Pre-Calculus Honors
Summer Assignment
June 2017

The intent of this assignment is to check your understanding of Algebra II before we begin a year of Pre-Calculus. By not having to review Algebra II, we have more time to "digest" the more "sophisticated" mathematics of Pre-Calculus.

Since this assignment is a review of some of the material studied last year, you are on your own for reviewing the material and doing the following assignments over the summer. It would be a good idea to work with other students that are also taking honors level pre-calculus. The problems listed below have been minimized to illustrate concepts that you should understand. ***You decide if you need to do more problems from each section to solidify understanding***. There will be several Pre-Calculus books (entitled *Advanced Mathematics*) left in the Reference Section of the Westport Library over the summer to use to practice extra problems. The packet must be completed and **evidence of your understanding must be shown on the packet** with answers placed in the spaces where provided. Complete work must be shown to justify your answer and graphs must be carefully drawn and labeled. ***** *If a calculator has been used, then you must set up what you entered into the calculator and what the calculator produced for you on your paper.* It is important to check your answers with those provided in this packet. If you are not getting them correct, you will not do well on your first test. Do not do the problems simply to "get them done". Complete the problems in a manner that makes you learn what you need to know. Show all work in a neat and organized manner.

The problem packet will be collected and thoroughly graded "college style" on the first day of school. You will also be able to download this summer assignment online from a link on the Staples High School website. We will spend a day answering questions and then take a test on the material. Good luck!

Mr. Papp
Mrs. Tarek
Mr. Wetzel

IN ALL CASES COMPLETE THE WRITTEN EXERCISES, NOT THE CLASS EXERCISES.

Section 1-1	objectives	Be able to find the intersection of two lines both analytically and graphically. Be able to develop and know the distance and midpoint formulas.
problems		*p. 5 written exercises 11, 21*
Section 1-2	objectives:	Be able to find the slope of a line Be able to differentiate between parallel, perpendicular and intersecting lines
problems		*p 11 written exercises 13, 17, 21*
Section 1-3	objectives:	Be able to find the equation of a line Be able to recognize and use the forms of a line
problems:		*p. 16 written exercises 15, 25, 27*

Section 1-4 objectives: Be able to model real world situations using linear models
Be able to use linreg on the calculator
Be able to define function, domain, range, and find the zeros of a function

problems: *p. 22 written exercises 11, 15, 23*

Section 1-5 objectives: Be able to manipulate complex numbers
Be able to find sum, differences, products, and quotients of complex numbers and recognize complex conjugates

problems: *p. 28 written exercises 13, 21, 31, 39*

Section 1-6 objectives: Be able to solve quadratic equations by:
1. factoring
2. completing the square
3. quadratic formula
4. graphing

Be able to find the discriminant and determine the nature of roots
Be able to recognize the possibilities of losing or gaining a root

problems *p. 35 written exercises 7, 15, 21, 25, 31, 35*

Section 1-7 objectives: Be able to graph quadratic functions
Be able to find the vertex and axis of symmetry
Be able to change $y = ax^2 + bx + c$ to $y = a(x-h)^2 + k$
Be able to solve systems involving quadratics both analytically and graphically

problems *p. 41 written exercises 27, 29, 35*

Section 1-8 objectives: Be able to model real world situations using quadratic functions
Be able to use quadreg on calculator

problems *p. 45 written exercises 7(using quadreg on your calc- not algebraically), 11, 17*

Section 2-1 objectives: To identify a polynomial function, to evaluate it using synthetic substitution, and to determine its zeros

problems *p. 56 written exercises 12, 17, 23*

Section 2-3 objectives: To graph a polynomial function and determine an equation for a polynomial graph.

problems *p. 66 written exercises 15*
p. 68 written exercises 31

Section 2-4 objectives: To write a polynomial function for a given situation and to find the maximum or minimum value of the function

problems *p. 71 written exercises 3, 9*
p. 73 written exercises 3, 5

Section 3-1 objectives: To solve and graph linear inequalities in one variable.

problems *p. 98 written exercises 9, 21, 27*

Section 3-2 objectives: To solve and graph polynomial inequalities in one variable.
problems p. 103 written exercises 13, 15

Section 5-1 objectives To define and apply integral exponents
problems *p.173 written exercises 11, 31, 37a, 41*

Section 5-2 objectives To define and apply rational exponents
problems *p. 178 written exercises 7, 23, 35*

Section 6.2 objectives To find equations of circles and graph them
problems *p. 222 written exercises 11, 13*

Section 6.3 objectives To find equations of ellipses and graph them
problems *p.228 written exercises 9*

Section 6.4 objectives To find equations of hyperbolas and graph them
problems *p. 235 written exercises 9*

Section 6.5 objectives To find equations of parabolas and graph them
problems *p. 240 written exercises 1, 19*

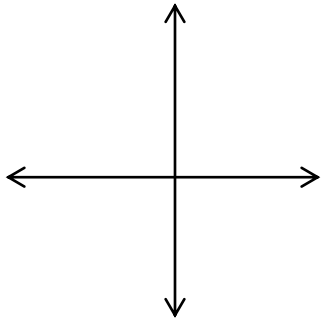
Pre-Calculus Honors Name:_____
Summer Assignment Period:_____ Date:_____
June 2017

SHOW EVIDENCE OF YOUR UNDERSTANDING ***for each problem*** *in this packet. This packet will be turned in on the first day of school and then graded. Every problem in this packet is to be completed* ***WITHOUT A CALCULATOR*** *unless indicated with this symbol:*

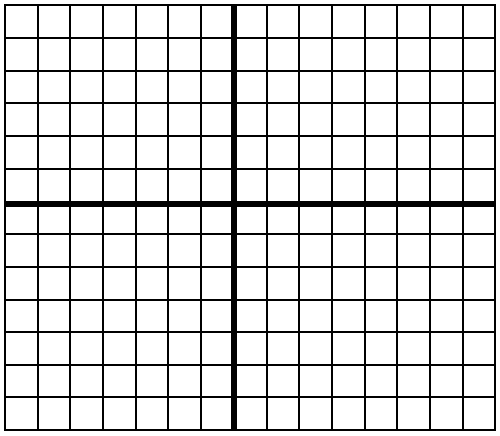
Section 1-1: Page 5 Written Exercises 11, 21

11. Graph the equation $3x-2y=6$. Label the origin and the *x*- and *y*-intercepts as *O*, *P* and *Q*, respectively. Find the area of ΔOPQ.

11._____



21. Plot $A(5,1)$, $B(7,-1)$, $C(1,-3)$, and $D(-1,-1)$. Use the midpoint formula to show that the diagonals of quadrilateral $ABCD$ have the same midpoint. What kind of quadrilateral is $ABCD$?_____



Section 1-2: Page 11 Written exercises 13, 17, 21

13. Find the slope and the *y*-intercept of the line $4x-2y=8$.

Slope:_____

y-int:_____

17. Tell which of the given equations have parallel line graphs and which have perpendicular line graphs. Show evidence and circle your answer.

a. $y=\frac{5}{2}x-8$ b. $-15x+6y-10=0$ c. $4x+10y=15$

21. Find the value of k if the line joining $(4, k)$ and $(6, 8)$ and the line joining $(-1, 4)$ and $(0, 8)$ are

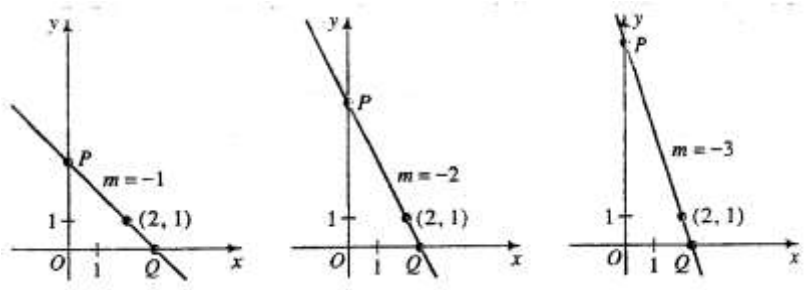
21a. parallel 21a._____

21b. perpendicular 21b._____

Section 1-3: Page 16 Written exercises 15, 25, 27

15. Write an equation of the perpendicular bisector of the segment joining $(0, 3)$ and $(-4, 5)$. 15._____

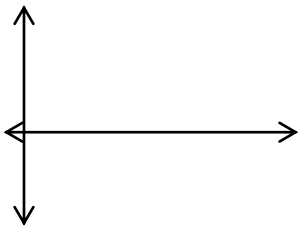
25. Each of the lines shown below passes through $(2, 1)$ and forms a triangle with the axes. Which of these three triangles has the least area? 25._____



27. The vertices of ΔABC are $A(8, 5)$, $B(0, 1)$, and $C(9, -2)$. Draw a picture to help you solve the following.

27a. Find the length and an equation of $\overline{BC}$. Length:_____

Equation:_____



27b. Find an equation of the altitude from *A to* $\overline{BC}$. 27b._____

27c. Find the point where the altitude from *A* intersects $\overline{BC}$. 27c._____

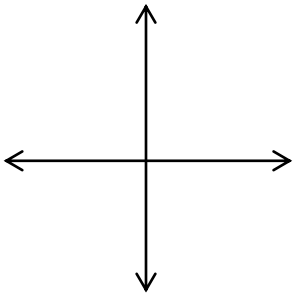
27d. Find the length of the altitude from *A* to $\overline{BC}$. 27d._____

27e. Find the area of ΔABC. 27e._____

Section 1-4: Page 22 Written exercises 11, 15, 23

11. Let *f* be a linear function such that $f(1) = 5$ and $f(3) = 9$.

11a. Sketch the graph of *f*.



11b. Find an equation for $f(x)$. 11b._____

 15. Maria Correia's new car costs $280 per month for car payments and insurance. She estimates that gas and maintenance cost $0.15 per mile.

15a. Express her total monthly cost as a function of the miles driven during the month. 15a._____

15b. What is the slope of the graph of the cost function? 15b._____

23. The last test that Mr. Clements gave was so hard that he decided to scale the grades upward. He decided to raise the lowest score of 47 to a 65 and the highest score of 78 to a 90. Find a linear function that would give a fair way to convert the other test scores. 23._____

Section 1-5: Page 28 Written exercises 13, 21, 31, 39

Simplify

13. $\left(5+i\sqrt{5}\right)\left(5-i\sqrt{5}\right)$ 13._____

Write each expression in the form of $a+bi$

21. $\dfrac{5+i}{5-i}$ 21._____

31. i^{-35} 22._____

39. Show that $\frac{\sqrt{2}}{2}(1+i)$ is a square root of *i*.

Section 1-6: Page 35 Written exercises 7, 15, 21, 25, 31, 35

Solve by completing the square. Give both real and imaginary roots if applicable. 7._____

7. $2z^2 - 16z - 1768 = 0$

Solve by using the quadratic formula. Give your answers in simplest radical form. Give both real and imaginary roots.

15. $\frac{4}{v} = \frac{v-6}{v-4}$ 15._____

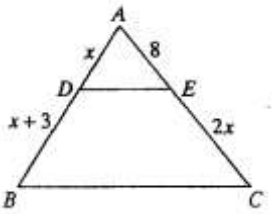
Solve by factoring. Be sure not to lose or gain roots.

21. $(4x+7)(x-1) = 2(x-1)$ 21._____

Solve by whichever method seems easiest. Be sure not to lose or gain roots.

25. $\frac{x+3}{x-3}+\frac{x-3}{x+3}=\frac{18-6x}{x^2-9}$ 25._____

31. $\overline{DE}$ is parallel to $\overline{BC}$. Find the value of *x*. 31._____



For examples #35a-e, provide an equation/inequality for each.

35a. What is the discriminant of the equation $4x^2+8x+k=0$? 35a._____

35b. For what value of *k* will the equation have a double root? 35b._____

35c. For what values of *k* will the equation have two real roots? 35c._____

35d. For what values of *k* will the equation have imaginary roots? 35d._____

35e. Name three values of *k* for which the given equation has rational roots. 35e._____

Section 1-7: Page 41 Written exercises 27, 29, 35

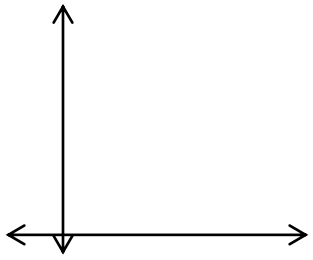
Find an equation of the quadratic function described.

27. Its graph is a parabola with x-intercepts 2 and – 1 and y-intercept 6. 27._____

29. Its graph is a parabola with vertex (4, 8) and passing through the origin. 29._____

35. A baseball player tries to hit a ball over an outfield fence that is 4 m high and 110 m from home plate. The ball is hit 1 m above home plate and reaches its highest point 30 m above a point on the ground that is 60 m from home plate.

35a. Make a sketch showing the path of the baseball. If home plate is at the origin of a coordinate system, find an equation of the parabolic path of the baseball. 35a._____



35b. Will the ball go over the outfield fence? Explain.

Section 1-8: Page 45 Written exercises 7 (use quadreg on your calc – do not do algebraically), 11, 17

7. Suppose your car contains just one gallon of gas. Driving at 20 mi/h you can go 26 mi. Likewise, you can go 34 mi driving at 40 mi/h and 32 mi driving at 50 mi/h.

7a. Find a quadratic function that models this data. 7a._____

7b. How far could you go if you drove at 65 mi/h? 7b._____

7c. The nearest gas station is 16 mi away. If the speed limit is 55 mi/h, at what maximum speed could you drive and still reach it? 7c._____

11. A stone is thrown with an upward velocity of 14 m/s from a cliff 30 m high.

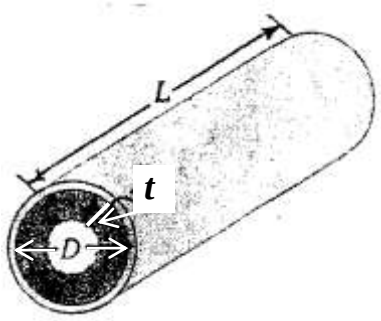
11a. Find its height above the ground *t* seconds later. 11a._____

11b. When will the stone reach its highest elevation? 11b._____

11c. When will the stone hit the ground? 11c._____

17. A water pipe of fixed length *L* has a carrying capacity that depends on the inner diameter of the pipe. The pipe initially has inner diameter *D*, but over many years, as mineral deposits accumulate inside the pipe, its carrying capacity is reduced.

17a. Give a quadratic function $f(t)$ that models the carrying capacity of the pipe as a function of the thickness *t* of mineral deposits. Your function will be in terms of the constants *D* and *L* and the variable *t*. (*Hint*: The volume of a cylinder is $\pi r^2 h$.) 17a._____



17b. Show that $f\left(\frac{1}{4}D\right) = \frac{1}{4}\text{g}f\left(0\right)$. Explain in your own words what your diagram says about the carrying capacity of the pipe.

Section 2-1: Page 56 Written exercises 12, 17, 23

12. Give the zeros of $w(x) = 2x^4 - x^3 - x^2$ 12._____

17. Find the values of the function $f(x) = x^3 - 9x$. (Remember: $i = \sqrt{-1}$). Provide each answer in simplest exact form and circle your answer.

17a. $f\left(-\frac{\sqrt{2}}{3}\right)$ 17b. $f\left(i\sqrt{3}\right)$

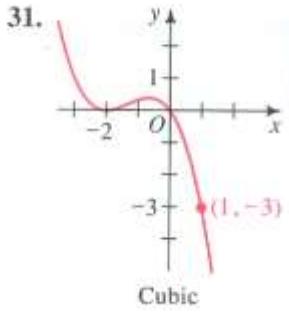
17c. $f\left(\frac{x}{3}\right)$ 17d. $f\left(x-3\right)$

23. If 4 is a zero of $f(x) = 3x^3 + kx - 2$, find the value of *k*. 23._____

Section 2-3: Page 66 Written Exercises 15, 31

15. Factor $f(x) = x^4 - x^2$ and sketch its graph. 15. _____

31. Give the equation for the graph shown below. 31. _____



Cubic

Section 2-4: Page 71 Written Exercises 3, 9

3. Suppose you have 102 m of fencing to make two side-by-side rectangular enclosures, as shown. What is the maximum area that you can enclose? 3._____

9. If a ball is thrown vertically upward at 30m/s, then its approximate height in meters t seconds later is given by $h(t) = 30t - 5t^2$.

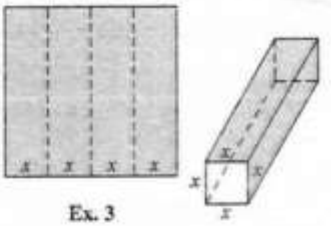
9a. After how many seconds does the ball hit the ground? 9a._____

9b. What is the domain of h? 9b._____

9c. How high does the ball go? 9c._____

Section 2-4: Page 73 Written Exercises 3, 5

3. In a rectangular piece of cardboard with perimeter 20 ft, three parallel and equally spaced creases are made, as shown. The cardboard is then folded to make a rectangular box with open square ends.



Ex. 3

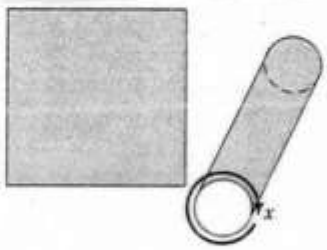
3a. Show that the volume of the box is $V(x) = x^2(10 - 4x)$.

3b. What is the domain of V? 3b._____

3c. Find the approximate value of x that maximizes the volume. 3c._____

Then give the approximate maximum volume. $V =$ _____

5. A rectangular piece of sheet metal with perimeter 50 cm is rolled into a cylinder with open ends, as shown.



5a. Express the volume of the cylinder as a function of x. 5a._____

Then give the domain of this function. D = _____

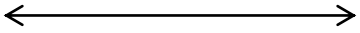
Section 3-1: Page 98 Written exercises 9, 21, 27

Solve the given equation or inequality and graph its solution on the number line. If there is no solution, say so.

9. $\frac{x+2}{4}-\frac{2-x}{3}+\frac{4x-5}{6}<4$ 9._____

21. $|2x-4|\le 5$ 21._____

27. Solve the given inequality $1\le|x-4|\le 3$ and graph its solution on the number line. 27._____



Section 3-2: Page 103 written exercises 13, 15

13. Solve the inequlity $x^4 - 3x^2 - 10 > 0$ 13. _____

15. Solve the inequality $a^3 + 2a^2 - 4a - 8 > 0$ 15. _____

Section 5-1: Page 173 Written exercises 11, 31, 37a, 41

Simplify each expression and circle your answer.

11a. $\left(a^{-1}-b^{-1}\right)^{-1}$

11b. $\left(a^{-1}gb^{-1}\right)^{-1}$

Simplify the expression.

31. $\dfrac{6a^{-2}+9a^{2}}{3a^{-2}}$

31._____

37a. Simplify by using powers of the same base.

37a._____

$$\frac{3^{5}g9^{4}}{27^{4}}$$

41. Simplify and circle your answers.(*Hint*: In exercise 41a, multiply the numerator and the denominator by 2^{3})

41a. $\dfrac{2^{-1}}{2^{-2}+2^{-3}}$

41b. $\dfrac{4^{-5}}{4^{-2}+4^{-3}}$

Section 5-2: Page 178 Written exercises 7, 23, 35

Simplify

7. $\left(16^{-3/5}\right)^{5/4}$ 7._____

23. Simplify: $\dfrac{2n^{1/3}-4n^{-2/3}}{2n^{-2/3}}$ 23._____

35. Solve.

35a. $(8x)^{-3}=64$ 35a._____

35b. $8x^{-3}=64$ 35b._____

35c. $(8+x)^{-3}=64$ 35c._____

Section 6-2: Page 222 Written exercises 11, 13

11. Write an equation of the circle described. 11._____

The circle is tangent to the *x*-axis at (4, 0) and has *y*-intercepts -2 and -8.

13. Write the equation in center-radius form. Give the center and radius. Center:_____

$$x^2 + y^2 - 2x - 8y + 16 = 0$$

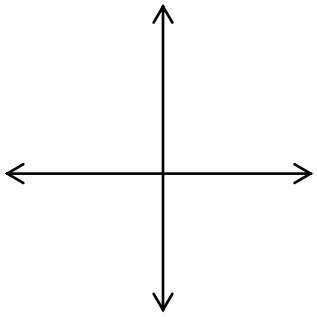
Radius:_____

Section 6-3: Page 228 Written exercises 9  se calc to check your graphs

9. Find the domain and range of the function. Then graph the function. Domain:_____

$$y = -\frac{1}{3}\sqrt{36 - x^2}$$

Range:_____



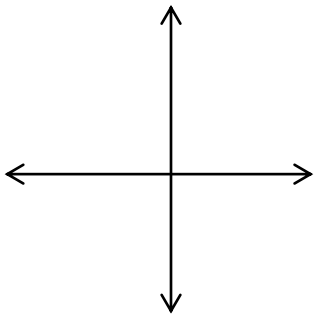
Section 6-4: Page 235 Written exercises 9 use calc to check your graphs

9. Give the domain and the range of the function. Then graph the function.

$y = \sqrt{x^2 - 4}$

Domain:_____

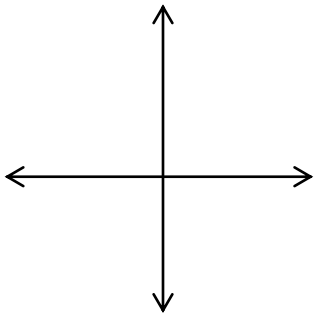
Range:_____



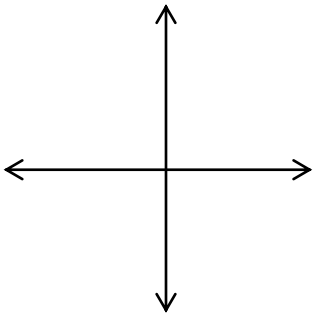
Section 6-5: Page 240 Written exercises 1, 19 use calc to check your graphs

Sketch each graph and label the vertex as well as two other points.

1a. $y = \frac{1}{8}x^2$

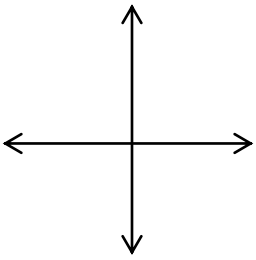


b. $x = \frac{1}{8}y^2$

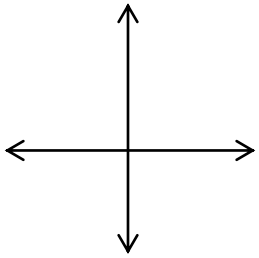


Sketch each graph and label two important points.

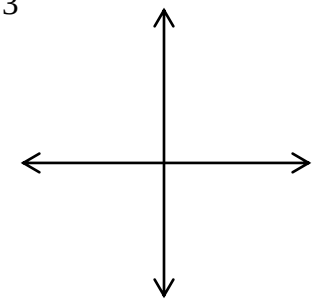
19a. $y = \sqrt{x}$



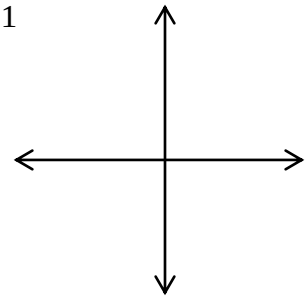
19b. $y = -\sqrt{x}$



19c. $y = -\sqrt{x-3}$



19d. $y = \sqrt{x+2} - 1$



Pre-Calculus Honors
Summer Assignment ANSWERS

Section 1-1: Page 5 Written Exercises 11, 21

11. Area of ΔOPQ = 3

21. Parallelogram

Section 1-2: Page 11 Written Exercises 13, 17, 21

13. $m = 2$; y-int. -4

17. $a \| b, a \perp c, b \perp c$

21. a. 0 b. $\frac{17}{2}$

Section 1-3: Page 16 Written Exercises 15, 25, 27

15. $2x - y = -8$

25. The first Δ

27. a. $3\sqrt{10}$; $x + 3y = 3$ b. $3x - y = 19$

c. $(6, -1)$ d. $2\sqrt{10}$ e. 30

Section 1-4: Page 22 Written Exercises 11, 15, 23

11. b. $f(x) = 2x + 3$

15. a. $C(m) = 0.15m + 280$ b. 0.15

23. $f(x) = \frac{25}{31}x + \frac{840}{31}$

Section 1-5: Page 28 Written Exercises 13, 21, 31, 39

13. 30

21. $\frac{12}{13} + \frac{5}{13}i$

31. i

39. $\left[\frac{\sqrt{2}}{2}(1+i)\right]^2 = \frac{1}{2}(2i) = i$

Section 1-6: Page 35 Written Exercises 7, 15, 21, 25, 31, 35

7. 34, – 26

15. 2, 8

21. 1, $-\frac{5}{4}$

25. 0

31. 6

35. a. $64 - 16k$ b. $k = 4$ c. $k < 4$ d. $k > 4$

e. For example, $k = 0$, $k = -12$, $k = -5$

Section 1-7: Page 41 Written Exercises 27, 29, 35

27. $f(x) = -3x^2 + 3x + 6$

29. $f(x) = -\frac{1}{2}x^2 + 4x$

35. a. $y = -\frac{29}{3600}(x - 60)^2 + 30$ b. Yes

Section 1-8: Page 45 Written Exercises 7, 11, 17

7. a. $D(s) = -0.02s^2 + 1.6s + 2$ b. 21.5 mi c. 55mi/h

11. a. $h(t) = -4.9t^2 + 14t + 30$ b. $\frac{10}{7}s$ later c. $\frac{30}{7}s$ later

17. a. $f(t) = \pi L\left(\frac{D}{2} - t\right)^2$

b. $f\left(\frac{1}{4}D\right) = \frac{1}{4}\text{g}f(0) = \frac{1}{16}\pi LD^2$

Section 2-1: Page 56 Written Exercises 12, 17, 23

12. -.5, 0, 1

17. a. $\frac{79\sqrt{2}}{27}$ b. $-12i\sqrt{3}$ c. $\frac{x^3}{27} - 3x$

d. $x^3 - 9x^2 + 18x$ 23. -47.5

Section 2-3: Page 66 Written exercises 15, 31

15. check with calculator

31. y = $-\frac{1}{3}$x(x + 2)^2

Section 2-4: Page 71 Written Exercises 3, 9
Page 73 Written Exercises 3, 5

3. $433.5m^2$

9. a. 6*s* b. $Dom.: 0 \le t \le 6$ c. 45 m

3. b. $Dom.: 0 < x < 2.5$

c. $x \approx 1.67$ ft; max. vol. $\approx 9.26\,ft^3$

5. a. $V(x) = \frac{x^2(25 - x)}{4\pi}$; $Dom.: 0 < x < 25$ b. $x \approx 16.67$ cm; max.vol. $\approx 184.21cm^3$

Section 3-1: Page 98 Written Exercises 9, 21, 27

9. $x < 4$

21. $-\frac{1}{2} \le x \le \frac{9}{2}$

27. $1 \le x \le 3$ or $5 \le x \le 7$

Section 3-2: Page 103 Written exwercises 13,15

13. x < -$\sqrt{5}$ or x > $\sqrt{5}$

15. a > 2

Section 5-1:Page 173 Written Exercises 11, 31, 37a, 41

11. a. $\frac{ab}{b - a}$ b. *ab*

31. $2 + 3a^4$

37a. 3

41. a. $\frac{4}{3}$ b. $\frac{1}{80}$

Section 5-2: Page 178 Written Exercises 7, 23, 35

7. $\frac{1}{8}$ 23. $n-2$ 35. a. $\frac{1}{32}$ b. $\frac{1}{2}$ c. $-\frac{31}{4}$

Section 6-2: Page 222 Written Exercises 11, 13

11. $(x-4)^2+(y+5)^2=25$

13. $(x-1)^2+(y-4)^2=1;\ C(1,4), r=1$

Section 6-3 : Page 228 Written Exercises 9

9. $Dom.: -6 \le x \le 6;$
$Range: -2 \le y \le 0$

Section 6-4: Page 235 Written Exercises 9

9. Domain: $|x| \ge 2$ Range: $y \ge 0$

Section 6-5: Page 241 Written Exercises 1, 19

1. check your graphs on the calculator
   a. $V(0, 0)$ b. $V(0, 0)$

19. check your graphs on the calculator