Show all your work to get full/ partial credit. Each problem is worth 5 points unless specified otherwise.

1. Divide, then find the quotient and remainder: \((3x^3 - 11x^2 - 10) \div (x - 4)\)

\[
\begin{array}{c|cccc}
4 & 3 & -11 & 0 & -10 \\
\hline
& 12 & 4 & 16 \\
\hline
& 3 & 1 & 6 \\
\end{array}
\]

Quotient = \(3x^2 + x + 4\)

Remainder = 6

\[
\frac{3x^3 - 11x^2 - 10}{x - 4} = 3x^2 + x + 4 + \frac{6}{x - 4}
\]

2. Consider the function \(f(x) = 5x^2 - 17x - 12\):

a. Use the Remainder Theorem to determine whether \(c = 4\) is a zero of \(f(x)\).

\[
\begin{array}{c|cccc}
4 & 5 & -17 & -12 \\
\hline
& 20 & 12 \\
\hline
& 5 & 3 & 0 \\
\end{array}
\]

By Remainder Theorem

4 is a zero.

b. Is \((x - 4)\) a factor of \(f(x)\)?

Explain your reasoning.

4 is a zero

By factor theorem

\(x - 4\) is a factor.

3. Solve the inequalities, write your answers using interval notation:

a. \(3x^2 - 2x + 9 \leq 2x(x + 4)\)

\[
\begin{align*}
3x^2 - 2x + 9 & \leq 2x(x + 4) \\
3x - 2x + 9 & \leq 0 \\
(x - 9)(x + 1) & \leq 0
\end{align*}
\]

\([1, 9]\)

b. \(\frac{x + 4}{x - 1} < 0\)

\[
\begin{array}{c|ccc}
& 0 & 4 & 10 \\
\hline
(+) & (--) & (+) \\
\end{array}
\]

\((-4, 1)\)
4. Write a degree 3 polynomial \( f(x) \) with zeros 1, \(-6\), and \(-3\). Leave this polynomial in factored form.

\[
f(x) = (x-1)(x+6)(x+3)
\]

5. For the function \( f(x) = \frac{5x-8}{x^2-4} \),
   a. Find the vertical asymptote(s).
   \[
   x^2-4 = 0 \\
   x = \pm 2
   \]
   \( x = 2 \)
   \( x = -2 \)
   b. Find the horizontal or slant asymptote
   \( \text{No slant asymptote} \)
   \( \text{Horizontal: } y = 0 / x\text{-axis} \)
   c. Find the x-intercept(s) and the y-intercept.
   \( \text{x-intercept (set } y=0) \)
   \[
   \frac{5x-8}{x^2-4} = 0 \\
   5x-8 = 0 \\
   x = \frac{8}{5}
   \]
   \( \left(\frac{8}{5}, 0\right) \)
   \( \text{y-intercept (set } x=0) \)
   \[
   y = \frac{-8}{-4} = 2
   \]
   \( (0, 2) \)

6. The amount of pain reliever that a physician prescribes for a child varies directly as the weight of the child. A physician prescribes 250 mg of the medicine for a 50-lb child.
   a. Write a variation model using \( k \) as the constant of variation.
   \[\text{Amount of medicine } = M \text{ weight } = W\]
   \[M = kW\]
   b. Solve for the constant of variation, \( k \)
   \[250 = k \cdot 50 \]
   \[k = \frac{250}{50} \]
   \[k = 5\]
   c. How much medicine should be prescribed for an 80-lb child?
   \[M = 5W \]
   \[M = 5(80) \]
   \[= 400 \text{ mg} \]
7. Use the definition of a one-to-one function to determine if \( f(x) = -3x + 2 \) is one-to-one.

\[
f(a) = f(b) \\
-3a + 2 = -3b + 2 \\
a = b \\
\text{Therefore, } f \text{ is } 1-1
\]

8. Show that the functions \( f(x) = 5x + 4 \) and \( g(x) = \frac{x-4}{5} \) are inverses of each other.

\[
(f \circ g)(x) = f[g(x)] = 5(\frac{x-4}{5}) + 4 = x \\
(g \circ f)(x) = g[f(x)] = \frac{5x + 4 - 4}{5} = x
\]

\( f \) and \( g \) are inverses.

9. The graph of a function \( y = f(x) \) is given below. Is the function a one-to-one function? Justify your answer.

The horizontal line hits the graph at more than one point. Therefore, \( f \) is not 1-1.

10. Find the inverse function of \( f(x) = \frac{x - 8}{3} \)

\[
y = \frac{x - 8}{3} \\
x = \frac{y - 8}{3} \\
3x = y - 8 \\
y = 3x + 8 \\
f^{-1}(x) = 3x + 8
\]
11. Graph the function $f(x) = 2^x$

12. Suppose that $3,000$ in principal is invested in an account and pays $4.5\%$ interest per year. Write an equation representing the amount in the account after $6$ years, compounded quarterly.

\[ P = 3000 \]
\[ r = 4.5\% = \frac{4.5}{100} \]
\[ t = 6 \]
\[ n = 4 \]

\[ P \left(1 + \frac{r}{n}\right)^{nt} = \]
\[ 3000 \left(1 + \frac{0.045}{4}\right)^{24} \]

13. The graph of $f(x) = \frac{x+4}{x-1}$ is given. Complete the following statements. (2.5 points each)

a. As $x \to -\infty$, $f(x) \to \underline{1}$.

b. As $x \to 1^+$, $f(x) \to \underline{\infty}$.

c. As $x \to 1^-$, $f(x) \to \underline{-\infty}$.

d. As $x \to \infty$, $f(x) \to \underline{1}$.