MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

Factor the polynomial \( f(x) \). Then solve the equation \( f(x) = 0 \).

1) \( f(x) = x^4 - 4x^3 - 7x^2 + 22x + 24 \)
   A) \((x - 2)(x - 3)(x - 1)(x - 4)\); 2, 3, 1, 4
   B) \((x - 2)(x - 3)(x + 1)(x - 4)\); 2, 3, -1, 4
   C) \((x + 2)(x + 3)(x + 1)(x - 4)\); -2, -3, -1, 4
   D) \((x + 2)(x - 3)(x + 1)(x - 4)\); -2, 3, -1, 4

Given the polynomial function \( f(x) \), find the rational zeros, then the other zeros (that is, solve the equation \( f(x) = 0 \)), and factor \( f(x) \) into linear factors.

2) \( f(x) = x^3 - 27x - 54 \)
   A) \(-3, 3, 6; f(x) = (x + 3)(x - 3)(x - 6)\)
   B) \(-6, -3, 3; f(x) = (x + 6)(x + 3)(x - 3)\)
   C) \(-3, \text{ multiplicity 2}; 6; f(x) = (x + 3)^2(x - 6)\)
   D) \(-3, \text{ multiplicity 2}; -6; f(x) = (x + 3)^2(x + 6)\)

Evaluate the function for the given values of \( a \) and \( b \). Then use the location theorem to determine which of the statements below is true.

3) \( a = 1, b = 4 \)
   \( f(x) = x^4 - 9x^3 + 19x^2 + 18x + 28 \)
   A) \( f(1) \) and \( f(4) \) have opposite signs, therefore \( f \) has a real zero between 1 and 4
   B) \( f(1) \) and \( f(4) \) have opposite signs, therefore \( f \) does not have a real zero between 1 and 4
   C) \( f(1) \) and \( f(4) \) have the same sign, therefore the intermediate value theorem cannot be used to determine whether \( f \) has a real zero between 1 and 4
   D) \( f(1) \) and \( f(4) \) have the same sign, therefore \( f \) does not have a real zero between 1 and 4

Information is given about a polynomial \( f(x) \) whose coefficients are real numbers. Find the remaining zeros of \( f \).

4) Degree 4; zeros: 5 - 5i, 6i
   A) \(-5 - 5i, -6i\)
   B) \(5 + 5i, -6i\)
   C) \(5 + 5i, 6 - i\)
   D) \(-5 + 5i, -6i\)

Form a polynomial \( f(x) \) with real coefficients having the given degree and zeros.

5) Degree: 3; zeros: -3 and 3 - 2i
   A) \( f(x) = x^3 - x^2 - 5x + 39 \)
   B) \( f(x) = x^3 - x^2 + 11x + 39 \)
   C) \( f(x) = x^3 - 3x^2 - 5x + 39 \)
   D) \( f(x) = x^3 - 3x^2 + 5x - 52 \)

Find all zeros of the function and write the polynomial as a product of linear factors.

6) \( f(x) = x^4 + 34x^2 + 225 \)
   A) \( f(x) = (x + 3i)(x - 3i)(x + 5i)(x - 5i) \)
   B) \( f(x) = (x + 3 + 5i)^2(x + 3 - 5i)^2 \)
   C) \( f(x) = (x + i)(x - i)(x + 15i)(x - 15i) \)
   D) \( f(x) = (x + 3i)^2(x + 5i)^2 \)

State the domain of the rational function.

7) \( f(x) = \frac{5x - 4}{2x + 16} \)
   A) \((\infty, -16) \cup (-16, \infty)\)
   B) \((\infty, 8) \cup (8, \infty)\)
   C) \((\infty, \infty)\)
   D) \((\infty, -8) \cup (-8, \infty)\)
Find the horizontal asymptote, if any, of the rational function.
8) \( f(x) = \frac{8x^3 - 3x - 7}{5x^3 - 2x + 8} \)

A) \( y = \frac{8}{5} \)  
B) None  
C) \( y = \frac{3}{2} \)  
D) \( y = 0 \)

Find the vertical asymptote(s) of the graph of the given function.
9) \( f(x) = \frac{x - 11}{x^2 - 4} \)

A) \( x = 11 \)  
B) \( y = 2, y = -2 \)  
C) \( x = 2, x = -2 \)  
D) \( x = 2 \)

Approximate the number using a calculator. Round your answer to three decimal places.
10) \( 4.5^\pi \)

A) 14.137  
B) 172.652  
C) 112.753  
D) 36.462

The graph of an exponential function is given. Select the function for the graph from the functions listed.
11)

![Graph of an exponential function]

A) \( f(x) = 4^{-x} \)  
B) \( f(x) = -4^{-x} \)  
C) \( f(x) = -4^x \)  
D) \( f(x) = 4^x \)

Simplify the expression. Express the answer so that all exponents are positive. Whenever an exponent is 0 or negative, we assume that the base is not 0.
12) \( \frac{(xy^2)(x^4y)}{(x^5y^2)^2} \)

A) \( \frac{y^4}{x^5} \)  
B) \( \frac{y^3}{x^6} \)  
C) \( \frac{x^5}{y^4} \)  
D) \( \frac{x^6}{y^3} \)

Solve the equation.
13) \( 2(1 + 2x) = 32 \)

A) \( \{4\} \)  
B) \( \{16\} \)  
C) \( \{-2\} \)  
D) \( \{2\} \)

Write the equation in its equivalent exponential form.
14) \( \log_5 125 = x \)

A) \( x^5 = 125 \)  
B) \( 5^x = 125 \)  
C) \( 125^x = 5 \)  
D) \( 125^5 = x \)
Find the domain of the logarithmic function.

15) \( f(x) = \ln (9 - x) \)

A) \((-\infty, 0)\)    B) \((-\infty, 9)\)    C) \((-\infty, 9) \text{ or } (9, \infty)\)    D) \((-9, \infty)\)