1. Identify the vertical asymptote(s) for the function \( f(x) = \frac{(x-k)(x-n)}{(x-k)(x+n)} \).

(a) \( x = k, x = -n \)  (b) \( x = k \)  (c) \( x = -n \)  (d) \( x = -k, x = n \)

2. Solve the given equation for the variable \( x \). Give exact answer.

\[ \ln(M + 6x) = 3 \]

(a) \( \frac{e^3 - M}{6} \)  (b) \( \frac{e^3 + M}{6} \)  (c) \( \frac{3e + M}{6} \)  (d) \( \frac{3e - M}{6} \)

3. Identify the function that has a horizontal asymptote at \( y = 0 \).

(a) \( f(x) = \frac{(x-a)^6}{(x-p)^4} \)  (b) \( f(x) = \frac{(x-a)^4}{(x-p)^6} \)  (c) \( f(x) = \frac{(x-a)^6}{(x-p)^6} \)  (d) not enough information

4. Mark buys one coffee and four donuts for a total of $12. Linda buys two coffees and three donuts for a total of $12. Choose the best strategy to determine the cost of a donut.

(a) Solve the equation \( x + 4y = 2x + 3y \)  (b) Solve the system \( x + 2y = 12 \)

(c) Solve the system \( x + 4y = 12 \)  (d) Solve the equation \( 4x + 3y = 12 \)

(d) \( 2x + 3y = 12 \)

5. An investment of $3600 earns an annual interest rate of 4%, compounded continuously. How long will it take for the investment to grow to a value of $7200?

(a) \( t = \frac{\log(2)}{0.04} \)  (b) \( t = \frac{\ln(2)}{4} \)  (c) \( t = \frac{\ln(2)}{0.04} \)  (d) \( t = \frac{\log(2)}{4} \)

6. Suppose \( \log(m) = 4 \), \( \log(n) = 100 \), and \( \log(w) = -2 \), find the exact value of the given expression.

\[ \log\left(\frac{m \cdot \sqrt[n]{n}}{w^3}\right) \]

(a) 60  (b) 48  (c) -5  (d) 5
7. Basic transformations are applied to the graph of the original function \( y = f(x) \) as shown below.

![Original graph of \( y = f(x) \)](image1)

![Transformation graph of \( y = f(x) \)](image2)

Identify the formula of the transformation graph of \( y = f(x) \).

(a) \( y = f(x + 1) + 2 \)  
(b) \( y = f(x - 1) - 2 \)  
(c) \( y = f(x + 1) - 2 \)  
(d) \( y = f(x - 1) + 2 \)

8. Choose the statement that best describes the function with the given graph.

![Graph](image3)

(a) Polynomial function  
(b) Quadratic function  
(c) Exponential function  
(d) Rational function

9. The graph of the quadratic function \( f(x) = ax^2 + bx + c \) is shown below.

![Graph](image4)

The value of \( b^2 - 4ac \) is

(a) negative  
(b) positive  
(c) zero  
(d) not enough information
10. The graph of a polynomial function of degree 3 is shown below.

Determine the function formula for the graph.

(a) \( f(x) = -(x - 3)(x + 1)^2 \)  
(b) \( f(x) = (x - 3)(x + 1)^2 \)

(c) \( f(x) = -(x - 3)^2(x + 1) \)  
(d) \( f(x) = (x - 3)^2(x + 1) \)

11. Find the radius of the circle with equation \( x^2 + y^2 - 14x + 18y + 6 = 0 \).

Give exact answer.

\[
\begin{align*}
x^2 - 14x + 49 + y^2 + 18y + 91 &= 124 \\
\text{radius} &= \sqrt{124}
\end{align*}
\]

12. Find the slope of the line with equation \( 3(x + y) = 7x + 5 \).

\[
\begin{align*}
3x + 3y &= 7x + 5 \\
3y &= 4x + 5 \\
y &= \frac{4}{3}x + \frac{5}{3} \\
slope &= \frac{4}{3}
\end{align*}
\]

13. A ball is launched vertically upward from the top of a platform 5 feet tall with an
initial velocity of 96 feet per second. The height \( h \) in feet of the ball above the ground after \( t \) seconds is \( h = 5 + 96t - 16t^2 \). What is the maximum height reached by the ball?

\[
\begin{align*}
\text{max height occurs when } & t = -\frac{96}{2(-16)} = 3 \\
\text{max height } & = 5 + 96(3) - 16(3)^2 = 5 + 288 - 144 = 149
\end{align*}
\]

14. Write the equation of the line that is parallel to the line \( 24x - 4y - 8 = 0 \) and passes through the point \((-7, 2)\).

\[
\begin{align*}
-4y & = -24x + 8 \\
y & = 6x - 2 \Rightarrow \text{slope} = 6 \\
\text{desired line} & \\
\quad y - 2 & = 6(x + 7) \\
\quad y & = 6x + 44
\end{align*}
\]

15. Construct an equation for the circle shown below, where point \( C \) is the center of the circle.
16. Find the solution for the given system of equations. Give exact answer. You must show work that supports your answer.

\[ \begin{align*}
6x + 5y &= 8 \\
4x - 3y &= 18
\end{align*} \]

\[ \begin{align*}
24x + 20y &= 32 \\
24x - 18y &= 108
\end{align*} \]

\[ \begin{align*}
38y &= -76 \\
y &= -2
\end{align*} \]

\[ \begin{align*}
4x - 3(-2) &= 18 \\
4x &= 12 \\
x &= 3
\end{align*} \]

Solution: \( x = 3, y = -2 \)

17. Simplify the given expression. Write answer in factored form, reduced to lowest terms, using only positive exponents.
18. Find all solutions to the equation. Give exact answer.

\[
\begin{align*}
\frac{x}{x+1} + \frac{1}{x-2} &= \frac{6x}{x^2-x-2} \\
x(x-2) + (x+1) &= 6x \\
x^2 - 2x + x + 1 - 6x &= 0 \\
x^2 - 7x + 1 &= 0 \\
x &= \frac{7 \pm \sqrt{49-4}}{2} = \frac{7 \pm \sqrt{45}}{2}
\end{align*}
\]

19. Determine the interval(s) where the graph of the given function is above the x-axis. Give answer using interval notation.

\[ |2x - 3| \leq 5 \]

\[ -5 \leq 2x - 3 \leq 5 \]
\[ -2 \leq 2x \leq 8 \]
\[ -1 \leq x \leq 4 \]

solution
\[ [-1, 4] \]