Unit 7 – Polynomials

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**Section 7-1: Naming Polynomials (Day 1)**

**Review Question**
What are the three possibilities for a solution to a system of equations?
**Point, Infinite, Empty Set**

**Discussion**
What do the following prefixes mean?
Mono – **one**
Bi – **two**
Tri – **three**
Poly – **many**

Can you think of any words that start with these prefixes?
Monologue, monopoly, bicycle, triangle, polygamist

**SWBAT** name a polynomial and its degree

**Definitions**

**Monomial** – number, variable, or product of the two (no variable in denominator)

**Monomial or not?**
- 3 **Yes**
- 3x **Yes**
- 3xy² **Yes**
- 3x + y² **Yes**

**Binomial** – sum/difference of two monomials
Ex: 2a² + 4x²y²

**Trinomial** – sum/difference of three monomials
Ex: 3x²y + 2x + 3x²y²

**Polynomial** – any number of monomials
Ex: 3x²y + 2x + 3x²y²

**You Try!**

Name the polynomial.
1. 5x³ **M**
2. 9y **M**
3. c³ + 7c² **B**
4. 3z³ – 2x²y³z – 4x²z **T**
5. 6n³ – n²p² **B**
6. 4ab **M**
7. 15 – 8ag **B**
8. 3a²b³c⁴ – 18a⁵c **B**
9. -13 **M**
10. 2x³ – 4y + 7xy **T**
11. 7 + d³ – b²c²d³ + b⁶ **P**
12. 11r³t⁴ – 2s⁴t⁵ + 24 **T**
**Degree** – sum of the exponents of variables on a single term

Find the degree.
1. $3$   $0$
2. $3x$   $1$
3. $2x^2y^4$   $6$

**Degree of a polynomial** – highest degree of any term

Find the degree of the polynomial.
1. $3x + 2x^2y^3 + 4x^2 + 2$   $5$
2. $4x^3y - x^2y^3 + 4x^4y^2 + 2$   $6$

**You Try!**

Find the degree of each polynomial.
1. $5x^3$   $3$
2. $9y$   $1$
3. $c^4 + 7c^2$   $4$
4. $3z^5 - 2x^2y^3z - 4x^2z$   $6$
5. $6n^3 - n^2p^2$   $4$
6. $4ab$   $2$
7. $15 - 8ag$   $2$
8. $3a^3b^3c^4 - 18a^5c$   $9$
9. $-13$   $0$
10. $2x^3 - 4y + 7xy$   $3$
11. $7 + d^5 - b^2c^2d^3 + b^6$   $7$
12. $11r^2t^4 - 2s^4t^5 + 24$   $9$

**What did we learn today?**

**Section 7-1 Homework (Day 1)**

Name the polynomial and degree.

1. $5x^3 + 2x$
2. $y$
3. $2c^4 + c^2 + c + 1$
4. $3z^5 - 2x^2y^3z - 4x^2z$
5. $5n^2 - n^2p^5$
6. $2abc$
7. $5a^3g^4 - 8ag$
8. $3a^3b^4c^4 - 18a^4c + 6ac$
9. $5$
10. $2x^5 - 4y + 7xy$
11. $5a + d^5 - b^4c^2d^3 + b^6$
12. $10r^3t^5 - 2s^4t^7 + 2s$
Review Question
Name the polynomial and its degree.
1. \(2x^3y + 4y^3\) \(\text{B; 4}\)
2. \(x + 2x^2y + 3y\) \(\text{T; 3}\)

Discussion
Can you combine? Why or why not?
1. \(2x + 3x\) \(\text{Yes}\)
2. \(2x + 3y\) \(\text{No}\)
3. \(2x^2 + 3x^2\) \(\text{Yes}\)
4. \(2x^3 + 3x^4\) \(\text{No}\)
5. \(2xy^2 + 3xy^2\) \(\text{Yes}\)
6. \(2xy^2 + 3xy^3\) \(\text{No}\)

So, how do we know when we can combine?
When the variables and their exponents are the same

SWBAT add and subtract two polynomials

Example 1: \(2x^2 + 3x + 4x^2 - 2x + 5\) \(6x^2 + x + 5\)

Example 2: \((4x^2 + 7x - 12) + (-9x^2 - 6 + 2x)\) \(-5x^2 + 9x - 18\)

Example 3: \((6x^2 - 8x + 12x^3) - (-11x^2 + 6x^3)\) \(17x^2 - 8x + 6x^3\)

You Try!
1. \(6x^2 + 3x + x^2 - 4x - 3\) \(7x^2 - x - 3\)
2. \((x^2 + xy - 3y^2) + (4x^2 - 2xy + y^2)\) \(5x^3 - xy - 2y^2\)
3. \((x^2 - x + 5) - (2x + 5)\) \(x^2 - 3x\)
4. \(6x - (8x + 5y)\) \(-2x - 5y\)

What did we learn today?
Simplify. Then name the polynomial and degree of your answer.

1. \((6n^2 - 4) + (-2n^2 + 9)\)

2. \((9z - 3z^2) + (4z - 7z^2)\)

3. \((3 + a^2 + 2a) + (a^2 - 8a + 5)\)

4. \((-3n^2 - 8 + 2n) + (5n + 13 + n^2)\)

5. \((x + 5) + (2y + 4x - 2)\)

6. \((2b^3 - 4b + b^2) + (-9b^2 + 3b^3)\)

7. \((11 + 4d^2) - (3 - 6d^2)\)

8. \((4g^3 - 5g) - (2g^3 + 4g)\)

9. \((-4y^3 - y + 10) - (4y^3 + 3y^2 - 7)\)

10. \((4x + 5xy + 3y) - (3y + 6x + 8xy)\)

11. \((3x^2 + 8x + 4) - (5x^2 - 4)\)

12. \((5ab^2 + 3ab) - (2ab^2 + 4 - 8ab)\)

13. \((x^3 - 7x + 4x^2 - 2) - (2x^2 - 9x + 4)\)

14. \((5x^2 + 3a^2 - 5x) - (2ab^2 - 5ax + 7x)\)

15. \((3a + 2b - 7c) + (6b - 4a + 9c) + (-7c - 3a - 2b)\)

16. \((5x^2 - 3) + (x^2 - x + 11) + (2x^2 - 5x + 7)\)
Review Question
Simplify. Then name the polynomial and its degree.
\((2x^2y - 4y) - (x + 3x^2y + 3y)\) \(-x^2y - x - 7y\), Binomial; 3

Discussion
What is \(x + x\) ? 2x
What is \((x)(x)\) ? \(x^2\)
Why do you have to solve these two expressions differently? One is addition and one is multiplication.
The same is true about polynomials. Addition is handled differently than multiplication. Let’s try to figure out how multiplication works.

What does \((x^2)(x^3)\) mean? \(x \times x \times x \times x = x^5\)
What is the rule for exponents when we are multiplying? Add the exponents

What does \((x^3)^3\) mean? \(x \times x \times xx = x^6\)
What is the rule for exponents when we are raising a polynomial to a power? Multiply the exponents

*Notice how these rules are different from the addition/subtraction rules from yesterday.

SWBAT multiply two monomials

Definitions
\((a^m)(a^n) = a^{m+n}\)
\((a^m)^n = a^{mn}\)

Example 1: \((x^4)(x^3) = x^7\)
\((x^4)^3 = x^{12}\)

*Notice how these two problems are different.

Example 2: \((2x^3)(3x^4) = 6x^7\)
Example 3: \((2x^2y^3)^3 = 8x^6y^9\)
Example 4: \((2xy^4)(4x^2y^3) = 16x^4y^{11}\)

You Try!
1. \((x^2y^3)(x^3y) = x^5y^4\)
2. \((3x^2y)(6x^3y^4) = 18x^5y^5\)
3. \((3xy^3)^3 = 27x^3y^9\)
4. \((2x^5y^3)(3xy^2) = 72x^{11}y^{12}\)
5. \((-x^3y^3)(-3x^2yz)^3 = -27x^{12}y^{16}\)
6. \((2x)^3(4x^5) + (2x)^4 = 42x^8\)
What did we learn today?

Simplify.
1. \((x^2)(x^4)\)  
2. \((x^3)^4\)  
3. \((2x^3)(3x^3)\)  
4. \((2ab^4)^3\)  
5. \((a^4b^3)(a^2b^3)\)  
6. \((3x^2y^3)^2(2x)^3\)  
7. \((4x^2y)(3xy)^2\)  
8. \((x^2y^8) + (2xy^4)^2\)  
9. \((x^2y^3)^2(x^2y)^3\)  
10. \((2x^4y^4)(2x^3y)^3\)  
11. \((2a^2b^3)^3(2b)^3\)  
12. \((3a^8b^4)^3(2a^2b^3)^3\)  
13. \((\frac{1}{4}x^3y^4)^3\)  
14. \((3x^3y^3)^2(4x^2y)^3\)  
15. \((3x^2y^4)^2 + (2x^3)(3xy)^2\)  
16. \((2^2)^3\)
**Review Question**
What is the rule for exponents when we are multiplying? **Add the exponents**
What is the rule for exponents when we are raising a polynomial to a power? **Multiply the exponents**

**Discussion**
How do you get better at something? **Practice**
Today will be a day of practice.

**Example 1:** \((x^2y^4)^2(2x^2y^3) = 2x^6y^{10}\)

**You Try!**
1. \((4x^2y^3)(2x^3y) = 8x^5y^4\)
2. \(\left(\frac{2}{3}x^2y^3\right)^2 = \frac{4}{9}x^4y^6\)
3. \((2xy)^2(4x^2y^3)^3 = 256x^8y^{15}\)
4. \((2x^2y^4)^2 + (2x^3)(4xy)^2 = 36x^4y^8\)

**What did we learn today?**

<table>
<thead>
<tr>
<th>Simplify.</th>
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</thead>
<tbody>
<tr>
<td>1. ((ab^4)(ab^2))</td>
<td>2. ((-c^3d^4)(4cd^3))</td>
</tr>
<tr>
<td>3. ((5a^3b^3c^4)(6a^3b^4c^2))</td>
<td>4. ((9p^4q^3)^2)</td>
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<tr>
<td>5. ([(3x^3y^4)^3)</td>
<td>6. ((5x^3y^4)^2)</td>
</tr>
<tr>
<td>7. (\left(\frac{1}{2}x^3y^4\right)^3)</td>
<td>8. ((2xy^2z^3)(x^3y^2z))</td>
</tr>
<tr>
<td>9. ((x^4y^3)(x^3y^2z))</td>
<td>10. ((4cd)^2(3d^3))</td>
</tr>
<tr>
<td>11. ((-2ag^2)^4(-3a^2g^3)^3)</td>
<td>12. ((8y^3)(3x^2y^2)\left(\frac{3}{8}xy^4\right))</td>
</tr>
<tr>
<td>13. ((3x^3y^4)^2 + 4x^4y^8)</td>
<td>14. ((4x^3y)^2 - (4x^4y)(3x^2y))</td>
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</tbody>
</table>
Review Question
What is the rule for exponents when we are multiplying? **Add the exponents**
What is the rule for exponents when we are raising a polynomial to a power? **Multiply the exponents**

Discussion
What is $x^5 \div x^3$?

$\frac{x^5}{x^3} = x^{5-3} = x^2$

What is the rule for exponents when we are dividing monomials? **Subtract the exponents**

Let’s try to figure out what a monomial raised to a power of zero is.

\[
2^3 = 8 \\
2^2 = 4 \\
2^1 = 2 \\
2^0 = 1
\]

What is the rule for when something is raised to the zero power? **The answer is 1.**

Let’s try to continue the pattern.

\[
2^3 = 8 \\
2^2 = 4 \\
2^1 = 2 \\
2^0 = 1 \\
2^{-1} = \frac{1}{2} \\
2^{-2} = \frac{1}{4}
\]

What is the rule for when something is raised to a negative power? **The monomial slides to the bottom.**

**SWBAT** divide two monomials

**Definitions**

\[
a^m \div a^n = a^{m-n}
\]

\[
a^0 = 1
\]

\[
a^{-n} = \frac{1}{a^n}
\]

**Example 1:**

\[
\frac{a^2b^3}{a^3b^2} = \frac{b}{a}
\]

**Example 2:**

\[
\frac{15x^3y^5}{-3xy^2} = -5x^2
\]

\[
= \frac{y^3}{y^3}
\]
Example 3: \[
\frac{(a^{-2}b^4)^6}{a^3b^{-12}(a^{-9}b^{-15})} = 1
\]

**You Try!**

1. \[
-27x^3y^4 \quad \frac{9xy^6}{9xy^6} = -3x/y^2
\]
2. \[
(2x^2y)^3 \quad \frac{2xy^3}{2xy^3} = 4x^5/y^2
\]
3. \[
\frac{(4x^2y^3)(2x^3y^4z^2)}{2x^8y^2} = 4y^6/x^3
\]
4. \[
\frac{(3x^2y^2)(2xy^3)}{6xy^{10}} = 3x^4/y^5
\]

**What did we learn today?**

<table>
<thead>
<tr>
<th>Section 7–4 Homework (Day 1)</th>
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</table>

**Simplify.**

1. \[
x^4y^6 \quad \frac{x^3y^2}{x^3y^2} =
\]
2. \[
\frac{a^2b^6}{a^2b^4} =
\]
3. \[
12x^5y^6 \quad \frac{2x^3y^8}{2x^3y^8} =
\]
4. \[
-15x^2y^6z \quad \frac{5x^8y^6}{5x^8y^6} =
\]
5. \[
\frac{24x^8y^5z^5}{6x^8y^6z^5} =
\]
6. \[
3x^2y^3z^0 =
\]
7. \[
\frac{(2ab)^3}{(a^4b)^3} =
\]
8. \[
\frac{(2x^2y^3)^2}{x^2y^8} =
\]
9. \[
\frac{(3x^2y^3)(2xy^2)}{2x^3y^2} =
\]
10. \[
(2x^4y^3)(3xy^3) =
\]
11. \[
\frac{(2x^2y^3z)^2(3x^3y^4z^2)}{6x^4y^{10}z^8} =
\]
12. \[
\frac{(4x^5y^3)(2xy^5)}{(x^4y^5)(2x^3y^2)} =
\]
13. \[
(4x^2y^2)(3x^3y^4) =
\]
14. \[
\frac{(x^2y^4z^5)^0}{x^{-2}y^2} =
\]
**Section 7-4: Dividing Monomials (Day 2)**

**Review Question**
What is the rule for exponents when we are dividing? **Subtract the exponents**
What is a polynomial raised to a power of 0? **The answer is 1**
What is the rule for raising a polynomial to a negative exponent? **Slide it to the bottom**

**Discussion**
How do you get better at something? **Practice**
Today, will be a day of practice.
Let’s make sure we really understand negative exponents first.

**SWBAT** divide two monomials

**You Try!**
1. \((2x^2y)(4x^3y^2) = 32x^8y^5\)
2. \(\frac{(2x^2y)^3}{(xy)(xy^5)} = 8x^4y^3\)
3. \((3x^{-2}y)^2 = x^4/9y^6\)
4. \(\frac{(2x^2y^3)^2}{x^{-3}y^8} = 4x^7/y^3\)

**What did we learn today?**

**Section 7-4 In-Class Assignment (Day 2)**

**Simplify.**
1. \(\frac{x^8y^3}{x^3y^3} = \)
2. \(\frac{a^5b^6}{a^{-2}b^4} = \)
3. \(\frac{16x^6y^5z^3}{4x^3y^5z} = \)
4. \(-\frac{20x^2y^8z}{4xy^8} = \)
5. \(\frac{4^{-2}x^8y^3z^4}{2x^8y^6z^2} = \)
6. \(3^2x^0y^{-2}z^4 = \)
7. \(\frac{\left(-3a^2b^4\right)^3}{(a^2b)^3} = \)
8. \(\left(2x^2y^3\right)^2(3xy^3) = \)
9. \(\frac{(4x^4y^3)(2xy^5)}{2x^4y^2} = \)
10. \((x^5y)^3(2xy)^3 = \)
11. \( \frac{(3x^2y^3z)(3x^3y^4z^2)}{3x^4y^6z^8} = \)

12. \( \frac{(8x^7y^4)(2xy^3)}{(x^4y^5)(2x^4y^2)} = \)

13. \( (2x^4y^2)(5x^2y^4) = \)

14. \( \frac{(x^{-2}y^4z^5)^0}{x^{-4}y^5} = \)

15. \( \frac{1}{3x^{-2}} = \)

16. \( (\sqrt{5})^2 = \)
Review Question
What is the rule for exponents when we are multiplying? **Add the exponents**
What is the rule for combining terms when we are adding and subtracting?
The variables and their exponents must be the same

Discussion
Do you remember the distributive property?
Can someone explain it in their own words?
a(b + c) = ab + ac
-3(2x − 5) = -6x + 15

**SWBAT** multiply a monomial by a polynomial

Example 1: **Simplify:** 7x(4x² − 10xy)  \hspace{1cm} 28x³ − 70x²y

Example 2: **Simplify:** -3x³y(2x³y + 4y) + 2x³y²(4x + 3xy²)  \hspace{1cm} 2x⁴y² + 6x⁴y⁴ − 12x³y²

Example 3: **Solve:** x(x + 3) + 7x − 5 = x(8 + x) − 9x  \hspace{1cm} x = 5/11

You Try!
1. 8x(x² − 3x)  \hspace{1cm} 8x³ − 24x²
2. -4x³y³(2xy² + x²y³ − 3x³y²)  \hspace{1cm} -8x³y⁵ − 4x⁴y⁶ + 12x⁵y⁵
3. 6x(2x − 3) + 5(2x² + 3x + 2)  \hspace{1cm} 22x² − 3x + 10
4. 2x(x³ + 4x + 8) − 3x(3x² − 9x − 4)  \hspace{1cm} -7x³ − 19x² + 28x
5. 3x(x − 5) − 3x² = -30  \hspace{1cm} x = 2
6. x(x − 6) + 2 = x(x − 4) − 2x + 2  \hspace{1cm} All Reals

What did we learn today?
Simplify each polynomial.
1. \(d(-2d + 4) + 15d\) \(-2d^2 + 19d\)

2. \(-x(4x^2 - 2x) - 5x^3\) \(-9x^3 + 2x^2\)

3. \(3w(6w - 4) + 2(w^2 - 3w + 5)\) \(20w^2 - 18w + 10\)

4. \(5n(2n^3 + n^2 + 8) + n(4 - n)\) \(10n^4 + 5n^3 + 44n - n^2\)

5. \(10(4m^3 - 3m + 2) - 2m(-3m^2 - 7m + 1)\) \(46m^3 + 14n^2 - 32m + 20\)

6. \(4y(y^2 - 8y + 6) - 3(2y^3 - 5y^2 + 2)\) \(-2y^3 - 17y^2 + 18\)

7. \(-3c^2(2c + 7) + 4c(3c^2 - c + 5) + 2(c^2 - 4)\) \(6c^3 - 23c^2 + 20c - 8\)

8. \(4x^3(x + 2) + 3x(5x^2 + 2x - 6) - 5(3x^2 - 4x)\) \(19x^3 - 1x^2 + 2x\)

Solve each equation.
9. \(2(4x - 7) = 5(-2x - 9) - 5\) \(x = -2\)

10. \(2(5a - 12) = -6(2a - 3) + 2\) \(a = 2\)

11. \(4(3p + 9) - 5 = -3(12p - 5)\) \(p = -1/3\)

12. \(7(8w - 3) + 13 = 2(6w + 7)\) \(w = 1/2\)

13. \(d(d - 1) + 4d = d(d - 8)\) \(d = 0\)

14. \(c(c + 3) - c(c - 4) = 9c - 16\) \(c = 8\)
Section 7-5: Multiplying a Monomial by a Polynomial (Day 2)

**Review Question**
What is the rule for exponents when we are multiplying? **Add the exponents**
What is the rule for combining terms when we are adding and subtracting?
The variables and their exponents must be the same

**Discussion**
How do you get better at something? **Practice**
Today, will be a day of practice.

**SWBAT** multiply a monomial by a polynomial

**You Try!**
1. \(2x^2(4x^2 - 5x)\) \(8x^4 - 10x^3\)
2. \(-2x^2y(3xy^2 + 2x^2 + 3x + 1)\) \(-6x^4y^3 - 2x^4y^3 + 6x^7y^3\)
3. \(3x(2x - 4) + 2(2x^2 - 2x + 1)\) \(10x^3 - 6x + 2\)
4. \(2x^2(x^2 + 2x + 3) - 2x(3x^2 + 5x - 4)\) \(2x^4 - 2x^3 - 4x^2 + 8x\)
5. \(2x(3x - 2) - 6x^2 = -28\) \(x = 7\)
6. \(2x(x - 3) + 2 = 3(-2x - 4) + 2x^2 + 5\) Empty Set

**What did we learn today?**

**Simplify each polynomial.**
1. \(5(n - 3) + 2(n^2 + 6n)\) \(2n^2 + 17n - 15\)
2. \(-2x(x + 3) + 3(x + 3)\) \(-2x^2 - 3x + 9\)
3. \(4m(n - 1) - 5(n + 1)\) \(4mn - 4m - 5n^2 - 5n\)
4. \(-7xy + x(7y - 3)\) \(-3x\)
5. \(5(c + 3a) - c(2c + 1)\) \(2c^2 - 6c + 15a\)
6. \(-9n(1 - n) + 4(n^2 + n)\) \(13n^2 - 5n\)

**Solve each equation.**
7. \(-6(11 - 2x) = 7(-2 - 2x)\) \(x = 2\)
8. \(11(n - 3) + 5 = 2n + 44\) \(n = 8\)
9. \(a(a - 6) + 2a = 3 + a(a - 2)\) \(a = -3/2\)
10. \(q(2q + 3) + 20 = 2q(q - 3)\) \(q = -20/9\)
11. \(w(w + 12) = w(w + 14) + 12\) \(w = -6\)
12. \(x(x - 3) + 4x - 3 = 8x + x(3 + x)\) \(x = -3/10\)
13. \(-3(x + 5) + x(x - 1) = x(x + 2) - 3\) \(x = -2\)
14. \(n(n - 5) + n(n + 2) = 2n(n - 1) + 1.5\)
    \(n = -1.5\)
**Review Question**
What is a polynomial? **Any number of monomials; could be 3 or 4**
What does multiplying polynomials mean? **Multiply any two terms together**

**Discussion**
Think of our progression:
(x^2)(x^3) = **Monomial by Monomial**
x^2(x + 2x + 3) = **Monomial by Polynomial**
What’s next?
(x^2 + 2)(x – 3) = **Polynomial by Polynomial**
How do you think we would do this problem? **Do the distributive property twice.**

**SWBAT** multiply a polynomial by a polynomial

**Example 1:** (x – 4)(x + 6)  \( x^2 + 2x – 24 \)

**Example 2:** (2y + 7)(3y^2 – 2y + 3)  \( 6y^3 + 17y^2 – 8y + 21 \)

**Example 3:** (x^2 + 4x – 5)(3x^2 – 7x + 2)  \( 3x^4 + 5x^3 – 41x^2 + 43x – 10 \)

**You Try!**
1. (x – 3)(x – 3)  \( x^2 – 6x + 9 \)
2. (5t + 4)(2t – 6)  \( 10t^2 – 22t – 24 \)
3. (2b – 3)(3b^2 – 2b^2 + b)  \( 6b^4 – 13b^3 + 8b^2 – 3b \)
4. (y^2 – 5y + 3)(2y^2 + 7y – 4)  \( 2y^4 – 3y^3 – 33y^2 + 41y – 12 \)
5. (x – 3) – (x + 4)  \( -7 \)

**What did we learn today?**

**Section 7-6 Homework (Day 1)**

1. (b + 8)(b + 2)  \( b^2 + 10b + 16 \)
2. (x – 4)(x – 9)  \( x^2 – 13x + 36 \)
3. (y + 4)(y – 8)  \( y^2 – 4y – 32 \)
4. (2w – 5)(w + 7)  \( 2w^2 + 9w – 35 \)
5. (8d + 3)(5d + 2)  \( 40d^2 + 31d + 6 \)
6. (7x – 4)(5x – 1)  \( 35x^2 – 27x + 4 \)
7. \((2n + 3)(2n + 3)\)
\[4n^2 + 12n + 9\]

8. \((10r - 4)(10r + 4)\)
\[100r^2 - 16\]

9. \((8x + 2y)(5x - 4y)\)
\[40x^2 - 22xy - 8y^2\]

10. \((p + 4)(p^2 + 2p - 7)\)
\[p^3 + 6p^2 + p - 28\]

11. \((2x^2 + 3)(3x^2 + 1)\)
\[6x^4 + 11x^2 + 3\]

12. \((3x^3 - 2x^2)(2x + 1)\)
\[6x^4 - x^3 - 2x^2\]

13. \((3x + 2y)(5x - 7y)\)
\[15x^2 - 11xy - 14y^2\]

14. \((5y - 6)(2y - 3)\)
\[10y^2 - 27y + 18\]

15. \((2x - 5)(3x^2 - 4x + 1)\)
\[6x^3 - 23x^2 + 22x - 5\]

16. \((n^2 - 3n + 2)(n^2 + 5n - 4)\)
\[n^4 + 2n^3 - 17n^2 + 22n - 8\]

17. \((4a^2 + 3a - 7)(2a^2 - a + 8)\)
\[8a^4 + 2a^3 + 15a^2 + 31a - 56\]

18. \((2x^3y + 3x^2y)(x^2 + xy^3)\)
\[2x^5y + 2x^4y^4 + 3x^3y + 3x^3y^4\]

19. \((4x^2y^3 - 2)(2x^2y^3 + 3)\)
\[8x^4y^6 + 8x^2y^3 - 6\]

20. \((2x^3 - 3y^4)(4x^3 + 5)\)
\[8x^5 + 10x^2 - 12x^3y^4 - 15y^4\]
Review Question
How do we multiply a polynomial by a polynomial? Use the distributive property more than once

Discussion
How do you get better at something? Practice
Today, will be a day of practice.

SWBAT multiply a polynomial by a polynomial

Example 1: \((x - 4y)(x - 6y)\) \(x^2 - 10xy + 24y^2\)

Example 2: \((4y + 3)(2y^2 - 3y + 5)\) \(8y^3 - 6y^2 + 11y + 15\)

You Try!
1. \((x - 5)(x - 6)\) \(x^2 - 11x + 30\)
2. \((3t + 2)(4t - 1)\) \(12t^2 + 5t - 2\)
3. \((b + 2)(2b^3 + 3b^2 + 4b)\) \(2b^4 + 7b^3 + 10b^2 + 8b\)
4. \((y^2 + 2y - 4)(3y^2 + 2y - 4)\) \(3y^4 + 8y^3 - 12y^2 - 16y + 16\)
5. \((3x - 3) - (5x - 5)\) \(-2x + 2\)

What did we learn today?
Section 7-6 Homework (Day 2)

1. \((d + 2)(d + 5)\) \(d^2 + 7d + 10\)  
2. \((z + 7)(z - 4)\) \(z^2 + 3z - 28\)

3. \((m - 8)(m - 5)\) \(m^2 - 13m + 40\)  
4. \((a + 2)(a - 19)\) \(a^2 - 17a - 38\)

5. \((c + 15)(c - 3)\) \(c^2 + 12m - 45\)  
6. \((x + y)(x - 2y)\) \(x^2 - xy - 2y^2\)

7. \((2x - 5)(x + 6)\) \(2x^2 + 7x - 30\)  
8. \((7a - 4)(2a - 5)\) \(14a^2 - 43a + 20\)

9. \((4x + y)(2x - 3)\) \(8x^2 - 10xy - 3y^2\)  
10. \((7v + 3)(v + 4)\) \(7v^2 + 31v + 12\)

11. \((7s - 8)(3s - 2)\) \(21s^2 - 38s + 16\)  
12. \((4g + 3h)(2g - 5h)\) \(8g^2 - 14gh - 15h^2\)

13. \((4a + 3)(2a - 1)\) \(8a^2 + 2a - 3\)  
14. \((7y - 1)(2y - 3)\) \(14y^2 - 23y + 3\)

15. \((2x + 3y)(4x + 2y)\) \(8x^2 + 16xy + 6y^2\)  
16. \((12r - 4s)(5r + 8s)\) \(60r^2 + 76rs - 32s^2\)

17. \((-a + 1)(-3a - 2)\) \(3a^2 - a - 2\)  
18. \((2n - 4)(-3n - 2)\) \(-6n^2 + 8n + 8\)

19. \((x - 2)(x^2 + 2x + 4)\) \(x^3 - 8\)  
20. \((3x + 5)(2x^2 - 5x + 11)\) \(6x^3 - 5x^2 + 8x + 55\)

21. \((4s + 5)(3s^2 + 8s - 9)\) \(12s^3 + 47s^2 + 4s - 45\)  
22. \((3a + 5)(-8a^2 + 2a + 3)\) \(-24a^3 - 34a^2 + 19a + 15\)

23. \((a - b)(a^2 + ab + b^2)\) \(a^3 - b^3\)  
24. \((c + d)(c^2 - cd + d^2)\) \(c^3 + d^3\)

25. \((5x - 2)(-5x^2 + 2x + 7)\) \(-25x^3 + 20x^2 + 31x - 14\)  
26. \((-n + 2)(-2n^2 + n - 1)\) \(2n^3 - 5n^2 + 3n - 2\)

27. \((x^2 - 7x + 4)(2x^2 - 3x - 6)\) \(2x^4 - 17x^3 + 23x^2 + 30 - 24\)  
28. \((x^2 + x + 1)(x^2 - x - 1)\) \(x^4 - x^2 - 2x - 1\)

29. \((a^2 + 2a + 5)(a^2 - 3a - 7)\) \(a^4 - a^3 - 8a^2 - 29a - 35\)  
30. \((5x^4 - 2x^2 + 1)(x^2 - 5x + 3)\) \(5x^6 - 25x^5 + 13x^4 + 10x^3 - 5x^2 - 5x + 3\)
**Review Question**
How do we multiply a polynomial by a polynomial? **Use the distributive property more than once**

**Discussion**
How would you do the following problem 435 x 100? **Notice that you can multiply it out or use the shortcut. I will be showing you the shortcut for multiplying polynomials today.**

What does $5^2$ mean? $5 \times 5$
What does $(x + 4)^2$ mean? $(x + 4)(x + 4)$
How would you do this problem? **Use the distributive property twice**

Let’s do it: $(x + 4)^2$

$(x + 4)(x + 4) = x^2 + 8x + 16$

Notice how the answer is related to the problem.
**Square the x, Double the product of x and 4, Square the last term**
This shortcut is called square, double, square.
When do we use square, double, square? **When a binomial is being squared**
Examples: $(x + 4)^2, (x - 2)^2, (2x + 3y^2)^2$

Notice that using the distributive property twice will still work.

**SWBAT** use a shortcut to square a binomial

**Example 1:** $(x + 5)^2 = x^2 + 10 + 25$

**Example 2:** $(y - 3)^2 = y^2 - 6y + 9$

**Example 3:** $(2x - 3y^2)^2 = 4x^2 - 12xy^2 + 9y^4$

**Example 4:** $(x + 2)^2(x - 3) = (x^2 + 4x + 4)(x - 3) = x^3 + x^2 - 8x - 12$

**You Try!**
1. $(x + 1)^2 = x^2 + 2x + 1$
2. $(x - 6)^2 = x^2 - 12 + 36$
3. $(3x - 4y)^2 = 9x^2 - 24xy + 16y^2$
4. $(x^2 + 2x - 1)^2 = \text{Not Square, Double, Square} x^4 + 4x^3 + 2x^2 - 4x + 1$
5. $(2x^2 + 3x - 2) - (4x^2 - 4x + 2) = -2x^2 + 7x - 4$
6. $(4x + 5y)^2 = 16x^2 + 40xy^2 + 25y^4$

**What did we learn today?**
Section 7-7 Homework (Day 1)

1. \((x + 5)^2 = \)

2. \((y - 4)^2 = \)

3. \((2x + 3)^2 = \)

4. \((2xy^2 - 4y^3)^2 = \)

5. \((3x^2 y - 2y)(x^2 + 2x^2 y - 4) = 3x^4 + 6x^4 y^2 - 14x^2 y - 4x^2 y^2 + 8y \)

6. \((2x + y)(3x - 4y) = 6x^2 - 5xy - 4y^2 \)

7. \((2x - 4)(2x + 4) = 4x^2 - 16 \)

8. \((2xy + 3)^2 = \)

9. \((2x^2 + 2x - 5) - (6x^2 - 5x + 4) = -4x^2 + 7x - 9 \)

10. \((3x + 4) - (x - 3) = 2x + 7 \)

11. \((3y^2 + 2x^3 y^4)(y^3 - 2x) = 3y^5 - 6xy^2 + 2x^3 y^7 - 4x^4 y^4 \)

12. \(\frac{1}{2} x(8x^3 - 6xy) = 4x^4 - 3x^2 y \)

13. \((2x + 3y - 5)^2 = 4x^2 + 12xy - 20x + 9y^2 - 30y + 25 \)

14. \((2x^2 + x + 3)(x^2 - x - 4) = 2x^4 - x^3 - 6x^2 - 7x - 12 \)

15. \((4x - 1)(4x + 1)(x - 4) = 16x^3 - 64x^2 - x + 4 \)

16. \((x + 4)^2(x + 1) = x^3 + 9x^2 + 24x + 16 \)
Review Question
When do we use the shortcut “Square Double Square”? When a binomial is being squared

Discussion
Can we use the shortcut for (x + 4)(x – 4)? Why not? Not the difference of two squares
What is different about this problem?

Let’s do this problem and try to find a shortcut.

(x + 4)(x – 4) = x^2 – 16

Notice how the answer is related to the problem.
First term squared minus the second term squared. (Difference of Two Squares)

When do we use difference of two squares? When two quantities are the same except for their signs
(x + 4)(x – 4)
(x – 2)(x + 2)
(2x + 3y^2)(2x – 3y^2)
Notice that using the distributive property twice will still work.

SWBAT use a shortcut for the difference of two squares

Example 1: (x + 5)(x – 5) = x^2 – 25

Example 2: (3x + 7b)(3x – 7b) = 9x^2 – 49b^2

Example 3: (4x^2 – 3y)(4x^2 + 3y) = 16x^4 – 9y^2

You Try!
1. (3x – 2)(3x + 2) = 9x^2 – 4
2. (2x – 4)^2 = 4x^2 – 16x + 16
3. (4x^2 – y)(4x^2 + y) = 16x^4 – y^2
4. (x + 4)^2 – (2x^2 + 6x – 2) = -x^2 – 2x + 18
5. (2x^2 + 4)(3x^2 – 2x + 3) = 6x^4 – 4x^3 + 18x^2 – 8x + 12
6. (4x^2 – 3y^3)(4x^2 + 3y^3) = 16x^4 – 9y^6

What did we learn today?
1. \((x - 5)(x + 5) = \)

2. \((y - 4)(y + 4) = \)

3. \((2x + 3)(2x - 3) = \)

4. \((3xy^2 - 4y^3)(3xy^2 + 4y^2) = \)

5. \((2x^2y - 4x)(x^2 + 3x^2y - 2)\)
   \[2x^4y + 6x^4y^2 - 4x^3y - 4x^3 - 12x^3y - 8x\]

6. \((4x + 2y)(x - 3y)\)
   \[8x^2 - 10xy - 6y^2\]

7. \((2x - 4)^2\)

8. \((3x^2y + 5)^2\)

9. \((5x^2 + 3x - 5) - (7x^2 - 15x + 2)\)

10. \((-2x + 5) - (x - 5)\)

11. \((2y^3 + x^4y^4)(3y^3 - 4x)\)
   \[6y^6 - 12xy^3 + 3x^4y^7 - 4x^5y^4\]

12. \((4x - y)(4x + y)\)

13. \((x^2 + 2x^3y - 5)\)
   \[x^4 - 10x^2 - 20x^3y + 4x^6y^2 + 25\]

14. \((2x^2 + x + 3)(x^2 - x - 4)\)
   \[2x^4 - x^3 - 6x^2 - 7x - 12\]

15. \((2x - 2)(2x + 2)(x - 2)\)
   \[4x^3 - 12x + 8\]

16. \((x + 3)^2(x - 5)\)
   \[x^3 + x^2 - 21x - 45\]
Review Question
When do we use the shortcut “Square Double Square”? When a binomial is being squared
When do we use difference of two squares? When two quantities are the same except for their signs

Discussion
What is this unit called? Polynomials
What is this unit about? Performing operations on polynomials (Adding, Subtracting, Multiplying, Dividing)

Let’s think about what we have learned:
\[2x^2 + 3x^2 = 5x^2\]
\[(x^2)(x^3) = x^5\]
\[(x^3)^3 = x^6\]
\[(x^3)/(x^2) = x\]
\[x^2 = 1/x^2\]
\[x^0 = 1\]

Then we started multiplying polynomials:
\[(2x^2 + 3)(x^2 + 2x) = 2x^4 + 4x^3 + 3x^2 + 6x\]
\[(x + 3)^2 = x^2 + 6x + 9\]
\[(x + 3)(x - 3) = x^2 - 9\]

SWBAT review for the Unit 7 test

Discussion
1. How do you study for a test? The students either flip through their notebooks at home or do not study at all. So today we are going to study in class.

2. How should you study for a test? The students should start by listing the topics.

3. What topics are on the test? List them on the board
   - naming polynomials
   - adding/subtracting polynomials
   - multiplying monomials
   - dividing monomials
   - multiplying (monomial by poly)
   - multiplying polynomials
   - special products

4. How could you study these topics? Do practice problems

Practice Problems
Have the students do the following problems. They can do them on the dry erase boards or as an assignment. Have students place dry erase boards on the chalk trough. Have one of the groups explain their solution.
1. \[ \frac{(7x^2 - 3xy + 2y^2)}{-(-2x^2 + xy + 4)} \]
\[ 9x^2 - 4xy + 2y^2 - 4 \]

2. \[ (5y^5)^2 (2x^2y)^3 \]
\[ 200x^6y^{13} \]

3. \[ \frac{4x^3y^{-2}z^4}{2x^{-1}y^{-2}z^4} \]
\[ 2x^4/z^3 \]

4. \[ \frac{(-2x^2y^{-2})^3 (3x)}{(2x^{-2}y^{-1})^{-3}} \]
\[ -192xy^3 \]

5. \[ (3x^2y - 2y)(x^2 + 2x^2y - 4) \]
\[ 3x^4y + 6x^4y^2 - 14x^2y^2 - 4x^2y^2 + 8 \]

6. \[ (2x + y)(3x - 4y) \]
\[ 6x^2 - 5xy - 4y^2 \]

7. \[ (2x - 4)(2x + 4) \]
\[ 4x^2 - 16 \]

8. \[ (2xy + 3)^2 \]
\[ 4x^2y^2 + 12xy + 9 \]

9. \[ -4x + 9 = -8(2x + 4) \]
\[ -41/12 \]

10. \[ (3x + 4) - (x - 3) \]
\[ 2x + 7 \]

11. \[ 3x^2 + 8y^2 - 6x^2 + 4xy - 4y^2 \]
\[ -3x^2 + 4y^2 + 4xy \]

12. \[ \frac{1}{2}x(8x - 6xy) \]
\[ 4x^2 - 3x^2y \]

13. \[ -3(x + 3) + x(x - 1) = x(x + 2) - 3 \]
\[ -1 \]

14. \[ (2x^2 + x + 3)(x^2 - x - 4) \]
\[ 2x^4 - x^3 - 6x^2 - 7x - 12 \]

15. \[ (4x - 1)(4x + 1)(x - 4) \]
\[ 16x^3 - 64x^2 - x + 4 \]

16. \[ (x + 3)^2 - (2x^2 - 4x - 8) \]
\[ -x^2 + 10x + 17 \]

**What did we learn today?**
**SWBAT** do a cumulative review

**Discussion**
What does cumulative mean?  
*All of the material up to this point.*

Does anyone remember what the first six chapters were about? Let’s figure it out together.

1. **Pre-Algebra**  
2. **Solving Linear Equations**  
3. **Functions**  
4. **Linear Equations**  
5. **Inequalities**  
6. **Systems**

Things to Remember:
2. Reinforce the importance of retaining information from previous units.  
3. Reinforce connections being made among units.

### In-Class Assignment

1. What set of numbers does -5 belong?
   - a. counting  
   - b. whole  
   - c. integers  
   - d. irrationals

2. $6 + 2 = 2 + 6$ is an example of what property?
   - a. Commutative  
   - b. Associative  
   - c. Distributive  
   - d. Identity

3. $-8.2 + (-3.2) =$
   - a. -5.0  
   - b. -11.4  
   - c. 15.1  
   - d. -9.8

4. $\frac{1}{6} - \frac{2}{4} =$
   - a. 20/12  
   - b. 10/12  
   - c. 7/24  
   - d. 2/3

5. $(-3.8)(2.6) =$
   - a. -9.88  
   - b. -6.4  
   - c. 8.2  
   - d. -5.9

6. $15.6 ÷ 2.4 =$
   - a. 4.8  
   - b. 6.5  
   - c. 18  
   - d. -13.8

7. $-\frac{2}{2} ÷ \frac{10}{3} =$
   - a. -2/12  
   - b. -1/4  
   - c. -3/4  
   - d. 8/9
8. Which of the following is equal to $4^{3/2}$?
   a. 12  b. 64  c. 68  d. 128

9. Which of the following is equal to $\sqrt{1681}$?
   a. 39  b. 41  c. 49  d. 51

10. $18 - (9 + 3) + 22$
   a. 10  b. 28  c. 32  d. 2

11. $18 - 24 \div 12 + 3$
   a. 15  b. 16  c. 19  d. 20

12. $3x + 4y - 8x + 6y$
   a. $11x + 10y$  b. $5x + 2y$  c. $5x + 10y$  d. $-5x + 10y$

13. $-2x + 8 = 14$
   a. 11  b. -11  c. 3  d. -3

14. $2(x - 3) - 5x = 4 - 3x$
   a. 5  b. 6  c. Empty Set  d. Reals

15. Which of the following is a solution to $y = 2x - 4$ given a domain of {-3, 0, 6}?
   a. (0, 5)  b. (6, 2)  c. (-3, -10)  d. (-3, 7)

16. Which equation is not a linear equation?
   a. $-4x + 2y = 7$  b. $\frac{x}{4} = y$  c. $x = -5$  d. $y = x^2 + 3$

17. Which equation is not a function?
   a. $y = 3x + 7$  b. $y = 5$  c. $x = -5$  d. $y = \frac{1}{2}x + 2$

18. If $f(x) = 4x + 3$, find $f(-3)$.
   a. 1  b. -3  c. 3  d. -9

19. Write an equation of a line that passes through the points (3, 6) and (4, 8).
   a. $y = x$  b. $y = -2x$  c. $y = 2x + 12$  d. $y = 2x$

20. Write an equation of a line that is perpendicular to $y = \frac{1}{3}x - 2$ and passes thru (-1, 3).
   a. $y = x$  b. $y = -3x$  c. $y = 3x + 6$  d. $y = 3x$

21. Write an equation of a line that is parallel to $y + 2x = -2$ and passes thru (3, -2).
   a. $y = -2x + 4$  b. $y = -2x$  c. $y = -2x + 8$  d. $y = 2x$

22. Write an equation of a line that is perpendicular to $x = -3$ and passes thru the point (2, -4).
   a. $y = 2$  b. $y = -4$  c. $y = 2x$  d. $y = 4$
23. Which of the following is a graph of: \( y = 2x - 5 \).
   a. \[
   \begin{array}{c}
   \end{array}
   \]
   b. \[
   \begin{array}{c}
   \end{array}
   \]
   c. \[
   \begin{array}{c}
   \end{array}
   \]
   d. \[
   \begin{array}{c}
   \end{array}
   \]

24. Which of the following is a graph of: \( y = 3 \).
   a. \[
   \begin{array}{c}
   \end{array}
   \]
   b. \[
   \begin{array}{c}
   \end{array}
   \]
   c. \[
   \begin{array}{c}
   \end{array}
   \]
   d. \[
   \begin{array}{c}
   \end{array}
   \]

25. \( \frac{x}{-2} - 8 > 12 \)
   a. \( x < -40 \)
   b. \( x < 40 \)
   c. \( x < 10 \)
   d. \( x < -10 \)

26. \( |2x + 8| > 14 \)
   a. \( x > 3 \) or \( x < -11 \)
   b. \( x > 3 \) and \( x < -11 \)
   c. \( x < -11 \)
   d. \( x > 3 \)

27. \( |4x + 1| > -2 \)
   a. \( x > -\frac{3}{4} \)
   b. \( x < \frac{1}{2} \)
   c. Empty Set
   d. Reals

28. Solve the following system of equations.
   \[ \begin{align*}
   y &= x + 2 \\
   2x + 3y &= 10 
   \end{align*} \]
   a. \( (0, 2) \)
   b. \( \left(\frac{4}{5}, \frac{14}{5}\right) \)
   c. \( \left(\frac{3}{2}, \frac{1}{2}\right) \)
   d. \( (-3, 1) \)

29. Solve the following system of equations.
   \[ \begin{align*}
   3x - y &= 10 \\
   7x - 2y &= 24 
   \end{align*} \]
   a. \( (0, 5) \)
   b. \( (6, 2) \)
   c. \( (4, 2) \)
   d. \( (-3, 7) \)

30. Solve the following system of equations.
   \[ \begin{align*}
   x - 6y &= 5 \\
   2x - 12y &= 10 
   \end{align*} \]
   a. Empty Set
   b. Infinite
   c. \( (1, 1) \)
   d. \( (-3, 5) \)

31. Simplify: \( 2(2y^3)^2(x^4y)^3 \)
   a. \( 8x^{12}y^9 \)
   b. \( 6x^{12}y^9 \)
   c. \( 8x^{12}y^{18} \)
   d. \( x^{12}y^9 \)

32. Simplify: \( (2x - 5) - (3x + 4) \)
   a. \( 5x + 9 \)
   b. \( -x - 9 \)
   c. \( -x - 1 \)
   d. \( 6x^2 + 7x + 20 \)
33. Simplify: \((2x - 5)(3x + 4)\)
   a. \(6x^2 + 7x + 20\)  
   b. \(6x^2 - 7x + 20\)  
   c. \(6x^2 + 23x + 20\)  
   d. \(6x^2 - 7x - 20\)

34. \((4x - 4y)(4x + 4y)\)
   a. \(16x^2 + 8x + 16y^2\)  
   b. \(16x^2 - 8x - 16y^2\)  
   c. \(16x^2 + 16y^2\)  
   d. \(16x^2 - 16y^2\)

35. \((3xy^2 + 3)^2\)
   a. \(9x^2y^4 + 18xy^2 + 9\)  
   b. \(9x^2y^4 + 9\)  
   c. \(6x^2y^4 + 9\)  
   d. \(6x^2 - 7x - 20\)

36. \(4x(x^2 + 3y^3)\)
   a. \(4x^3 + 7xy^3\)  
   b. \(4x^3 + 12xy^3\)  
   c. \(5x^3 + 7xy^3\)  
   d. \(6x^2 - 7x - 20\)
1. Simplify \((3y^4)^3\)
   a. \(27y^{12}\)  
   b. \(9y^3\)  
   c. \(3y^{64}\)  
   d. \(9y^{12}\)

2. Simplify \(x^4y^0z^5\)
   a. \(-x^4yz^2\)  
   b. 0  
   c. \(\frac{z^5}{x^4}\)  
   d. \(\frac{x^4}{z^5}\)

3. Find the difference of \((-4x^3 - 8x^2 + 6x - 4) - (8x^2 - 5)\)
   a. \(-4x^3 - 16x^2 + 6x - 9\)  
   b. \(-4x^3 - 16x^2 + 6x + 1\)  
   c. \(-4x^3 + 5x - 12\)  
   d. \(-12x^3 + 4\)

4. Find the product of: \((4x - 4)(2x + 2)\)
   a. \(8x^2 + 10x + 8\)  
   b. \(8x^2 - 8\)  
   c. \(8x^2 - 10x - 8\)  
   d. \(8x^2 + 8\)

5. Find the product of: \((x + 1)(x^2 + 2x + 1)\) (Use the distributive property)
   a. \(x^3 + 2x^2 + x + 1\)  
   b. \(x^3 + 3x^2 + 3x + 1\)  
   c. \(x^3 + 3x^2 + x + 1\)  
   d. \(x^2 + 2x + 2\)

6. The following problems require a detailed explanation of the solution. This should include all calculations and explanations.

   There are different rules when you multiply and raise monomials to a power.
   a. Explain why you add the exponents when you multiply two monomials together.

   b. Explain why you multiply the exponents when you raise a monomial to a power.

   c. Explain why something to the zero power is ‘1’. 