WIR SOLUTIONS: Sections 5.1 and 5.2

This document contains the answers and video solutions to the posed problems. Click the red box to watch the video solution. You can also watch all videos by viewing the [Section 5.1 and 5.2 playlist](#). Closed captions are available for all videos and the speed of the videos may be adjusted inside of "Settings" or the cog in the bottom right corner.

**Section 5.1**

1. Express \( \{x \mid x \leq 2 \text{ or } -8 < x \leq 10, \text{ but } x \neq 0\} \) in the equivalent interval notation.
   
   \[ \text{Answer: } (-\infty, 0) \cup (0, 10) \]
   
   [Click here for video solution to #1.]

2. For the graphs below, state the domain, the range, and whether the relation is a function or not.

   (a) \[ \text{Answer: Domain: } (-8, 2], \text{ Range: } \{y \mid y = 2, 3, 4, 5, 6\}, \text{ Not a Function} \]
   
   [Click here for video solution to #2a.]

   (b) \[ \text{Answer: Domain: } [-8, -1) \cup (-1, \infty), \text{ Range: } [-4, \infty), \text{ Yes is a function.} \]

   [Click here for video solution to #2b.]
Math 140 - Fall 2021
“Week-in-Review”

(c) Answer: Domain: \((-8, 2]\), Range: \(\{y | y = 2, 3, 4, 5, 6\}\), Yes is a function.

Click here for video solution to #2c.

(3) A graph of \(f(x)\) is shown below. Use the graph to

(a) find \(f(-4)\).
   \[Answer: f(-4) = 3\]

(b) find \(f(2)\).
   \[Answer: f(2) \text{ Does not exist (DNE)}\]

(c) determine all values of \(x\) where \(f(x) = 3\) and \(f(x) = 1\).
   \[Answer: f(x) = 3 \text{ when } x = -2, 5 \text{ and any } x \text{ on } [-6, -4]\]

Click here for video solution to #3.
(4) Use the function $g(x) = -2x^2 + 4x + 6$ to find the following:

(a) $g(-1)$
(b) $g(1)$
(c) $g(a + b)$
(d) $g(x + h)$
(e) $g(x + h) - g(x)$

Answer:
(a) $g(-1) = 0$
(b) $g(1) = 8$
(c) $g(a + b) = -2a^2 - 2b^2 + 4a + 4b + 12$
(d) $g(x + h) = -2x^2 - 4xh - 2h^2 + 4x + 4h + 6$
(e) $g(x + h) - g(x) = -4xh - 2h^2 + 4h$

Section 5.2

(5) Determine whether each function below is a polynomial. If it is a polynomial state the degree, leading term, leading coefficient, and constant term.

(a) $g(x) = -2x^3 + 4x^{1/2}$
(b) $h(x) = 6x + \pi - 8x^4 + 12x^3 - \sqrt{2}x^2$
(c) $p(x) = \frac{1}{2}x(x - 2)(x + 3)$

Answer:
(a) $g(x)$ is not a polynomial
(b) Yes $h(x)$ is a polynomial. Degree is 4; leading term is $-8x^4$; leading coefficient is $-8$, constant term is $\pi$.
(c) Yes $p(x)$ is a polynomial. Degree is 3, leading term is $\frac{1}{2}x^3$; leading coefficient is $\frac{1}{2}$, constant term is 0.

(6) For the polynomials below determine the (a) end behaviors, (b) real zeros, (c) domain, and (d) $y$-intercept.

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

Answer:
Right End Behavior: As $x \to \infty, k(x) \to \infty$
Left End Behavior: As $x \to -\infty, k(x) \to \infty$
Real Zeros: $x = 3, -1, 2$
Domain: $(-\infty, \infty)$
$y$-intercept: $(0, -6)$
(b) \( p(x) = -\frac{1}{3}(x - 3)^2(x + 1)(x - 2) \)

**Answer:**
Right End Behavior: As \( x \to \infty \), \( p(x) \to -\infty \)
Left End Behavior: As \( x \to -\infty \), \( p(x) \to \infty \)
Real Zeros: \( x = 3, -1, 2 \)
Domain: \( (-\infty, \infty) \)
y-intercept: (0, 6)

[Click here for video solution to #6b.](#)

(c) \( g(x) = 4(x + 5)^2 - 64 \)

**Answer:**
Right End Behavior: As \( x \to \infty \), \( g(x) \to \infty \)
Left End Behavior: As \( x \to -\infty \), \( g(x) \to \infty \)
Real Zeros: \( x = -9, -1 \)
Domain: \( (-\infty, \infty) \)
y-intercept: (0, 36)

[Click here for video solution to #6c.](#)

(d) \( f(x) = x^3 + x^2 - 6x \)

**Answer:**
Right End Behavior: As \( x \to \infty \), \( f(x) \to \infty \)
Left End Behavior: As \( x \to -\infty \), \( f(x) \to -\infty \)
Real Zeros: \( x = -3, 0, 2 \)
Domain: \( (-\infty, \infty) \)
y-intercept: (0, 0)

[Click here for video solution to #6d.](#)

(e) \( h(x) = -5x^2 - 10x + 17 \)

**Answer:**
Right End Behavior: As \( x \to \infty \), \( h(x) \to -\infty \)
Left End Behavior: As \( x \to -\infty \), \( h(x) \to -\infty \)
Real Zeros: No real zeros exist.
Domain: \( (-\infty, \infty) \)
y-intercept: (0, -17)

[Click here for video solution to #6e.](#)
(7) Examine the functions below and determine which are quadratics. For the quadratic functions, (a) find the vertex, (b) axis of symmetry, (c) range, and (d) maximum or minimum value (whichever exists).

(a) \( k(x) = \frac{1}{3} (x - 3)^2 (x + 1)(x - 2) \)

Answer: Not a quadratic.

(b) \( p(x) = -\frac{1}{3} (x - 3)^2 (x + 1)^2 (x - 2) \)

Answer: Not a quadratic.

(c) \( g(x) = 4(x + 5)^2 - 64 \)

Answer: Vertex: \((-5, -64)\), Axis of Symmetry: \(x = -5\), Range: \([-64, \infty)\), Minimum value is \(-64\), No maximum value.

(d) \( f(x) = x^3 + x^2 - 6x \)

Answer: Not a quadratic.

(e) \( h(x) = -5x^2 - 10x + 17 \)

Answer: Vertex: \((-1, -12)\), Axis of Symmetry: \(x = -1\), Range: \((\infty, -12]\), Maximum value is \(-12\), No minimum value.

Click here for video solution to #7.

(8) A company’s revenue function (in dollars) is given by \( R(x) = -x^2 + 1250x \) where \( x \) is the number of items sold and the company’s cost function (in dollars) is given by \( C(x) = 390x + 170500 \) where \( x \) is the number of items produced. Find

(a) The number of items sold when revenue is maximized.

Answer: 625

(b) The maximum revenue.

Answer: \( R(625) = 390,625 \)

(c) The number of items sold when profit is maximized.

Answer: 430

(d) The maximum profit.

Answer: \( P(430) = 14,400 \)

(e) The break-even quantity/quantities, if they exist.

Answer: 310 and 550

Click here for video solution to #8.