MTH 112 Chapter 2 Practice Test Problems

Divide and express the result in standard form.
1) \( \frac{6}{5 - i} \)
2) \( \frac{5i}{2 - i} \)
3) \( \frac{7 - 6i}{6 + 5i} \)

The graph of a quadratic function is given. Determine the function's equation.
4) [Graph of a quadratic function]
5) [Graph of a quadratic function]
6) [Graph of a quadratic function]

Find the coordinates of the vertex for the parabola defined by the given quadratic function.
7) \( f(x) = (x - 2)^2 - 2 \)
8) \( f(x) = (x + 3)^2 + 4 \)
9) \( f(x) = (x + 8)^2 - 5 \)
10) \( f(x) = x^2 - 5 \)
11) \( f(x) = -x^2 + 2x + 5 \)

Find the axis of symmetry of the parabola defined by the given quadratic function.
12) \( f(x) = (x + 7)^2 - 3 \)
13) \( f(x) = 11(x - 3)^2 + 4 \)
14) \( f(x) = x^2 - 14x - 1 \)

Find the range of the quadratic function.
15) \( f(x) = (x + 1)^2 - 3 \)
16) \( f(x) = x^2 - 4x + 5 \)

Find the x-intercepts (if any) for the graph of the quadratic function.
17) \( f(x) = x^2 - 4 \)
18) \( y + 1 = (x - 1)^2 \)
19) \( f(x) = x^2 + 10x + 14 \)

Find the y-intercept for the graph of the quadratic function.
20) \( y + 1 = (x - 1)^2 \)
21) \( f(x) = 3x^2 - 5x - 8 \)

Find the domain and range of the quadratic function whose graph is described.
22) The vertex is \((-1, -4)\) and the graph opens up.
23) The vertex is \((1, -6)\) and the graph opens down.
24) The maximum is \(-6\) at \(x = 1\)
Use the vertex and intercepts to sketch the graph of the quadratic function.

25) \( y + 1 = (x + 2)^2 \)

26) \( f(x) = (x - 2)^2 - 4 \)

27) \( f(x) = x^2 + 6x + 5 \)

28) \( f(x) = x^2 - 6x + 8 \)

Determine whether the given quadratic function has a minimum value or maximum value. Then find the coordinates of the minimum or maximum point.

29) \( f(x) = x^2 + 2x - 7 \)

30) \( f(x) = -4x^2 + 12x \)

Use the Leading Coefficient Test to determine the end behavior of the polynomial function.

31) \( f(x) = -2x^4 - 5x^3 + 5x^2 + 5x + 5 \)

32) \( f(x) = x^3 - 3x^2 - 4x + 4 \)

33) \( f(x) = (x - 2)(x + 1)(x + 2)^2 \)

34) \( f(x) = -5(x^2 + 1)(x + 2)^2 \)

Find the zeros of the polynomial function.

35) \( f(x) = x^3 + x^2 - 20x \)

36) \( f(x) = x^3 + 8x^2 - x - 8 \)

37) \( f(x) = x^3 + 4x^2 + 4x \)

38) \( f(x) = x^3 + 2x^2 - 9x - 18 \)

39) \( f(x) = 2(x - 3)(x + 7)^4 \)

Find the zeros for the polynomial function and give the multiplicity for each zero. State whether the graph crosses the x-axis or touches the x-axis and turns around, at each zero.

40) \( f(x) = 4(x - 3)(x - 2)^2 \)
41) \( f(x) = -4 \left(x + \frac{5}{2}\right)(x - 5)^3 \)

42) \( f(x) = \frac{1}{3}x^2(x^2 - 3)(x + 1) \)

43) \( f(x) = x^3 + x^2 - 20x \)

Use the Intermediate Value Theorem to determine whether
the polynomial function has a real zero between the given
integers.

44) \( f(x) = 9x^3 - 6x^2 + 2x - 7; \) between 1 and 2

45) \( f(x) = 2x^4 - 5x^2 - 6; \) between 1 and 2

46) \( f(x) = 9x^3 - 10x - 8; \) between 1 and 2

Determine the maximum possible number of turning points
for the graph of the function.

47) \( f(x) = -x^2 - 8x - 33 \)

48) \( f(x) = x^2 + 8x^3 \)

49) \( f(x) = (7x - 2)^3(x^3 - 3)(x - 1) \)

Graph the polynomial function.

50) \( f(x) = x^4 - 4x^2 \)

51) \( f(x) = x^3 + 4x^2 - x - 4 \)

52) \( f(x) = x^3 - 2x^2 - 5x + 6 \)

53) \( f(x) = 7x - x^3 - x^5 \)
54) \( f(x) = 6x^3 - 4x - x^5 \)

Divide using long division.

55) \((-24x^2 + 38x - 15) ÷ (-4x + 3)\)

56) \(\frac{9r^3 - 74r^2 - 58r - 45}{r - 9}\)

57) \(\frac{2x^3 - 11x + 6}{x - 2}\)

58) \(\frac{x^4 + 81}{x - 3}\)

Divide using synthetic division.

59) \(\frac{4x^2 + 7x - 15}{x + 3}\)

60) \(\frac{-3x^3 - 3x^2 + 12x + 12}{x + 2}\)

61) \(\frac{x^4 - 3x^3 + x^2 + 6x - 7}{x - 1}\)

62) \((4x^5 + 7x^4 + -12x^3 + x^2 - x + 75) ÷ (x + 3)\)

Use the Remainder Theorem to find the indicated function value.

63) \( f(x) = x^4 - 7x^3 - 6x^2 - 7x + 3; f(-3)\)

64) \( f(x) = 7x^4 + 3x^3 + 6x^2 - 4x + 73; f(2)\)

65) \( f(x) = x^5 - 3x^4 + 3x^3 + 9; f(-4)\)

Use the Rational Zero Theorem to list all possible rational zeros for the given function.

66) \( f(x) = x^4 + 3x^3 - 5x^2 + 5x - 12\)

67) \( f(x) = -4x^4 + 3x^2 - 4x + 6\)

68) \( f(x) = 6x^4 + 2x^3 - 3x^2 + 6x - 5\)

Find a rational zero of the polynomial function and use it to find all the zeros of the function.

69) \( f(x) = x^3 + 2x^2 - 9x - 18\)

70) \( f(x) = x^3 + 6x^2 - x - 6\)

71) \( f(x) = x^4 + 5x^3 - 2x^2 - 18x - 12\)

Solve the polynomial equation. In order to obtain the first root, use synthetic division to test the possible rational roots.

72) \( x^3 + 2x^2 - 9x - 18 = 0\)

73) \( x^3 - 3x^2 - x + 3 = 0\)

74) \( 3x^3 - x^2 - 15x + 5 = 0\)

75) \( x^4 - 7x^3 + 7x^2 + 59x - 156 = 0\)

Find an nth degree polynomial function with real coefficients satisfying the given conditions.

76) \( n = 3; 3 \text{ and } i \text{ are zeros; } f(2) = 30\)

77) \( n = 3; 2 \text{ and } -2 + 3i \text{ are zeros; leading coefficient is } 1\)

78) \( n = 4; 2i, 5, \text{ and } -5 \text{ are zeros; leading coefficient is } 1\)

Find the domain of the rational function.

79) \( h(x) = \frac{7x}{x + 3}\)

80) \( f(x) = \frac{x + 4}{x^2 - 25}\)

81) \( f(x) = \frac{x + 2}{x^2 - 9x}\)
Use the graph of the rational function shown to complete the statement.

82) As \( x \to -3^- \), \( f(x) \to ? \)

83) As \( x \to +\infty \), \( f(x) \to ? \)

84) As \( x \to -3^+ \), \( f(x) \to ? \)

Find the vertical asymptotes, if any, of the graph of the rational function.

86) \( g(x) = \frac{x}{x + 2} \)

87) \( h(x) = \frac{x}{x(x + 3)} \)

88) \( g(x) = \frac{x}{x^2 - 4} \)

89) \( \frac{x - 25}{x^2 - 8x + 15} \)

Find the horizontal asymptote, if any, of the graph of the rational function.

90) \( f(x) = \frac{15x}{3x^2 + 1} \)

91) \( h(x) = \frac{25x^3}{5x^2 + 1} \)

92) \( h(x) = \frac{-4x + 7}{2x - 3} \)

93) \( f(x) = \frac{-4x}{2x^3 + x^2 + 1} \)
Use transformations of \( f(x) = \frac{1}{x} \) or \( f(x) = \frac{1}{x^2} \) to graph the rational function.

94) \( h(x) = \frac{1}{x - 5} \)

95) \( f(x) = \frac{1}{x} - 3 \)

Graph the rational function.

96) \( f(x) = \frac{2x}{x - 1} \)

97) \( f(x) = \frac{3x^2}{x^2 - 25} \)

98) \( f(x) = -\frac{4}{x^2 - 9} \)

99) \( f(x) = \frac{3x^2}{x^2 + 9} \)
100) $f(x) = \frac{x - 2}{x^2 - x - 20}$

Find the slant asymptote, if any, of the graph of the rational function.

101) $f(x) = \frac{x^2 + 9}{x}$

102) $f(x) = \frac{6x^2}{5x^2 + 3}$

103) $g(x) = \frac{x^3 + 6}{x^2 - 1}$

Solve the polynomial inequality and graph the solution set on a number line. Express the solution set in interval notation.

104) $x^2 - 5x + 4 > 0$

105) $x^2 - 2x - 24 \leq 0$

106) $x^2 + 3x \leq 4$

107) $2x^2 - 5x \geq 7$

108) $x < 42 - x^2$

Solve the rational inequality and graph the solution set on a real number line. Express the solution set in interval notation.

109) $\frac{x - 2}{x + 1} < 0$

110) $\frac{-x + 9}{x - 5} \geq 0$

111) $\frac{x}{x + 6} > 0$

112) $\frac{(x - 1)(3 - x)}{(x - 2)^2} \leq 0$

113) $\frac{2}{x - 7} < 1$

114) $\frac{12}{x - 5} > \frac{10}{x + 1}$

Write an equation that expresses the relationship. Use $k$ as the constant of variation.

115) $d$ varies directly as $m$.

Determine the constant of variation for the stated condition.

116) $s$ varies directly as $r$, and $s = 40$ when $r = 5$.

117) $g$ varies directly as $f^2$, and $g = 180$ when $f = 6$. 
If \( y \) varies directly as \( x \), find the direct variation equation for the situation.

118) \( y = 10 \) when \( x = 6 \)

119) \( y = 0.4 \) when \( x = 0.2 \)

Solve the problem.

120) \( y \) varies directly as \( z \) and \( y = 187 \) when \( z = 11 \).
Find \( y \) when \( z = 16 \).

121) If \( y \) varies directly as the square of \( x \), and \( y = 40 \) when \( x = 8 \), find \( y \) when \( x = 20 \).

122) If the resistance in an electrical circuit is held constant, the amount of current flowing through the circuit is directly proportional to the amount of voltage applied to the circuit. When 3 volts are applied to a circuit, 75 milliamperes of current flow through the circuit. Find the new current if the voltage is increased to 11 volts.

123) The distance that an object falls when it is dropped is directly proportional to the square of the amount of time since it was dropped. An object falls 288 feet in 3 seconds. Find the distance the object falls in 5 seconds.

Write an equation that expresses the relationship. Use \( k \) as the constant of variation.

124) \( r \) varies inversely as \( b \).

If \( y \) varies inversely as \( x \), find the inverse variation equation for the situation.

125) \( y = 5 \) when \( x = 9 \)

126) \( y = 0.5 \) when \( x = 0.4 \)

Solve the problem.

127) \( x \) varies inversely as \( y^2 \), and \( x = 4 \) when \( y = 12 \).
Find \( x \) when \( y = 4 \).

Solve.

128) The amount of time it takes a swimmer to swim a race is inversely proportional to the average speed of the swimmer. A swimmer finishes a race in 50 seconds with an average speed of 3 feet per second. Find the average speed of the swimmer if it takes 30 seconds to finish the race.

129) If the voltage, \( V \), in an electric circuit is held constant, the current, \( I \), is inversely proportional to the resistance, \( R \). If the current is 90 milliamperes when the resistance is 4 ohms, find the current when the resistance is 12 ohms.

Write an equation that expresses the relationship. Use \( k \) as the constant of variation.

130) The intensity \( I \) of light varies inversely as the square of the distance \( D \) from the source. If the intensity of illumination on a screen 56 ft from a light is 3.4 footcandles, find the intensity on a screen 80 ft from the light.

Write an equation that expresses the relationship. Use \( k \) for the constant of proportionality.

131) \( p \) varies directly as \( q \) and inversely as \( r \).

132) \( x \) varies directly as the square of \( y \) and inversely as the cube of \( z \).

133) \( q \) varies jointly as \( r \) and \( s \) and inversely as the square root of \( a \).

Determine the constant of variation for the stated condition.

134) \( t \) varies directly as \( r \) and inversely as \( s \), and \( t = 2 \) when \( r = 30 \) and \( s = 75 \).

Find the variation equation for the variation statement.

135) \( c \) varies directly as \( a \) and inversely as \( b \); \( c = 4 \) when \( a = 48 \) and \( b = 48 \).

Solve the problem.

136) \( y \) varies jointly as \( a \) and \( b \) and inversely as the square root of \( c \). \( y = 8 \) when \( a = 4 \), \( b = 2 \), and \( c = 9 \).
Find \( y \) when \( a = 2 \), \( b = 6 \), and \( c = 25 \).

137) The time in hours it takes a satellite to complete an orbit around the earth varies directly as the radius of the orbit (from the center of the earth) and inversely as the orbital velocity. If a satellite completes an orbit 740 miles above the earth in 9 hours at a velocity of 28,000 mph, how long would it take a satellite to complete an orbit if it is at 1600 miles above the earth at a velocity of 34,000 mph? (Use 3960 miles as the radius of the earth.) Round to the nearest hundredth if necessary.
138) Body-mass index, or BMI, takes both weight and height into account when assessing whether an individual is underweight or overweight. BMI varies directly as one’s weight, in pounds, and inversely as the square of one’s height, in inches. In adults, normal values for the BMI are between 20 and 25. A person who weighs 182 pounds and is 71 inches tall has a BMI of 25.38. What is the BMI, to the nearest tenth, for a person who weighs 120 pounds and who is 65 inches tall?

Write an equation that expresses the relationship. Use k as the constant of variation.

139) f varies jointly as g and the square of z.

140) p varies jointly as q and the cube of r.

141) r varies jointly as b and the sum of p and h.

Find the variation equation for the variation statement.

142) z varies jointly as y and the cube of x; \( z = 2240 \) when \( x = 4 \) and \( y = -7 \)

Determine the constant of variation for the stated condition.

143) t varies jointly as r and s, and \( t = 896 \) when \( r = 32 \) and \( s = 7 \).

Solve the problem.

144) h varies jointly as f and g. Find h when \( f = 15 \), \( g = 8 \), and \( k = 3 \).

145) f varies jointly as \( q^2 \) and \( h \), and \( f = 64 \) when \( q = 4 \) and \( h = 2 \). Find f when \( q = 3 \) and \( h = 4 \).

146) The amount of paint needed to cover the walls of a room varies jointly as the perimeter of the room and the height of the wall. If a room with a perimeter of 70 feet and 8-foot walls requires 5.6 quarts of paint, find the amount of paint needed to cover the walls of a room with a perimeter of 45 feet and 6-foot walls.

147) While traveling in a car, the centrifugal force a passenger experiences as the car drives in a circle varies jointly as the mass of the passenger and the square of the speed of the car. If a passenger experiences a force of 36 newtons when the car is moving at a speed of 20 kilometers per hour and the passenger has a mass of 100 kilograms, find the force a passenger experiences when the car is moving at 20 kilometers per hour and the passenger has a mass of 40 kilograms.
1) \( \frac{15}{13} + \frac{3}{13} \)
2) \(-1 + 2i\)
3) \(\frac{12}{61} - \frac{71}{61}i\)
4) \(f(x) = (x + 2)^2 + 2\)
5) \(h(x) = (x - 3)^2 + 3\)
6) \(j(x) = -x^2 + 3\)
7) \((2, -2)\)
8) \((-3, 4)\)
9) \((-8, -5)\)
10) \((0, -5)\)
11) \((1, 6)\)
12) \(x = -7\)
13) \(x = 3\)
14) \(x = 7\)
15) \([-3, \infty)\)
16) \([1, \infty)\)
17) \((-2, 0)\) and \((2, 0)\)
18) \((0, 0)\) and \((2, 0)\)
19) \((-5 \pm \sqrt{11}, 0)\)
20) \((0, 0)\)
21) \((0, -8)\)
22) Domain: \((-\infty, \infty)\)
   Range: \([-4, \infty)\)
23) Domain: \((-\infty, \infty)\)
   Range: \((-\infty, -6)\)
24) Domain: \((-\infty, \infty)\)
   Range: \((-\infty, -6)\)
25) 
26) 
27) 
28) 
29) minimum; \([-1, -8]\)
30) maximum; \(\left\{\frac{3}{2}, 9\right\}\)
31) falls to the left and falls to the right
32) falls to the left and rises to the right
33) rises to the left and rises to the right
34) falls to the left and falls to the right
35) \(x = 0, x = -5, x = 4\)
36) \(x = -1, x = 1, x = -8\)
37) \(x = 0, x = -2\)
38) \(x = -2, x = -3, x = 3\)
39) \(x = 3, x = -7\)
40) 3, multiplicity 1, crosses x-axis; 2, multiplicity 2, touches x-axis and turns around
41) \(-\frac{5}{2}\), multiplicity 1, crosses x-axis
5) multiplicity 3, crosses x-axis
42) 0, multiplicity 2, touches x-axis and turns around;
-1, multiplicity 1, crosses x-axis;
\(\sqrt{3}\), multiplicity 1, crosses x-axis;
\(-\sqrt{3}\), multiplicity 1, crosses x-axis
43) 0, multiplicity 1, crosses the x-axis
-5, multiplicity 1, crosses the x-axis
4, multiplicity 1, crosses the x-axis
44) \(f(1) = -2\) and \(f(2) = 45\); yes
45) \(f(1) = -9\) and \(f(2) = 6\); yes
46) \(f(1) = -9\) and \(f(2) = 44\); yes
47) 1
48) 2
49) 6
50) 
51)
Answer Key
Testname: MTH 112 BTZ PRACTICE PROBLEMS (CH. 2)

52)

65) –1975
66) ± 1, ± 2, ± 3, ± 4, ± 6, ± 12
67) ± 1/4, ± 1/2, ± 3/4, ± 3/2 ± 1, ± 2, ± 3, ±

68) ± 1, ± 5, ± 1/2, ± 5/2, ± 1/3, ± 5/3, ± 1/6, ±

69) [-3, -2, 3]
70) [1, -1, -6]
71) [-1, 2, -3 + √3, -3 - √3]
72) [-3, -2, 3]
73) [1, -1, 3]
74) (1/3, √5, -√5]
75) [-3, 4, 3 + 2i, 3 - 2i]
76) f(x) = -6x^3 + 18x^2 - 6x + 18
77) f(x) = x^3 + 2x^2 + 5x - 26
78) f(x) = x^4 - 21x^2 - 100
79) {x|x ≠ 3}
80) {x|x ≠ -5, x ≠ 5}
81) {x|x ≠ 0, x ≠ 9}
82) -∞
83) 0
84) -∞
85) -∞
86) x = -2
87) x = -3
88) x = 2, x = -2
89) x = 5, x = 3
90) y = 0
91) no horizontal asymptote
92) y = -2
93) y = 0
94)

95)

53)

96)

54)

97)

55) 6x - 5
56) 9x^2 + 7x + 5
57) 2x^2 + 4x - 3
58) x^3 + 3x^2 + 9x + 27 + 162/x - 3
59) 4x - 5
60) -3x^2 + 3x + 6
61) x^3 - 2x^2 - x + 5 - 2/x - 1
62) 4x^4 - 5x^3 + 3x^2 - 8x + 23 + 6/x + 3
63) 240
64) 225

98)
99) $y = x$

100) $y = x$

101) $y = x$

102) no slant asymptote

103) $y = x$

104) $(-\infty, 1) \cup (4, \infty)$

105) $[-4, 6]$

106) $[-4, 1]$

107) $(-\infty, -1] \cup \left[\frac{7}{2}, \infty\right)$

108) $(-7, 6)$

109) $(-1, 2)$

110) $(5, 9]$

111) $(-\infty, -6) \text{ or } (0, \infty)$

112) $(-\infty, 1] \cup [3, \infty)$

113) $(-\infty, 7) \text{ or } (9, \infty)$

114) $(-31, -1) \text{ or } (5, \infty)$

115) $d = \text{km}$

116) $k = 8$

117) $k = 5$

118) $y = \frac{5}{3}x$

119) $y = 2x$

120) 272

121) 250

122) 275 milliamperes

123) 800 feet

124) $r = \frac{k}{b}$

125) $y = \frac{45}{x}$

126) $y = \frac{0.2}{x}$

127) $x = 36$

128) 5 feet per second

129) 30 milliamperes

130) 1.666 footcandles

131) $p = \frac{kq}{r}$

132) $x = \frac{ky^2}{z^3}$

133) $q = \frac{krs}{\sqrt{a}}$

134) $k = 5$

135) $c = \frac{4a}{b}$

136) 7.2

137) 8.77 hours

138) 20

139) $f = kgz^2$

140) $p = kqr^3$

141) $r = kb(p + h)$

142) $y = -5x^3y$

143) $k = 4$

144) $h = 360$

145) $f = 72$

146) 2.7 quarts

147) 14.4 newtons