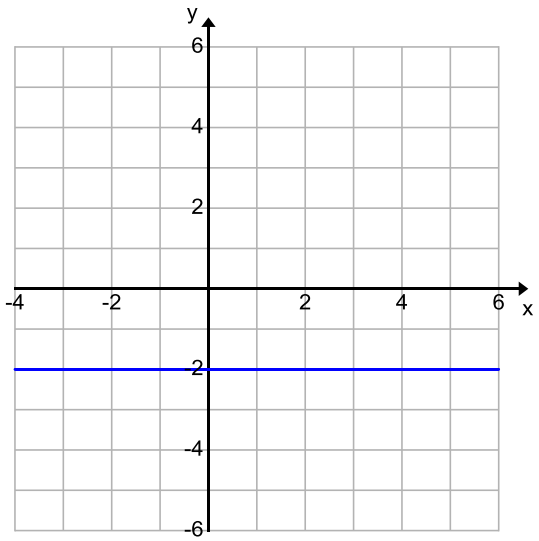
(a) $y = \frac{1}{2}(x+3)^2$



(b) $g(x) = -3(x-1)^2 + 2$



(c) $y = -2$



10. Create a first- and second-difference table for the following data.

x	-1	0	1	2	3
y	1	2	-3	-14	-31
1st Difference		1	-5	-11	-17
2nd Difference			-6	-6	-6

(b) What conclusion can be made from the first difference?

The function is NON-LINEAR.

(c) What conclusion can be made from the second difference?

The function is QUADRATIC.

11. A relation g is given by $g(x) = 3x^2 + 2x - 4$. Evaluate.

(a) $g(-2)$

$$g(x) = 3x^2 + 2x - 4$$
$$g(-2) = 3(-2)^2 + 2(-2) - 4$$
$$= 3(4) - 4 - 4$$
$$= 6$$

(b) $g(m)$

$$g(x) = 3x^2 + 2x - 4$$
$$g(m) = 3m^2 + 2m - 4$$

(c) $g(4a)$

$$g(x) = 3x^2 + 2x - 4$$
$$g(4a) = 3(4a)^2 + 2(4a) - 4$$
$$= 3(16a^2) + 8a - 4$$
$$= 48a^2 + 8a - 4$$

EXTRA QUESTIONS – Chapter 1 p. 186 # 1 – 8

(See back of the textbook for answers)