Prerequisite Skills

Finite Differences

5. Use finite differences to determine if each function is linear, quadratic, or neither.

a)

x	y
−2	−7
−1	−5
0	−3
1	−1
2	1
3	3
4	5

b)

x	y
−1	−8
0	−2
1	−1
2	5
3	7
4	13
5	20

c)

x	y
−4	−12
−3	−5
−2	0
−1	3
0	4
1	3
2	0

Domain and Range

6. State the domain and range of each function. Justify your answer.

a) $y = 2(x - 3)^2 + 1$

b) $y = \dfrac{1}{x + 5}$

c) $y = \sqrt{1 - 2x}$

Quadratic Functions

7. Determine the equation of a quadratic function that satisfies each set of conditions.

a) x-intercepts 1 and −1, y-intercept 3

b) x-intercept 3, and passing through the point (1, −2)

c) x-intercepts $-\frac{1}{2}$ and 2, y-intercept −4

8. Determine the x-intercepts, the vertex, the direction of opening, and the domain and range of each quadratic function. Then, graph the function.

a) $y = (x + 6)(2x - 5)$

b) $y = -2(x - 4)^2 + 1$

c) $y = -\frac{1}{4}(x - 3)^2 + 5$

d) $y = 5x^2 + 7x - 6$

e) $y = -3x^2 + 5x - 2$

Transformations

9. Identify each transformation of the function $y = f(x)$ as a vertical or horizontal translation, a stretch or compression, or a reflection in the x-axis or y-axis, or any combination of these.

a) $y = -4f(x)$

b) $y = \frac{1}{3}f(x)$

c) $y = f(2x)$

d) $y = f\left(-\frac{1}{3}x\right)$

e) $y = f(-x)$

10. i) Write an equation for the transformed function of each base function.

ii) Sketch a graph of each function.

iii) State the domain and range.

a) $f(x) = x$ is translated 2 units to the left and 3 units up.

b) $f(x) = x^2$ is stretched vertically by a factor of 5, reflected in the x-axis, and translated 2 units down and 1 unit to the left.

c) $f(x) = x$ is compressed horizontally by a factor of $\frac{1}{2}$, stretched vertically by a factor of 3, reflected in the x-axis, and translated 4 units to the left and 6 units up.

11. i) Describe the transformations that must be applied to the graph of each base function, $f(x)$, to obtain the given transformed function.

ii) Write an equation for the transformed function.

a) $f(x) = x$, $y = -2f(x + 3) + 1$

b) $f(x) = x^2$, $y = \frac{1}{3}f(x) - 2$

12. Describe the transformations that must be applied to the base function $y = x^2$ to obtain the function $y = 3\left[-\frac{1}{2}(x - 1)\right]^2 + 2$.

Answers

CHAPTER 1

Prerequisite Skills, pages 2–3

5. a) linear b) neither c) quadratic

6. a) $\{x \in \mathbb{R}\}$, $\{y \in \mathbb{R}, y \geq 1\}$ b) $\{x \in \mathbb{R}, x \neq -5\}$, $\{y \in \mathbb{R}, y \neq 0\}$

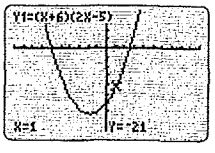
c) $\left\{x \in \mathbb{R}, x \leq \frac{1}{2}\right\}$, $\{y \in \mathbb{R}, y \geq 0\}$

7. Answers may vary. Sample answers:

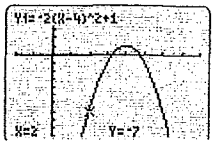
a) $y = -3(x + 1)(x - 1)$ b) $y = -\frac{1}{2}x^2 + 3x - \frac{9}{2}$

c) $y = 4\left(x + \frac{1}{2}\right)(x - 2)$

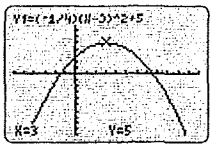
8. a) x-intercepts -6, $\frac{5}{2}$; vertex $\left(-\frac{7}{4}, -\frac{289}{8}\right)$; opens up; $\{x \in \mathbb{R}\}$, $\left\{y \in \mathbb{R}, y \geq -\frac{289}{8}\right\}$



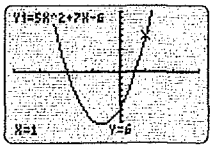
b) x-intercepts approximately 3.29, 4.71; vertex (4, 1); opens down; $\{x \in \mathbb{R}\}$, $\{y \in \mathbb{R}, y \leq 1\}$



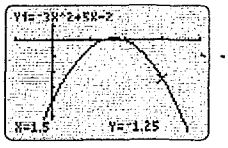
c) x-intercepts approximately -1.47, 7.47; vertex (3, 5); opens down; $\{x \in \mathbb{R}\}$, $\{y \in \mathbb{R}, y \leq 5\}$



d) x-intercepts -2, $\frac{3}{5}$; vertex $\left(-\frac{7}{10}, -\frac{169}{20}\right)$; opens up; $\{x \in \mathbb{R}\}$, $\left\{y \in \mathbb{R}, y \geq -\frac{169}{20}\right\}$

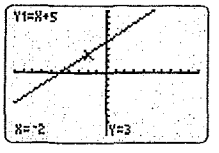


e) x-intercepts 1, $\frac{2}{3}$; vertex $\left(\frac{5}{6}, \frac{1}{12}\right)$; opens down; $\{x \in \mathbb{R}\}$, $\left\{y \in \mathbb{R}, y \leq \frac{1}{12}\right\}$



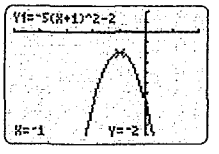
9. a) vertical stretch and a reflection in the x axis b) vertical compression c) horizontal compression d) horizontal stretch and a reflection in the y-axis e) reflection in the y-axis

10. a) i) $f(x) = x + 5$

ii) 

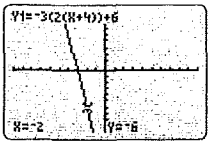
iii) $\{x \in \mathbb{R}\}$, $\{y \in \mathbb{R}\}$

b) i) $f(x) = -5(x + 1)^2 - 2$

ii) 

iii) $\{x \in \mathbb{R}\}$, $\{y \in \mathbb{R}, y \leq -2\}$

c) i) $f(x) = -3[2(x + 4)] + 6$

ii) 

iii) $\{x \in \mathbb{R}\}$, $\{y \in \mathbb{R}\}$

11. a) i) vertical stretch by a factor of 2, reflection in the x-axis, translation 3 units left, translation 1 unit up

ii) $y = -2(x + 3) + 1$ b) i) vertical compression by a factor of $\frac{1}{3}$, translation 2 units down ii) $y = \frac{1}{3}x^2 - 2$

12. vertical stretch by a factor of 3, horizontal stretch by a factor of 2, reflection in the y-axis, translation 1 unit right, translation 2 units up