

Session 4.1

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Notes to keep in mind

Make sure you have these things in your notes, because I will refer to them with the expectation that you have learned, memorized, or written them down.

1. Solving a system of equations with the **substitution method**

$$\begin{cases} 5x - 2y = 8 \\ y = x - 1 \end{cases} \xrightarrow{\text{substitute}} 5x - 2(x - 1) = 8 \xrightarrow{\text{solve}} \boxed{x = 2} \xrightarrow{\text{plug in}} y = (2) - 1 \xrightarrow{\text{solve}} \boxed{y = 1}$$

2. Solving a system of equations with the **elimination method**

$$\begin{cases} 4x - 7y = -12 \\ -3x + 6y = 9 \end{cases} \xrightarrow{\text{multiply}} \begin{cases} 12x - 21y = -36 \\ -12x + 24y = 36 \end{cases} \xrightarrow{\text{add}} 3y = 0 \xrightarrow{\text{solve}} \boxed{y = 0} \xrightarrow{\text{plug in}} -3x + 6(0) = 9 \xrightarrow{\text{solve}} \boxed{x = -3}$$

3. Characteristics of a polynomial, such as $ax^2 + bx + c$, or, more generally $ax^n + bx^{n-1} + \dots + z$

- (a) The **degree** of a polynomial is the highest variable exponent, such as 2 or n
 (b) The **leading coefficient** is the coefficient of the variable with the highest degree, such as a
 (c) The **constant term** is the number without a variable next to it, such as c or z

Main problems

1. Find all points on the following graphs with the specified value of y

(a) $y = |x + 2|$ where $y = 7$

(c) $y = -3 * |x + 2| - 4$ where $y = -13$

(b) $y = |x - 7|$ where $y = 5$

(d) $y = 3/4 * |x - 4| + 2$ where $y = 12$

2. Find the equation for the line passing through both points, then a parallel one, and a perpendicular one:

(a) $(-3, 7)$ and $(3, -1)$

(b) $(-2, -5)$ and $(6, 1)$

3. For each of the systems of equations, find the (x, y) solution.

(a) $\begin{cases} -x + 3y = 11 \\ y = 4 \end{cases}$

(d) $\begin{cases} x - 3y = 12 \\ y = -x \end{cases}$

(g) $\begin{cases} -8y - 5x = 16 \\ x = -2y - 5 \end{cases}$

(b) $\begin{cases} 8x - 2y = -7 \\ y = -9 \end{cases}$

(e) $\begin{cases} -4x + 2y = 11 \\ y = x + 3 \end{cases}$

(h) $\begin{cases} 2x + y = 9 \\ 3x - y = 16 \end{cases}$

(c) $\begin{cases} -3x + 7y = 10 \\ x = -2 \end{cases}$

(f) $\begin{cases} 12y + 7x = -21 \\ x = 3y + 1 \end{cases}$

(i) $\begin{cases} 2x - y = 9 \\ 3x + 4y = -14 \end{cases}$

(j)
$$\begin{cases} 12x - 3y = 6 \\ 4x - y = 2 \end{cases}$$

(k)
$$\begin{cases} 3x - 5y = 23 \\ 5x + 7y = 0 \end{cases}$$

(l)
$$\begin{cases} -x + 3y = 4 \\ -6y + 2x + 8 = 0 \end{cases}$$

4. Simplify each of the following polynomials

(a) Add $2x^2 - 4x + 1$ to $-6x^2 - 7x - 5$

(b) Add $-8x^2 + 11x - 6$ to $-7x^2 - 9x + 14$

(c) Subtract $-2x^2 - 3x + 11$ from $4x^2 + 7x - 3$

(d) Subtract $5x^2 - 4x - 7$ from $6x^2 - 5x + 3$

(e) Multiply/expand $(x + 3)^2$

(f) Multiply/expand $(x + 3)(x + 7)$

(g) Multiply/expand $(x - 2)(x + 5)$

5. Graph each of the following quadratic polynomials. Denote the min/max point and x -intercept(s).

(a) $y = x^2$

(e) $y = -x^2$

(i) $y = -(x + 3)^2$

(b) $y = x^2 + 2$

(f) $y = 1/2 * x^2$

(j) $y = 2(x + 5)^2$

(c) $y = x^2 - 6$

(g) $y = (x - 4)^2$

(k) $y = -(x - 5)^2 - 7$

(d) $y = 3x^2$

(h) $y = (x + 2)^2$

(l) $y = (x + 3)^2 + 5$

6. In general, what happens if we add c (a constant)?

7. In general, what happens if we multiply the polynomial by -1 ?

8. In general, what happens if we add c (a constant) inside the quadratic?

9. Factor each of the following, and list the x -intercepts:

(a) $y = x^2 - 10x + 25$

(i) $y = x^2 - 16$

(q) $y = x^2 + 4x - 21$

(b) $y = x^2 + 12x + 36$

(j) $y = x^2 - 121$

(r) $y = x^2 - 11x + 28$

(c) $y = x^2 - 16x + 64$

(k) $y = 3x^2 - 27$

(s) $y = x^2 - 5x - 36$

(d) $y = x^2 - 4x + 4$

(l) $y = 9x^2 - 25$

(t) $y = x^2 - 12x - 45$

(e) $y = x^2 + 22x + 121$

(m) $y = x^2 - 121/16$

(u) $y = 3x^2 + 9x - 30$

(f) $y = 2x^2 + 16x + 32$

(n) $y = x^2 + 8x + 15$

(v) $y = -2x^2 + 36x - 34$

(g) $y = -4x^2 + 8x - 4$

(o) $y = x^2 + 7x + 12$

(w) $y = -4x^2 + 12x + 216$

(h) $y = x^2 - 36$

(p) $y = x^2 + 2x - 15$

More problems

1. Work on 2014 ICTM 1A/2A: <http://www.ilmathcontest.com/hs/Questions/Reg/R14A.pdf>

2. Use the "Noah sheets": <http://teachers.edenpr.org/mkingsbury/mathteam/NoahSheets.pdf>