Prerequisite Skills

C. 1 # 1 – 12

Function Notation

1. Determine each value for the function $f(x) = -4x + 7$.
   a) $f(0)$ b) $f(3)$ c) $f(-1)$
   d) $f\left(\frac{1}{2}\right)$ e) $f(-2x)$ f) $f(3x)$

2. Determine each value for the function $f(x) = 2x^2 - 3x + 1$.
   a) $f(0)$ b) $f(3)$ c) $f(-1)$
   d) $f\left(\frac{1}{2}\right)$ e) $3f(2x)$ f) $f(3x)$

Slope and y-intercept of a Line

3. State the slope and the y-intercept of each line.
   a) $y = 3x + 2$ b) $4y = 6 - 2x$
   c) $5x - y + 7 = 0$ d) $y + 6 = -5(x + 1)$
   e) $-(x + 4) = 2(y - 3)$

Equation of a Line

4. Determine an equation for the line that satisfies each set of conditions.
   a) The slope is 3 and the y-intercept is 5.
   b) The x-intercept is -1 and the y-intercept is 4.
   c) The slope is -4 and the line passes through the point $(7, 3)$.
   d) The line passes through the points $(2, -2)$ and $(1, 5)$.

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.

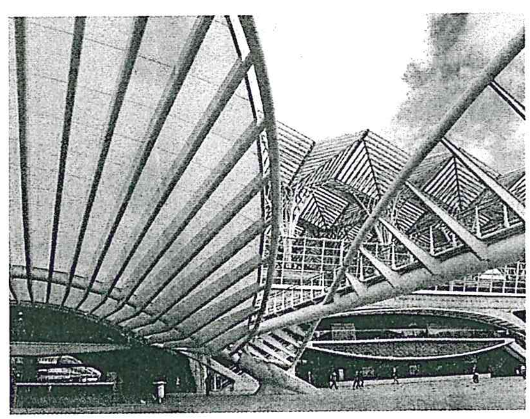
    a) $f(x) = x$, $y = -2f(x + 3) + 1$

    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 $y = 3\left[-\frac{1}{2}(x - 1)\right]^2 + 2$.

CHAPTER PROBLEM

Mathematical shapes and curves surround us. They are found in the designs of buildings, bridges, vehicles, furniture, containers, jewellery, games, cake decorations, fabrics, amusement parks, golf courses, art, and almost everywhere else! Some careers that involve working with mathematical designs are civil engineering, architectural design, computer graphics design, interior design, and landscape architecture.



Throughout this chapter, you will explore how the curves represented by polynomial functions are applied in various design-related fields.