1. A cylindrical barrel with a radius of 2 feet is being filled with water at a rate of 5 ft$^3$/min. Which of the following is an equation for the height, $h$, of the water in the barrel as a function of time, $t$? Assume that the barrel is initially empty.

A. $h(t) = \frac{5t}{2\pi}$
B. $h(t) = \frac{5t}{4\pi}$
C. $h(t) = \sqrt{\frac{5t}{2\pi}}$
D. $h(t) = \sqrt{\frac{5t}{4\pi}}$
E. $h(t) = \frac{5t}{8\pi}$

2. Find a polynomial $f(x)$ of degree 3 that has zeros at $x = -5, x = 2, x = 4$ and satisfies $f(3) = 24$.

A. $f(x) = -24(x + 5)(x - 2)(x - 4)$
B. $f(x) = 3(x + 5)(x - 2)(x - 4)$
C. $f(x) = -3(x + 5)(x - 2)(x - 4)$
D. $f(x) = 8(x + 5)(x - 2)(x - 4)$
E. $f(x) = \frac{1}{8}(x + 5)(x - 2)(x - 4)$

3. If a savings account pays an interest rate of 2.3% per year compounded quarterly has an initial investment of $4000, how much money will be in the account after 7 years?

A. $4,696.57$
B. $4,560.97$
C. $4,163.80$
D. $4,690.18$
E. $4,978.23$
4. Find the intervals where the function \( f(x) > 0 \).
\[
f(x) = 2(x + 1)(x - 3)(x - 5)
\]
A. \((-\infty, -1) \cup (3, 5)\)
B. \((-1, 3) \cup (5, \infty)\)
C. \((-\infty, -1) \cup (5, \infty)\)
D. \((-\infty, -1) \cup (-1, 3)\)
E. \((-1, 3) \cup (3, 5)\)

5. Find an equation of a rational function \( f \) that satisfies the given conditions.
   - vertical asymptotes: \( x = -1, x = 3 \)
   - horizontal asymptote: \( y = 2 \)
   - \( x \)-intercepts: \(-2, 1\)
   - hole at \( x = 0 \)
A. \( f(x) = \frac{2(x + 1)(x - 3)}{(x + 2)(x - 1)} \)
B. \( f(x) = \frac{2x(x + 2)(x - 1)}{x(x + 1)(x - 3)} \)
C. \( f(x) = \frac{2x(x + 2)(x - 3)}{x(x + 2)(x - 1)} \)
D. \( f(x) = \frac{2(x + 2)(x - 1)}{(x + 1)(x - 3)} \)
E. None of the above

6. Under certain conditions the atmospheric pressure \( p \) (in inches) at an altitude of \( h \) feet is given by \( p = 29e^{-0.0034h} \). What is the pressure at an altitude of 30,000 feet?
A. 0.00207 inches
B. 0.01058 inches
C. 0.00894 inches
D. 0.00108 inches
E. 0.01005 inches
7. Find the quotient, \( q(x) \), and remainder, \( r(x) \), if \( f(x) \) is divided by \( p(x) \).
\[
f(x) = x^4 + 3x^3 - 12 \quad p(x) = x + 2
\]
A. \( q(x) = x^3 + x^2 - 2x + 4; r(x) = -20 \)
B. \( q(x) = x^3 + x^2; r(x) = -14 \)
C. \( q(x) = x^3 + 5x^2 - 10x + 20; r(x) = -52 \)
D. \( q(x) = x^3 + 5x^2 + 10x - 20; r(x) = 28 \)
E. \( q(x) = x^3 + 2x^2; r(x) = -12 \)

8. Solve the equation: \( \log_3(x - 4) = 2 \)
A. 4
B. 13
C. 12
D. 15
E. 7

9. Which of the following could be the graph of \( f(x) = -2(x - 2)^2(x + 3) \)?

A. 
B. 
C. 
D. 
E.
10. Given \( f(x) = \frac{x^2 + 2x - 3}{x^2 - x + 3} \), find the value of \( x \) at which the graph crosses the horizontal asymptote.
   A. 0
   B. 1
   C. 2
   D. 3
   E. it does not cross the horizontal asymptote

11. Find the inverse function of \( f(x) = \frac{2x - 3}{5x + 2} \).
   A. \( f^{-1}(x) = \frac{5x + 2}{2x - 3} \)
   B. \( f^{-1}(x) = \frac{3 - 2x}{-5x - 2} \)
   C. \( f^{-1}(x) = \frac{3 - 5x}{2 - 2x} \)
   D. \( f^{-1}(x) = \frac{5x + 3}{2x + 2} \)
   E. \( f^{-1}(x) = \frac{2x + 3}{2 - 5x} \)

12. A scientist has limited data on the temperature \( T \) (in °C) during a 24 hour period. If \( t \) denotes time in hours and \( t = 0 \) corresponds to midnight, find the third degree polynomial that fits the information in the following table.

<table>
<thead>
<tr>
<th>( t ) (hours)</th>
<th>0</th>
<th>4</th>
<th>10</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>( T ) (°C)</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>0</td>
</tr>
</tbody>
</table>

   A. \( T(t) = -\frac{5}{192}t(t - 4)(t - 18) \)
   B. \( T(t) = -16t(t - 4)(t - 18) \)
   C. \( T(t) = -\frac{5}{8}t(t - 4)(t - 18) \)
   D. \( T(t) = -10t(t - 4)(t - 18) \)
   E. \( T(t) = -\frac{1}{30}t(t - 4)(t - 18) \)
13. Which of the following could represent the graph of \( f(x) = e^{-x} - 3 \)?

A.  
B.  
C.  
D.  
E.  

14. Given \( f(x) = \frac{5}{2x - 3} \), find the domain and range of the inverse, \( f^{-1}(x) \).

A.  
B.  
C.  
D.  
E.  

15. The radioactive bismuth isotope \(^{210}\text{Bi}\) disintegrates according to \( Q = k (2)^{-t/5} \), where \( k \) is a constant and \( t \) is the time in days. Express \( t \) in terms of \( Q \) and \( k \).

A.  
B.  
C.  
D.  
E.  
Answers:
1. B
2. C
3. A
4. B
5. B
6. D
7. A
8. B
9. E
10. C
11. E
12. E
13. B
14. C
15. A