1. Use the remainder theorem to find the remainder when \( f(x) = 8x^3 - 3x^2 + x + 4 \) is divided by \( g(x) = x - 1 \). Is \( g(x) \) a factor of \( f(x) \)?

2. List the potential rational zeros of the function \( f(x) = 12x^8 - x^7 + 6x^4 - x^3 + x - 3 \).

3. Find a polynomial of degree 7 with zeros 1, 2, \( 1 - i \) and \( 3 + 4i \).
4. Find the complex zeros of \( f(x) = x^3 - 3x^2 - 6x + 8 \).

5. Find the zeros of \( f(x) = x^4 - 4x^3 + 9x^2 - 20x + 20 \).
6. Use synthetic division to determine whether the following factors divide \( f(x) = x^3 - 7x - 6 \):

(a) \( x + 1 \)
(b) \( x + 2 \)
(c) \( x - 2 \)
(d) \( x - 3 \)
7. Use transformations to graph $f(x) = 3^{-x} - 2$. Be sure to label 3 points. What is the domain and range of the function? Where is the horizontal asymptote?

8. Use transformations to graph $f(x) = -3^x - 2$. Be sure to label 3 points. What is the domain and range of the function? Where is the horizontal asymptote?
9. Solve the following equations:

(a) \( e^x = e^{3x+8} \)

(b) \( 5^{x^2+8} = 125^{2x} \)

(c) \( 9^{-x+15} = 27^x \)

(d) \( e^{x^2} = e^{3x} \cdot \frac{1}{e^2} \)
10. Find the exact value of each logarithm:
   (a) \( \log_{\sqrt{3}} 9 \)
   (b) \( \log_{10} \sqrt{10} \)
   (c) \( \ln \sqrt{e} \)
   (d) \( \ln \sqrt{e^2} \)

11. What is the domain of \( f(x) = \log_5 \left( \frac{x + 1}{x} \right) \)?
12. What is the domain of $\sqrt{\ln(x)}$?

13. Sketch the graph of $f(x) = \log(-x) + 1$. Label 3 points and any asymptotes.
14. Solve the following equations:

(a) \( \log_5 x = 3 \)
(b) \( \ln e^x = 5 \)
(c) \( \log_6 36 = 5x + 3 \)
(d) \( e^{3x} = 10 \)
(e) \( \log_x \left( \frac{1}{8} \right) = 3 \)
15. If \( \ln 2 = a \) and \( \ln 3 = b \) use properties of logs to write each logarithm in terms of \( a \) and \( b \).
   (a) \( \ln 8 \)
   (b) \( \ln \sqrt[3]{6} \)

16. Write the following logarithm as the sum and difference of logarithms and write powers as factors:
   \[ f(x) = \ln \left[ \frac{5x^2 \sqrt{1-x}}{4(x+4)^2} \right], \quad 0 < x < 1. \]

17. Write the following as a single logarithm: \( 3 \log(3x + 1) - \log(x^2 - 1) + 2 \log(x + 1) \). Simplify as much as possible.
18. Solve the following logarithmic expressions:

(a) $3 \log_2(x - 1) + \log_2 4 = 4$
(b) $\log_2(x + 7) + \log_2(x + 8) = 1$
(c) $\log_8(x + 6) = 1 - \log_8(x + 4)$

19. Solve $3^{1-2x} = 4^x$. 
20. Find the amount that results from each investment:
   (a) $50 invested at 6% compounded monthly after a period of 3 years.
   (b) $600 invested at 5% compounded daily after a period of 3 years.

21. Find the principal needed today to get each new amount.
   (a) To get $75 after 3 years at 8% compounded quarterly.
   (b) To get $600 after 2 years at 4% compounded quarterly.
22. On January 1, Kayla places $1000 in a COD that pays 6.8% compounded continuously and matures in 3 months. She then takes her $1000 and the interest earned in a savings account that pays 5.25% compounded continuously. How much does Kayla have in her savings account on May 1?

23. The number $N$ of bacteria present in a culture at time $t$ (in hours) obeys the law of exponential growth $N(t) = 1000e^{0.01t}$.

   (a) How many bacteria are present at time $t = 0$?
   (b) What is the growth rate of the bacteria?
   (c) What is the population after 4 hours?
   (d) When will the number of bacteria reach 1700?
   (e) When will the number of bacteria double?
24. The half-life of radium is 1690 years. If 10 grams are present now, how much will be present in 50 years?