

Learning Objectives and Review Problems

Higher Order Learning Objectives

1. Use the language of mathematics to communicate mathematical ideas, using symbols and notations correctly, and presenting solutions in a clear and organized way.
2. Apply problem-solving skills to the solution of real-world problems.
3. Use a variety of problem-solving strategies to set up, solve and check multipart problems.
4. Make connections between different mathematical concepts, such as geometric, analytic and numerical interpretations of functions.
5. Use technology to explore relationships of mathematical ideas and to decrease time on routine computations.

Chapter 3 Learning Objectives

- (3-A) Evaluate functions given by formulas, words, tables, and graphs.
- (3-B) Use and manipulate function notation such as $g(x + 1)$.
- (3-C) Find the domain of a function given by a formula, graph, or table.
- (3-D) Find the range of a function given by a formula, graph, or table.
- (3-E) Be able to evaluate a function from its graph.
- (3-F) Be able to determine whether a given graph is the graph of a function using the Vertical Line Test.
- (3-G) Be able to evaluate and graph a piecewise-defined function.
- (3-H) Compute the average rate of change of a function over a given interval. Interpret as a slope on a graph. Include units if necessary.
- (3-I) Find on a graph of a function: turning points, minima, maxima, interval(s) on which the function is increasing and decreasing.
- (3-J) Set up and simplify difference quotients of the form $\frac{f(x+h)-f(x)}{h}$.
- (3-K) Be able to graph translations and reflections of basic graphs.
- (3-L) Be able to graph combinations of reflections and translations for basic graphs by writing the rigid motion as a list of intermediate steps.

- (3-M) Given functions f and g , find functions $f + g$, $f - g$, fg , f/g , $f \circ g$ and $g \circ f$.
- (3-N) Express a given function as the composition of two other functions.
- (3-O) Be able to simplify expressions using the identities $f(g(x)) = x$ and $g(f(x)) = x$ when f and g are inverses.
- (3-P) If when f and g are inverses, be able to swap x -values and y -values in different settings: if $f(a) = b$ then $g(b) = a$, domain and range get swapped, if (a, b) is on the graph of f then (b, a) is on the graph of the inverse of f .
- (3-Q) Be able to verify that two functions f and g are inverses by computing and simplifying $f(g(x))$ and $g(f(x))$.
- (3-R) Be able to graph the inverse of f given the graph of f .
- (3-S) If f is given by a formula, be able to find a formula for the inverse of f by swapping x and y , then solving for y .
- (3-T) Given a table of values for f , make a table of values for the inverse of f
- (3-U) Know what it means for a function to be one-to-one, and that a function has an inverse if and only if it is one-to-one.
- (3-V) Be able to show a function f is one-to-one by showing that $f(a) = f(b)$ implies $a = b$; be able to show that f is not one-to-one by finding a, b so $a \neq b$ but $f(a) = f(b)$
- (3-W) Be able to use the Horizontal Line Test to determine whether a function is one-to-one.

Chapter 3 Review Problems.

1. Chapter 3 Review: 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 15, 18, 19, 20, 28, 35, 36, 37, 38, 39, 40, 41, 44, 45, 47, 50, 53-79, 81-94, 95-100, 102, 103, 106, 107-109.
2. Chapter 3 Test: 1-13, 16

Chapter 4 Learning Objectives

- (4-A) Given the values of a linear function $f(x) = ax + b$ at two points, find a and b .
- (4-B) Use linear functions to model real-life situations.
- (4-C) Be able to graph quadratic functions by completing the square.
- (4-D) Use quadratic functions to model real-life situations. Be able to find the maximum or minimum value by finding vertex.
- (4-E) Find a function of one variable for a given quantity using constraints to reduce the number of variables. (For example, the area of a rectangle with fixed perimeter)

(4-F) Maximize or minimize a quantity in a word problem.

(4-G) Graph polynomial functions. Be able to find

- x - and y -intercepts
- excluded regions
- large-scale behavior

Know basic properties of the graph of a polynomial of degree n

(4-H) Graph rational functions. Be able to find

- x - and y -intercepts
- excluded regions
- large-scale behavior
- horizontal and vertical asymptotes

Chapter 4 Review Problems.

1. Chapter 4 Review: 1, 5, 6, 7, 9, 11, 13, 14, 15, 19, 21, 25, 29, 31, 35, 39, 41, 43, 45, 47, 49, 53, 55, 57
2. Chapter 4 Test: 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14

Chapter 5 Learning Objectives

(5-A) Be able to graph $y = a^x$ ($a > 0$) and variations of it. Be able to find domain, range, intercepts and asymptotes.

(5-B) Be able to evaluate logarithmic expression such as $\log_b \sqrt{b}$, $\log_2(1/8)$, $e^{2\ln x}$, \dots

(5-C) Be able to graph $y = \log_a x$ ($a > 1$) and variations of it. Be able to find domain, range, intercepts and asymptotes.

(5-D) Be able to use log and exponent rules to rewrite expressions involving logarithms and exponents.

(5-E) Be able to solve equations involving logs and exponents, being sure to throw out extraneous solutions.

(5-F) Be able to solve inequalities involving logs and exponents.

(5-G) Use exponential functions to model real-world problems, especially

- population growth
- radioactive decay
- compound interest

Chapter 5 Review Problems.

1. Chapter 5 Review: 2-5, 7-20, 22, 25, 26, 33, 35-45, 47, 50, 51-66, 67, 69, 71, 78, 85-90, 91-96, 98, 99, 103, 104, 107
2. Chapter 5 Test: 1, 2, 4, 6, 8-20

Chapter 12 Learning Objectives

- (12-A) Simplify complex numbers to standard form $a + bi$.
- (12-B) For a complex number z , find the complex conjugate \bar{z} , the real part and the imaginary part.
- (12-C) Find the sum $z + w$, difference $z - w$ and product zw of two complex numbers z, w
- (12-D) Find and simplify the quotient z/w of two complex numbers using \bar{w} .
- (12-E) Find all roots (real and complex) of a quadratic equation.
- (12-F) Given polynomials $p(x)$ and $q(x)$, use long division to write polynomial $p(x)$ in the form $d(x) \cdot q(x) + R(x)$. As a particular case, given a factor $q(x)$ of $p(x)$, find $d(x)$ so that $p(x) = d(x) \cdot q(x)$.
- (12-G) Determine whether a given number is a root of an equation.
- (12-H) Specify the multiplicity of a root of an equation (in factored form)
- (12-I) Use the Factor Theorem to check if $x - r$ is a factor of a polynomial.
- (12-J) Use the Remainder Theorem to evaluate a function.
- (12-K) Apply the Factor Theorem to solve a polynomial equation $p(x) = 0$ by
1. finding one real root r somehow (guessing, looking at the graph, being told),
 2. dividing $p(x)$ by $x - r$ to get $p(x) = (x - r)d(x)$,
 3. factoring $d(x)$
- (12-L) Find a polynomial or polynomial equation satisfying given conditions involving roots and their multiplicities; degree; coefficients; factors.
- (12-M) Write polynomials as products of linear factors.

Chapter 12 Review Problems.

1. Chapter 12 Review (page 969, text): 1, 5, 9, 11, 17, 21, 39, 41, 43, 61, 67, 69, 71, 73, 75, 76, 77, 78, 81a
2. Chapter 12 Test (page 972, text): 1, 2, 4, 5, 6, 9, 10, 16, 17