

Chapter IV topics:

- Transformations of functions.
- Properties of functions.
- Combining functions.
- Inverses of functions.

Chapter V topics:

- Polynomial functions and polynomial inequalities.
- Polynomial division and the division algorithm.
- Locating real zeros of polynomial functions.
- The fundamental theorem of algebra.
- Rational functions and rational inequalities.

Chapter VI topics:

- Exponential functions and their graphs.
- Exponential models.
- Logarithmic functions and their graphs.
- Logarithmic properties and models.
- Exponential and logarithmic equations.

1. Graph the function

$$f(x) = -\sqrt{x+5} - 2$$

by making the appropriate transformations of a basic curve. State the basic function, the transformations and find all intercepts that exist.

2. Graph the function

$$g(x) = 2|x - 4| + 3$$

by making the appropriate transformations of a basic curve. State the basic function, the transformations and find all intercepts that exist.

3. Graph the function

$$h(x) = \begin{cases} x^2, & -1 \leq x \leq 1, \\ x + 1, & x < -1 \text{ or } x > 1 \end{cases}$$

State all intercept points that exist.

4. Determine if the following relation $F(x) = (x - 1)^2 - 2$ is a function.
5. If the above relation is a function, then find the open intervals of monotonicity where the function is increasing, decreasing, or constant.
6. For the given function determine:

$$f(x) = \frac{3}{x+4}$$

domain of f , $f(0)$, $\frac{f(x+1) - f(x)}{x}$

7. For the given relation

$$R = \{(4, 2), (3, -1), (-2, -1), (2, 4)\}$$

find the inverse R^{-1} of the given relation, find the domain of the inverse relation R^{-1} , find the range of the inverse relation R^{-1}

8. Determine if the function $s(x) = \frac{1}{x^2}$ has an inverse function $s^{-1}(x)$.

Hint: sketch a graph and use a Horizontal Line Test or use a one-to-one function definition.

9. Find a formula for the inverse of the following function

$$f(x) = \sqrt[3]{3x - 1}.$$

10. Solve the following polynomial equations by factoring and/or using the quadratic formula, making sure to identify all the solutions.

(a) $x^4 - 8x^3 + 25x^2 = 0$

11. For each of the following polynomial functions, determine the behaviour of its graph as $x \rightarrow \pm\infty$ and identify the x - and y -intercepts. Use this information to sketch the graph of each polynomial.

(a) $r(x) = x^2 - 2x - 3$

12. Solve the following polynomial inequalities.

(a) $(x^2 - 1)(x - 4)(x + 5) \leq 0$

13. Use polynomial long division to rewrite each of the following fractions in the form $q(x) + \frac{r(x)}{d(x)}$.

(a) $\frac{x^3 + 2x^2 - 4x - 8}{x - 3}$

14. Use synthetic division to determine if the given value for c is a zero of the corresponding polynomial. If not, determine $p(c)$.

(a) $p(x) = 12x^4 - 7x^3 - 32x^2 - 7x + 6, c = 1$

15. Construct a polynomial function with the stated properties.

(a) Third-degree, zeros of -2, 1, and 3, and y -intercept of -12.

(b) Second-degree, zeros of -4 and 3, and goes to $-\infty$ as $x \rightarrow -\infty$.

16. List all of the potential rational zeros of the following polynomials.

(a) $q(x) = x^3 - 10x^2 + 23x - 14$

17. Use Descartes's Rule of Signs to determine the possible numbers of positive and negative real zeros of the following polynomials.

(a) $f(x) = x^4 - 25$

18. Use the Intermediate Value Theorem to show that the following polynomial has a real zero between the indicated values.

(a) $f(x) = 5x^3 - 4x^2 - 31x - 6$; -3 and -1

19. Sketch the graph of each factored polynomial.

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

20. Use all available methods to solve each polynomial equation.

(a) $x^4 + 15 = 2x^3 + 8x^2 - 10x$

(b) $x^3 - 5 = 5x^2 - 9x$

21. Find equations for the vertical asymptotes, if any, for each of the following rational functions.

(a) $f(x) = \frac{x^2 + 5}{x^3 - 27}$

22. Find equations for the horizontal or oblique asymptotes, if any, for each of the following rational functions.

(a) $f(x) = \frac{5}{x - 1}$

(b) $g(x) = \frac{2x^2 - 5x + 6}{x - 3}$

(c) $k(x) = \frac{-3x + 5}{x - 2}$

23. Sketch the graphs of the following rational functions.

(a) $g(x) = \frac{5}{x - 1}$

24. Solve the following rational inequalities.

(a) $\frac{5}{x - 2} > \frac{3}{x + 2}$

25. Sketch the graphs of the following functions. State their domain and range.

(a) $f(x) = (0.5)^x$

(b) $g(x) = 10^x$

26. Solve the following exponential equations.

(a) $3^{2x-1} = 27$

(b) $3^{x^2+4x} = 81^{-1}$

(c) $10^x = 0.01$

27. Use the properties of logarithms to expand the following expressions as much as possible.

(a) $\log_9(9xy^{-3})$

(b) $\log_2\left(\frac{y^2 + z}{16x^4}\right)$

28. Use the properties of logarithms to condense the following expressions as much as possible.

(a) $2 \log a^2b - \log(1/b) + \log(1/a)$

(b) $3 \log_4(x^2) + \log_4(x^6)$

29. Evaluate the following logarithmic expressions.

(a) $\log_2 0.01$

(b) $\log_6 3^4$

30. Solve the following exponential and logarithmic equations.

(a) $10^{2x+5} = e$

(b) $81^x = 3^{2x+16}$

(c) $\log_4(x-3) + \log_4 2 = 3$

(d) $\log_2 x = 4$