Honors Pre-Calculus Name: ____

Chapter 3 Review Packet

The problems are numbered (*Chapter number*).(*Section number*).(*Problem number*). Refer to your text for help or to seek similar problems for extra practice. Only use a calculator when you see the calculator symbol □.

3.1.1. Give the definition of a complex number.

3.1.2. The number i is an abbreviation for _____________, and i^2 equals _____________.

Write each expression using the imaginary unit, i.

3.1.3. $\sqrt{-49}$

3.1.4. $\sqrt{-11}$

Write each of the complex numbers in standard form, $a + bi$.

3.1.5. $\left(\sqrt{81} + \sqrt{-9}\right) + \left(\sqrt{-36} + \sqrt{25}\right)$

3.1.6. $\left(\sqrt{64} + \sqrt{-16}\right) - \left(\sqrt{9} - \sqrt{-4}\right)$

Simplify. Leave your answer in standard form, $a + bi$.

3.1.7. $7\sqrt{-25}$

3.1.8. $-4i \cdot 5i$

3.1.9. $(6i)^2$

3.1.10. $(-3i)^2$

3.1.13. $(8 - 6i) + (7 + 5i)$

3.1.14. $(5 - 3i) - (7 - 7i)$

3.1.15. $-5i(3 + 7i)$

3.1.16. $(3 - 4i)(2 + 6i)$

3.1.17. $-\frac{24}{6i}$

3.1.18. $\frac{13}{5i}$

3.1.19. $\frac{20}{2-i}$

3.1.20. $\frac{6+17i}{3+2i}$

Standard form: $y = a(x - h)^2 + k$ General form: $y = ax^2 + bx + c$ $x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$

a. Fill in the blank to complete the perfect square trinomial.

b. Then write the trinomial as the square of a binomial.

3.2.1. $x^2 + 12x +$ ____

3.2.2. $x^2 - 6x +$ ____

Solve the equations by completing the square. Round to three decimal places.

□3.2.3. $3x^2 + 24x - 51 = 0$

□3.2.4. $2x^2 - 32x + 178 = 0$

Use the quadratic formula to solve the equation. Do not use a calculator.

3.2.5. $3x^2 - 5x + 2 = 0$

3.2.6. $2x^2 + 3x - 2 = 0$

Use the quadratic formula to solve the equation. Use a calculator to evaluate your answers rounded to three decimal places.

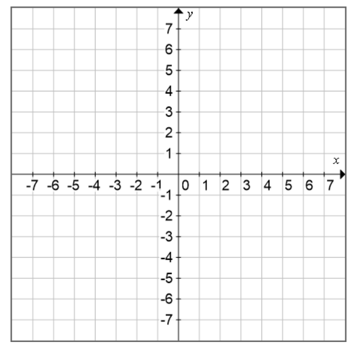
□3.2.7. $x^2 - 6x + 130 = 0$ □3.2.8. $3x^2 - 2x - 80 = 0$

3.2.9. Give instructions on how to find the x-intercept(s) of an equation.

3.2.10. Give instructions on how to find the y-intercept(s) of an equation.

3.2.11. Write the quadratic function $y = \frac{2}{3}(x - 6)^2 + 5$ in general form.

3.2.12. Find the coordinates of the vertex and intercepts. Write your points as ordered pairs. Use them to graph the parabola.
$f(x) = -x^2 - 6x - 5$

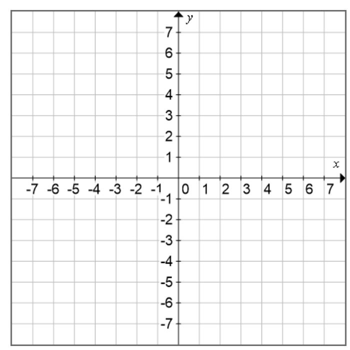


Vertex:

y-intercept:

x-intercept(s):

3.2.13. Find the coordinates of the vertex and intercepts. Write your points as ordered pairs. Use them to graph the parabola.
$g(x) = 2x^2 - 8x + 6$

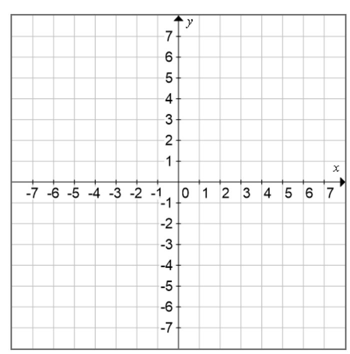


Vertex:

y-intercept:

x-intercept(s):

3.2.14. Find the coordinates of the vertex and intercepts. Write your points as ordered pairs. Use them to graph the parabola.
$f(x) = \frac{1}{2}x^2 - 2x - 6$



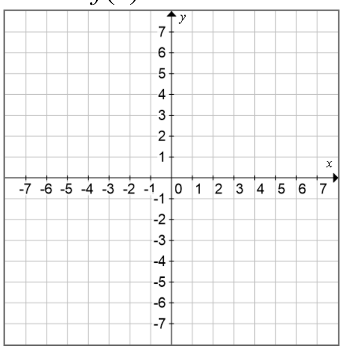
Vertex:

y-intercept:

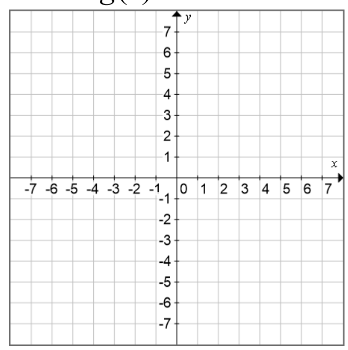
x-intercept(s):

Write the quadratic function in standard form, and give the coordinates of its vertex. Then use transformations to graph the function.

3.2.15. $f(x) = -2x^2 + 20x - 46$

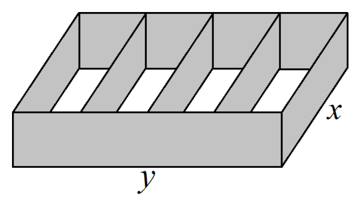


3.2.16. $g(x) = 3x^2 + 18x + 22$



□3.2.17. A college football team has an average attendance of 18,800 people with an average ticket price of \$31. Their market research indicates that for every \$1 the ticket price is increased, attendance will drop by 500 people. (a) Express the team's game revenue R as a function of the ticket price x. (b) What should they set their ticket price at to maximize revenue? (c) What will their attendance be at that price? (d) At that price, what will the team's revenue be for each game?

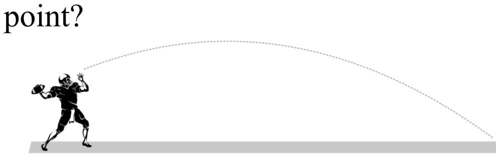
□3.2.18. 720 feet of fencing are used to build a rectangular enclosure with subdivisions, as pictured. (a) Express the total area of the enclosure A as a function of x. (b) Find the dimensions of the enclosure which will maximize the total area. (c) Find the total area of the enclosure. (d) Find the area of one of the smaller subdivisions.



□3.2.19. The path of a thrown football can be modeled by the function $f(x) = -0.1x^2 + 1.2x + 6.4$, where $f(x)$ is the height of the football (in feet) and x is the football's horizontal distance (in feet) from the quarterback. (a) How high is the football when it is released? (b) What is the maximum height of the football? (c) How far does the ball travel before landing?

□3.2.20. A manufacturer of office chairs has daily production costs of $C = 5{,}800 - 27x + 0.03x^2$, where C is the total cost (in dollars) and x is the number of chairs produced. How many chairs should the manufacturer produce so the daily costs are a minimum?

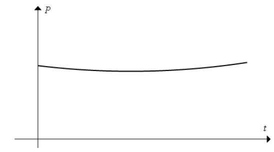
□3.2.21. A football is thrown through the air, and it follows the path of a parabola. Its height is y (in meters), its horizontal distance traveled is x (in meters), and they are related by the equation $y = -0.02x^2 + 0.86x + 2.1$. How high is the football at its highest point?



□3.2.22. From 1990 to 2010, the population of a city, P (in thousands), was a function of t, where t stands for the number of years after 1990. $P = 0.07t^2 - 1.68t + 22$

a. In what year was the population of the city smallest?

b. What was the population that year?



□3.2.23. Use your calculator's tools to find the coordinates of the x-intercepts of the function $y = x^3 + 2.1x^2 - 47.4x + 59.5$.

□. 3.2.24. Use your calculator's tools to find the coordinates of the points where $y = 0.4x + 5.3$ and $y = 0.5x^2 - 18x + 165$ intersect.

Determine the end behavior of the function.

3.3.1. $f(x) = -x^3 + 3x^2 + 4x - 2$

3.3.2. $f(x) = (x^2 + 1)(-5x^2 + 2)$

3.3.3. $f(x) = (6 - x)^5$

Identify the coordinates of the x-intercept(s) and y-intercept of the function.

3.3.4. $f(x) = x^4 - 81$

3.3.5. $g(x) = 2x(3x - 2)(5x + 1)$

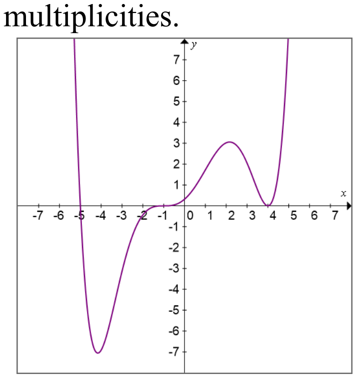
3.4.1. If $(x + 6)$ is a factor of a polynomial, then __________ is a zero of the polynomial. If -8 is a zero of a polynomial, then __________ is a factor of that polynomial.

Find the zeros of the polynomial function and state their multiplicities.

3.4.2. $f(x) = -3x^4(x^2 - 9)(x + 3)(x^2 + 9)$

3.4.3. $g(x) = 20x^5 - 60x^4 + 45x^3$

3.4.4. Use the graph of the polynomial function to identify its zeros and their multiplicities.



Find the x-intercepts of the function. List its zeros and their multiplicities.

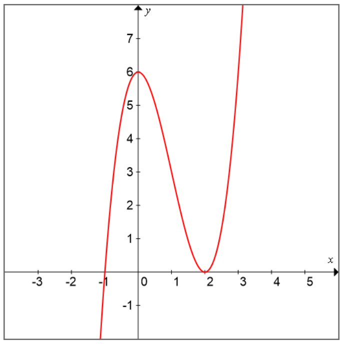
3.4.5. $f(x) = x^3 - 2x^2 - 16x + 32$

3.4.6. $g(x) = x^5 - x^3$

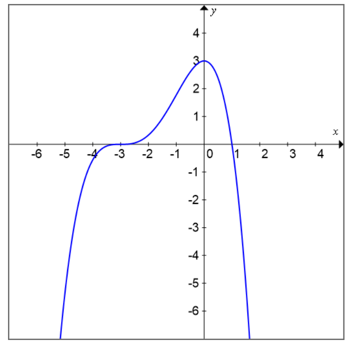
3.4.7. Write the equation of the polynomial function of degree 5 that passes through $(0, -15)$ with roots of multiplicity of 2 at $x = 3$ and $x = -1$ and a root with a multiplicity of 1 and $x = 2$. Leave your answer in factored form.

Use the graph to write the equation of the polynomial function of least degree. Leave your answer in factored form.

3.4.8.



3.4.9.



Divide. Leave your answer as a mixed number.

3.5.1. $3\overline{)2861}$

3.5.2. $8\overline{)6274}$

Divide the polynomials using long division. Write your answer in mixed-number form.

3.5.3. $(4x^3 - 7x + 8) \div (2x - 1)$

3.5.4. $(x^3 + 5x^2 + 6x - 3) \div (x^2 + 3x - 1)$

3.5.5. When can synthetic division be used to divide two polynomials?

Divide the polynomials using synthetic division. Write your answer in mixed-number form.

3.5.6. $(x^3 - 2x + 12) \div (x + 3)$

3.5.7. $(5x^5 - 17x^3 - 14x + 4) \div (x - 2)$

3.5.8. $(6x^3 - 5x^2 + 9x - 4) \div (x - \frac{1}{2})$

Find the function's x-intercept(s), y-intercept, vertical asymptotes, horizontal asymptotes, and slant asymptotes. Use the information to graph the function. Do not use a calculator.

3.7.1. $f(x) = \frac{2x+9}{x+4}$

3.7.2. $h(x) = \frac{x^2+2x-15}{3x-12}$

3.7.3. $f(x) = \frac{x^2}{x^2-9}$

3.7.4. $g(x) = \frac{x^2+x-6}{-2x+6}$

3.7.5. $f(x) = \frac{x-2}{x^2+x-12}$

3.7.6. $g(x) = \frac{-x^3+9x}{x^2-4}$

Answer Key

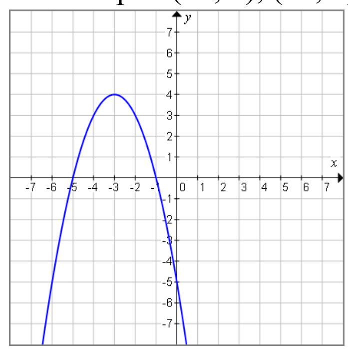
3.1.1. A complex number is a number that can be written in the form $a + bi$, where a and b are real numbers.

3.1.2. The number i is an abbreviation for $\sqrt{-1}$, and i^2 equals -1.

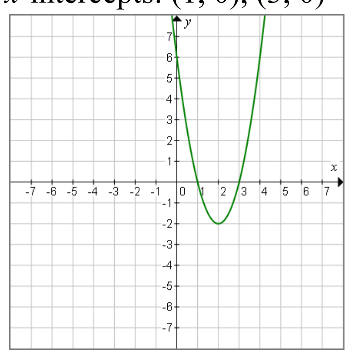
3.1.3. $7i$
3.1.4. $i\sqrt{11}$
3.1.5. $14 + 9i$
3.1.6. $5 + 6i$
3.1.7. $35i$
3.1.8. 20
3.1.9. -36
3.1.10. -9
3.1.13. $15 - i$
3.1.14. $-2 + 4i$
3.1.15. $35 - 15i$
3.1.16. $30 + 10i$
3.1.17. $4i$
3.1.18. $-\frac{13}{5}i$
3.1.19. $8 + 4i$
3.1.20. $4 + 3i$

3.2.1a. 36
3.2.1b. $(x + 6)^2$
3.2.2a. 9
3.2.2b. $(x - 3)^2$
3.2.3. -9.745 and 1.745
3.2.4. $8 \pm 5i$
3.2.5. $\frac{2}{3}$ and 1
3.2.6. -2 and $\frac{1}{2}$
3.2.7. $3 \pm 11i$
3.2.8. -4.841 and 5.508
3.2.9. Put 0 in for y, and solve for x.
3.2.10. Put 0 in for x, and solve for y.
3.2.11. $y = \frac{2}{3}x^2 - 8x + 29$

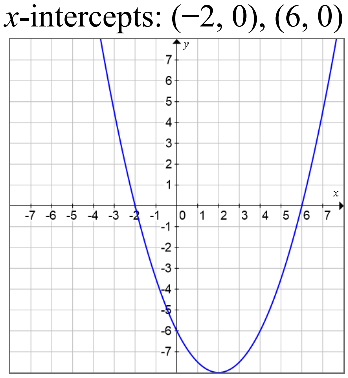
3.2.12. Vertex: $(-3, 4)$
y-intercept: $(0, -5)$
x-intercepts: $(-5, 0)$, $(-1, 0)$



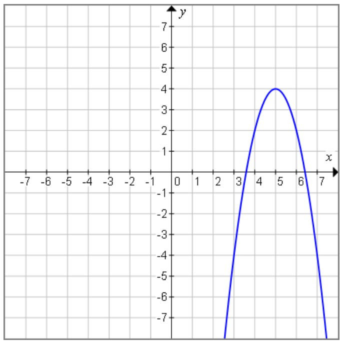
3.2.13. Vertex: $(2, -2)$
y-intercept: $(0, 6)$
x-intercepts: $(1, 0)$, $(3, 0)$



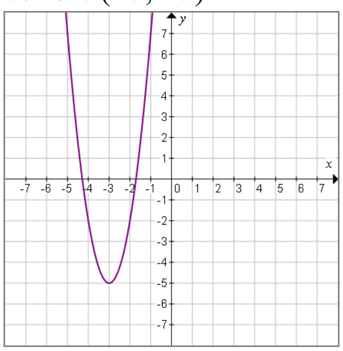
3.2.14. Vertex: $(2, -8)$
y-intercept: $(0, -6)$
x-intercepts: $(-2, 0)$, $(6, 0)$



3.2.15. $f(x) = -2(x-5)^2 + 4$
Vertex: (5, 4)



3.2.16. $g(x) = 3(x+3)^2 - 5$
Vertex: (−3, −5)



3.2.17a. $R(x) = -500x^2 + 34300x$
3.2.17b. \$34.30
3.2.17c. 17,150 people
3.2.17d. \$588.245
3.2.18a. $A(x) = -2.5x^2 + 360x$
3.2.18b. $x = 72$ feet, $y = 180$ feet
3.2.18c. 12,960 ft^2
3.2.18d. 3,240 ft^2
3.2.19a. 6.4 feet
3.2.19b. 10 feet
3.2.19c. 16 feet
3.2.20. 450 chairs
3.2.21. 11.345 meters
3.2.22a. 2002 ($t = 12$)
3.2.22b. 11,920 people
3.2.23. (−8.5, 0), (1.4, 0), (5, 0)
3.2.24. (14.023, 10.909), (22.777, 14.411)

3.3.1. As $x \to -\infty, f(x) \to \infty$
As $x \to \infty, f(x) \to -\infty$

3.3.2. As $x \to -\infty, f(x) \to -\infty$
As $x \to \infty, f(x) \to -\infty$

3.3.3. As $x \to -\infty, f(x) \to \infty$
As $x \to \infty, f(x) \to -\infty$

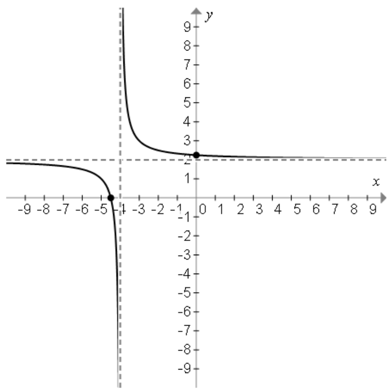
3.3.4. y-int: (0, −81)
x-int: (−3, 0), (3, 0)

3.3.5. y-int: (0, 0)
x-int: (0, 0), $\left(\frac{2}{3}, 0\right)$, $\left(-\frac{1}{5}, 0\right)$

3.4.1. −6, $(x + 8)$
3.4.2. 0 (mult. 4), –3 (mult. 2), 3 (mult. 1)
3.4.3. 0 (mult. 3), $\frac{3}{2}$ (mult. 2)
3.4.4. −5 (mult. 1), –1 (mult. 3), 4 (mult. 2)
3.4.5. −4, 2, and 4
3.4.6. −1, 0, and 1
3.4.7. $y = \frac{5}{6}(x-3)^2(x+1)^2(x-2)$
3.4.8. $y = \frac{3}{2}(x-2)^2(x+1)$
3.4.9. $y = -\frac{1}{9}(x+3)^3(x-1)$

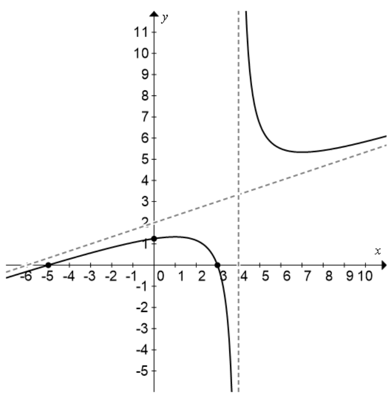
3.5.1. $953\frac{2}{3}$
3.5.2. $784\frac{1}{4}$
3.5.3. $2x^2 + x - 3 + \frac{5}{2x-1}$
3.5.4. $x + 2 + \frac{x-1}{x^2+3x-1}$
3.5.5. Synthetic division can be used whenever the divisor is in the form $x - c$.
3.5.6. $x^2 - 3x + 7 - \frac{9}{x+3}$
3.5.7. $5x^4 + 10x^3 + 3x^2 + 6x - 2$
3.5.8. $6x^2 - 2x + 8$

3.7.1. $\left(-\ 4\frac{1}{2}, 0\right)$, $\left(0, 2\frac{1}{4}\right)$, $x = -4$, and $y = 2$

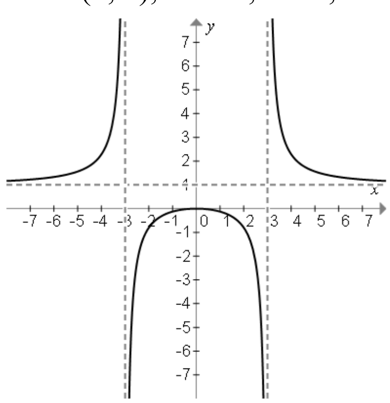


3.7.2. $(-5, 0)$, $(3, 0)$, $\left(0, 1\frac{1}{4}\right)$, $x = 4$, and

$y = \frac{1}{3}x + 2$

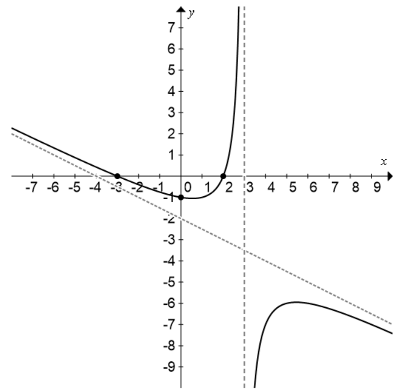


3.7.3. $(0, 0)$, $x = -3$, $x = 3$, and $y = 1$

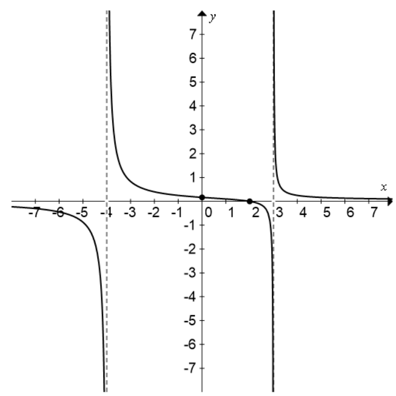


3.7.4. $(-3, 0)$, $(2, 0)$, $(0, -\ 1)$, $x = 3$, and

$y = -\ \frac{1}{2}x - 2$



3.7.5. $(2, 0)$, $\left(0, \frac{1}{6}\right)$, $x = -4$, $x = 3$, and $y = 0$



3.7.6. $(-3, 0)$, $(0, 0)$, $(3, 0)$, $x = -3$, $x = 3$, and

$y = -x$