Please check your homework:

We will do #18 & 21 after we go over the rest of the homework.

5. The function is a polynomial that is already written in standard form. It has degree 4 (quartic) and a leading coefficient of \( \pi \).

8. The function is not a polynomial function because the term \( \frac{2}{x} \) has an exponent that is not a whole number.

24. A; The ends approach opposite directions so the function must be odd. It imitates an odd function whose coefficient is positive.

25. The degree is even and the leading coefficient is positive.

26. The degree is odd and the leading coefficient is negative.

27. The degree is even and the leading coefficient is negative.

Graph
\[ f(x) = x^4 - 2 \]

51. Visual thinking: Suppose \( f(x) \to -\infty \) as \( x \to -\infty \) and \( f(x) \to +\infty \) as \( x \to +\infty \).

Describe the end behavior of \( g(x) = -f(x) \).

50. If \( f(x) = \sqrt{x} + 1 \), from the graph, \( f(x) \to -\infty \) as \( x \to -\infty \), and \( f(x) \to +\infty \) as \( x \to +\infty \). So, the degree is odd and the leading coefficient is negative. The constant term is \( f(0) = 1 \).

56. Which function(s) are represented by the graph shown?
58. a. As $t \to +\infty$, $P(x) \to +\infty$.
   As $t \to -\infty$, $P(x) \to +\infty$.
   
   b. 
   
   ![Graph of P(t) vs. Years since 1980]
   
   c. $p(t) = 0.138t^4 - 6.24t^3 + 86.8t^2 - 239t + 1450$
   $p(30) = 0.138(30)^4 - 6.24(30)^3 + 86.8(30)^2$
   $- 239(30) + 1450$
   $= 111,780 - 168,480 + 78,120 - 7170 + 1450$
   $= 15,700$ periodicals
   
   The model may not be appropriate to use to predict the number of periodicals in 2010 because the model may not be accurate outside the range of years from 1980 to 2002.

Critical Thinking

Give an example of a polynomial function $f$ such that $f(x) \to -\infty$ as $x \to -\infty$ and $f(x) \to -\infty$ as $x \to +\infty$.

$f(x) = -x^2$

What kind of function is it?

Degree: Even

Leading Coefficient: Negative
18. \( h(x) = -8x^3 + 14x - 35, \ x = 4 \)

\[
\begin{array}{c|ccccc}
-8 & 0 & 14 & -35 \\
\hline
4 & -32 & -128 & 456 \\
\hline
-8 & -32 & 114 & 491 \\
\hline
\end{array}
\]

\( f(4) = -491 \)

21. \( h(x) = -7x^3 + 11x^2 + 4x, \ x = 3 \)

\[
\begin{array}{c|cccc}
-7 & 11 & 4 & 0 \\
\hline
3 & -21 & -30 & -76 \\
\hline
-7 & -10 & -26 & -78 \\
\hline
\end{array}
\]

\( h(3) = -78 \)
Use synthetic substitution to evaluate the polynomial function for the given value of $x$.

6. $f(x) = 7x^4 - 3x^3 + x^2 + 5x - 9; x = 2$

\[
\begin{array}{c|ccccc}
2 & 7 & -3 & 15 & -9 \\
\hline
 & 14 & 22 & 16 & 102 \\
 & 7 & 11 & 23 & 51 & 93 \\
\end{array}
\]

$f(2) = 93$

7. $g(x) = x^3 - 8x + 6; x = -3$

\[
\begin{array}{c|ccccc}
1 & -3 & 8 & 6 \\
\hline
 & -3 & 9 & -3 \\
 & 1 & -3 & 1 & 3 \\
\end{array}
\]

$g(-3) = -3$

10. $h(x) = x^4 + 7x^3 + x^2 - 2x - 6; x = -3$

\[
\begin{array}{c|ccccc}
1 & 7 & 1 & -2 & -6 \\
\hline
 & -3 & -2 & 3 & -8 \\
 & 1 & -1 & 1 & 3 & -9 \\
\end{array}
\]
Pascal’s Triangle

\[(a + b)^0 = 1\]
\[(a + b)^1 = a + b\]
\[(a + b)^2 = a^2 + 2ab + b^2\]
\[(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3\]
\[(a + b)^4 = a^4 + 4a^3b + 6a^2b^2 + 4ab^3 + b^4\]
\[(a + b)^5 = a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5\]

**Binomial Theorem:** The relationship between Pascal’s Triangle and the coefficients of the terms in the expansion of powers of \(a + b\).

Expand the following by using the Binomial Theorem and Pascal’s Triangle:

\[(y + 5)^2\]
\[= (y)^2 + 2(y)(5) + 5^2\]
\[= y^2 + 10y + 25\]

\[(x + 4)^2\]
\[= (\_\_\_\_)^2 + 2(\_\_\_\_)(\_\_\_\_) + (\_\_\_\_)^2\]
\[= (\_\_\_\_)^2\]

\[(-2y + 9)^2\]
\[= (\_\_\_\_\_\_\_\_)^2 + 2(-2y)(9) + (9)^2\]
\[= 4y^2 - 36y + 81\]
1. $(x+3)^3$
   \[ (x+3)(x+3)(x+3) \]
   \[ 1(x^3)(3) \]
   \[ 3(x^2)(3)^2 \]
   \[ 3(x)(3)^3 \]
   \[ (3)^3 \]

2. $(x+3)^3$
   \[ (x+3)(x+3)(x+3) \]
   \[ 1(x^3)(3) \]
   \[ 3(x^2)(3)^2 \]
   \[ 3(x)(3)^3 \]
   \[ (3)^3 \]

3. $(x+2)^4$
   \[ (x+2)(x+2)(x+2)(x+2) \]
   \[ 1(x^4)(4) \]
   \[ 4(x^3)(4)^2 \]
   \[ 6(x^2)(4)^3 \]
   \[ 4(x)(4)^4 \]
   \[ (4)^4 \]

4. $(2x+1)^4$
   \[ (2x+1)(2x+1)(2x+1)(2x+1) \]
   \[ 1((2x)^4) (1) \]
   \[ 4((2x)^3) (1)^2 \]
   \[ 6((2x)^2) (1)^3 \]
   \[ 4((2x) (1)^4 \]
   \[ (1)^4 \]

5. $(3x+1)^3$
   \[ (3x+1)(3x+1)(3x+1) \]
   \[ 1((3x)^3) (1) \]
   \[ 3((3x)^2) (1)^2 \]
   \[ 3((3x)^1) (1)^3 \]
   \[ (1)^3 \]

6. $(5x+3)^3$
   \[ (5x+3)(5x+3)(5x+3) \]
   \[ 1((5x)^3) (3) \]
   \[ 3((5x)^2) (3)^2 \]
   \[ 3((5x)^1) (3)^3 \]
   \[ (3)^3 \]

7. $(x+y)^3$
   \[ (x+y)(x+y)(x+y) \]
   \[ 1((x)^3) (y) \]
   \[ 3((x)^2) (y)^2 \]
   \[ 3((x)^1) (y)^3 \]
   \[ (y)^3 \]

8. $(x+y)^4$
   \[ (x+y)(x+y)(x+y)(x+y) \]
   \[ 1((x)^4) (y) \]
   \[ 4((x)^3) (y)^2 \]
   \[ 6((x)^2) (y)^3 \]
   \[ 4((x) (y)^4 \]
   \[ (y)^4 \]

9. $(2x+3y)^4$
   \[ (2x+3y)(2x+3y)(2x+3y)(2x+3y) \]
   \[ 1((2x)^4) (3y) \]
   \[ 4((2x)^3) (3y)^2 \]
   \[ 6((2x)^2) (3y)^3 \]
   \[ 4((2x) (3y)^4 \]
   \[ (3y)^4 \]

10. $(3x+1)^3$
    \[ (3x+1)(3x+1)(3x+1) \]
    \[ 1((3x)^3) (1) \]
    \[ 3((3x)^2) (1)^2 \]
    \[ 3((3x)^1) (1)^3 \]
    \[ (1)^3 \]

11. $(2x+1)^4$
    \[ (2x+1)(2x+1)(2x+1)(2x+1) \]
    \[ 1((2x)^4) (1) \]
    \[ 4((2x)^3) (1)^2 \]
    \[ 6((2x)^2) (1)^3 \]
    \[ 4((2x) (1)^4 \]
    \[ (1)^4 \]

12. $x^3 + 9x^2 + 27x + 27$
    \[ \text{Exp} \]
    \[ 1331 \]
    \[ 27x^3 + 27x^2 + 9x + 1 \]
Sec. 2.1 - 2.3 Quiz Review Answers

1) a. \(1.04 \times 10^{10}\)  
   b. about 7482 days or about 20.5 years

2) Answers will vary. \(f(x) = -x^5\)

3) a. 4, quartic

<table>
<thead>
<tr>
<th>t</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>61,181</td>
<td>61,938</td>
<td>62,390</td>
<td>62,394</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>t</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>61,910</td>
<td>61,002</td>
<td>59,836</td>
<td>58,683</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>t</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>57,915</td>
<td>58,010</td>
<td>59,547</td>
</tr>
</tbody>
</table>

4. The surface area of the sun is about \(3.39 \times 10^8\) greater than the surface area of Pluto.

5. \(\frac{2a}{3b^2c^2}\)

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

7. \(\frac{2\pi}{3} x^3 = \pi x^2 - 4\pi x + \frac{20\pi}{3}\)

8. \(x^2 + 3x - 12\)

9. \(x^3 - 14x^2 + 57x - 54\)

10. \(x^3 - 4x^2 - 11x + 30\)

11. \(49x^2 - 42x + 9\)

12. [Graph Image]