PreCalculus 2
Inequalities

Solve and graph the following.

1. $4(x + 1) < 2x + 3$

2. $-8 \leq 1 - 3(x - 2) \leq 13$

3. $\frac{x-1}{4} \leq \frac{x+4}{6}$

Now try These

1. $7x - 12 < 9$

2. $\frac{15 - 6x}{3} > 5$

3. $\frac{x + 2}{4} - \frac{2 - x}{3} + \frac{4x - 5}{6} \leq 4$

Try These. Solve.

1. $|x - 8| = 5$

2. $|4w - 1| = 10$

3. $|2p + 3| = -5$

Absolute Value Inequalities

Try These. Solve and Graph.

1. $|2x - 4| \leq 5$

2. $\left|\frac{x-3}{2}\right| > 7$

Factoring:

Warm Up. Factor the following.

1. 24

2. $3x^3 - 6x^2$

3. $x^2 + 11x + 30$

4. $2x^2 - 4x - 30$

Example 1: Factor

$25x^3 - 15x^2 + 50x - 30$

Example 2: Factor

$7r^2 + 11r + 4$

Example 3: Factor

$x^4 + 11x^2 + 10$

Example 4:

$16p^6 - 9$

Factor the following completely.

1. $2x^2 + 5x - 7$

2. $2x^2 - x - 3$

3. $x^4 - 2x^2 - 15$

4. $4x^3 - x^2 + 12x - 3$

5. $x^3 - 5x^2 + x - 5$

6. $x^4 - 13x^2 + 40$

7. $x^3 + 14x^2 + 45x$

8. $x^4 - 25$

Polynomial Inequalities

Warm-Up. Find the zeros of the following.

1. $(x + 1)^2(3x - 2)(x - 5)^3 = 0$

2. $x^2 + 4x = 21$

Example 1: Solve and Graph

$(x + 1)(x - 1)(x - 4)^2 \geq 0$

Example 2: Solve and Graph

$x^3 - 2x^2 > -x$

Example 3: Solve and Graph

$$\frac{(x + 2)(x - 5)^2}{(x - 4)} \leq 0$$

Solve and graph the following.

1. $x(x + 1)(x - 3) > 0$

2. $x^4 - 35x^2 \leq 2x^3$

3. $\frac{(x + 7)(x - 3)}{(x - 1)} \geq 0$

Solving Inequalities Graphically

Warm Up. Find the zeros of the following using your graphing calculator.

1. $2x^3 + x^2 - 8x + 3 = 0$

2. $2x^3 - 5x^2 + 1 = 0$

Inequalities in one variable of the form $f(x) > 0$, $f(x) < 0$, $f(x) \geq 0$, and $f(x) \leq 0$ can be solved using a graphing calculator.

Real zeros of a polynomial are also the x-intercepts of the polynomial.
If 2 is a Real zero of $P(x) = x^2 - 6x + 8$, then (2, 0) is an x-intercept of P(x), conversely if (-3, 0) is an x-intercept of $P(x) = x^2 + 2x - 3$, then -3 is a Real zero of P(x).

1. Graph each of the following. Identify the number of Real zeros and list them. (Hint: You are using the zero function on your calculator)

P(x)	Number of Real zeros	Real zeros (numerical)
$x^3 - 3x + 1$		
$2x^2 - x + 4$		
$x^3 - x^2 + x + 1$		

2. How do the zeros help you determine the solution to a polynomial inequality? ie. What does it mean for a function to be greater than or less than zero, graphically?

3. Graph $P(x) = x^3 - x + 1$
   a. Find any real zeros _____

   b. List the interval where $P(x) > 0$ _____

   c. List the interval where $P(x) < 0$ _____

4. Graph the polynomials below and complete the chart.

P(x)	Approx. zero (s)	Interval(s) P(x) > 0	Interval(s) P(x) < 0
$(x + 3)(x - 2)$			
$x^4 - 3x^3 + 3x - 2$			
$x^3 - 2(x + 1)$			

5. For each of the following, Sketch the graph, list and graph the real number line solution, darken the coordinate plane graph to identify the solution set.

a. $x^4 - 5x^2 + 4 > 0$

b. $(x + 3)(x - 2) < 0$

c. $x^4 - 3x^3 + 3x - 2 > 0$

d. $x^3 - 2(x + 1) < 0$

Inequalities/Functions #1

For each of the following solve and graph the solution.

1. $8x + 6 > 30$

2. $\frac{8-11x}{4} \leq 13$

3. $\frac{2-x}{3} < \frac{3-2x}{5}$

4. $2x(6x - 1) \geq (3x - 2)(4x + 3)$

5. $\frac{4}{3}\left(x-\frac{1}{2}\right)+\frac{1}{2}x \geq \frac{2}{3}\left(2x-\frac{5}{2}\right)$

6. $|x| \geq .5$

7. $|x| > -2$

8. $|x - 7| > 3$

9. $|x + 2| < -1$

10. $|x + 3| = 7$

11. $|3x - 9| \geq 9$

12. $|6 - 3x| < 12$

Inequalities/ Functions #2

Factor the following completely.

1. $2x^2 - 13x + 20$

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

3. $x^4 - 26x^2 - 27$

4. $x^6 + 2x^4 - 16x^2 - 32$

5. $10w^3 - 8w^2 + 25w - 20$

6. $8x^4 + 10x^2 - 3$

7. $5x^3 + 24x^2 - 5x$

8. $m^6 - 64$

9. $2y^6 + 13y^4 + 6y^2$

10. $p^4 - 81$

Inequalities/ Functions #3 (Polynomial)

Solve and graph the solution.

1. $(x + 7)(x + 9) > 0$

2. $(1 - x)(x - 3)(x - 5) < 0$

3. $(2x - 5)^2(x + 3)(x + 2) \geq 0$

4. $x^2 + 3x - 18 \leq 0$

5. $x^2 - 8x + 16 < 0$

6. $1 - 2x - 3x^2 \geq 0$

7. $3x^3 + 7x^2 - 6x \geq 0$

8. $b^4 - 16 \leq 0$

9. $r^3 - 9r > 8r^2$

10. $\dfrac{(x+1)(x-3)^2}{(x-5)^2} \geq 0$

11. $\dfrac{(3n-12)^2}{3n^2-12} \geq 0$

12. $\dfrac{n^2+4n+4}{n^2+4n} < 0$

Inequalities/ Functions #4 (polynomial)

For each of the following using your graphing calculator.
a. Sketch the graph.
b. List and graph the real number line solution.
c. Darken the coordinate plane graph to identify the solution set.

1. $-x^2 - 6x - 7 < 0$

2. $-x^5 + 4x^3 - x + 1 > 0$

3. $x^4 - 4x^3 + 2x^2 + x + 4 > 0$

Inequality Review

For each of the following solve and graph the solution.

1. $3(8 - 4x) < 9 - 7x$

2. $\frac{1}{3}(x-3) \le \frac{x-2}{4}$

3. $|x - 3| < 5$

4. $|x + 6| \ge 4$

5. $|7 - 5x| \le 2$

6. $(2x - 1)(x + 4)(x - 3)^2 \ge 0$

7. $2x^3 - x^2 > x$

8. $4x^2 + 5x - 6 < 0$

9. $\frac{(x-6)(x+1)}{(x-3)^2} \le 0$

For the following function use your graphing calculator and sketch the graph, list and graph the real number line solution, darken the coordinate plane graph to identify the solution set.

10. $x^3 - 3x - 1 < 0$