Problem Statements

1. Perform the indicated operation on the functions \( f(x) = 3x^2 + 5 \) and \( g(x) = x + 7 \) and determine the domain of each new function.
   
a. \((f + g)(x)\)

b. \((fg)(x)\)

c. \(\left(\frac{f}{g}\right)(x)\)

d. \((f \circ g)(x)\)
2. Perform the indicated operation on the functions \( f(x) = \frac{x - 1}{x + 2} \) and \( g(x) = 2x + 3 \) and determine the domain of each new function.

a. \((f \circ g)(x)\)

b. \((g \circ f)(x)\)

c. \((f \circ f)(x)\)

d. \((g \circ g)(x)\)
3. Graphically verify whether \( f(x) = 2\sqrt{x - 2} \) and \( g(x) = \frac{x^3 + 2}{2} \) are inverse functions.

![Graph of f(x) and g(x)](image)

4. Determine whether the function \( g(x) = \sqrt[3]{x^3 - 27} \) has an inverse, and, if it does, find the inverse function algebraically.

![Graph of g(x) and its inverse](image)

5. Determine whether the function \( h(x) = |x - 3| - 4 \) where \( x \leq -3 \) has an inverse, and, if it does, find the inverse function algebraically.

![Graph of h(x) and its inverse](image)
6. Determine whether the function \( f(x) = \frac{5 + 3x}{2x - 1} \) has an inverse, and, if it does, find the inverse function algebraically.

7. Describe the transformation(s) of the graph of \( f(x) = 3^x \) that yield(s) the graph of \( g(x) = 3^{-x+3} + 2 \).

Transformations:

Domain:

\( y \)-intercept:

Horizontal Asymptote:
8. Describe the transformation(s) of the graph of $f(x) = e^x$ that yield(s) the graph of $g(x) = -e^{2x-1} + 2$.

Transformations:

Domain:

$y$-intercept:

Horizontal Asymptote:

9. Describe the transformation(s) of the graph of $f(x) = 3^x$ that yield(s) the graph of $g(x) = 3^{-0.7x} + 1$, then choose the graph that matches the function.

Transformations:

Domain:

$x$-intercept(s):

Horizontal Asymptote(s):

10. Solve the equation for $x$: $3^{x^2-1} = 27$
11. Simplify each of the following without a calculator:
   
a. \( \log_5(125) \)

b. \( 11^{\log_{11}(5)} + 2 \)

c. \( \log(10^{-4}) \)

d. \( \log_2(8x + 3) = \log_2(9) \)
12. Describe the transformations of \( f(x) = \log_2(x) \) that yield \( g(x) = -\log_2(x - 4) + 2 \). Then state the domain, \( x \)-intercept, and vertical asymptote of the logarithmic function \( f(x) \), then choose the graph that matches the function.

Transformations:

Domain:

\( x \)-intercept(s):

Vertical Asymptote(s):

13. Describe the transformations of \( f(x) = \ln(x) \) that yield \( g(x) = \ln(3x + 1) - 1 \). Then state the domain, \( x \)-intercept, and vertical asymptote of the logarithmic function \( g(x) \), then choose the graph that matches the function.

Transformations:

Domain:

\( x \)-intercept(s):

Vertical Asymptote(s):