Simplifying and Combining Like Terms

Exponent

Coefficient $4x^2$ Variable (or Base)

* Write the coefficients, variables, and exponents of:
a) $8c^2$ b) $9x$ c) y^8 d) $12a^2b^3$

Like Terms: Terms that have identical variable parts {same variable(s) and same exponent(s)}

When simplifying using addition and subtraction, combine "like terms" by keeping the "like term" and adding or subtracting the numerical coefficients.

Examples:
$3x + 4x = 7x$ $13xy – 9xy = 4xy$ $12x^3y^2 - 5x^3y^2 = 7x^3y^2$

Why can't you simplify?
$4x^3 + 4y^3$ $11x^2 – 7x$ $6x^3y + 5xy^3$

Simplify:

1) $7x + 5 – 3x$ 2) $6w^2 + 11w + 8w^2 – 15w$ 3) $(6x + 4) + (15 – 7x)$

4) $(12x – 5) – (7x – 11)$ 5) $(2x^2 - 3x + 7) – (-3x^2 + 4x – 7)$ 6) $11a^2b – 12ab^2$

WORKING WITH THE DISTRIBUTIVE PROPERTY

Example:
$3(2x – 5) + 5(3x +6) =$
Since in the order of operations, multiplication comes before addition and subtraction, we must get rid of the multiplication before you can combine like terms. We do this by using the distributive property:

$3(2x – 5) + 5(3x +6) =$
$3(2x) – 3(5) + 5(3x) + 5(6) =$
$6x - 15 + 15x + 30 =$

Now you can combine the like terms:
$6x + 15x = 21x$
$-15 + 30 = 15$

Final answer: $21x + 15$

Multiplying and Dividing Monomials

Multiplying:

$3^2 = 3 \bullet 3 = 9$ $4 \bullet 4 = 4^2 = 16$ $4^3 = (4)(4)(4) = 64$ $(5)(5)(5)(5)(5)(5) = 5^6 = 15{,}625$

The same goes for variables:

$x \bullet x = x^2$

$x^2 \bullet x^3 = (x)(x) \bullet (x)(x)(x) = x^5$

(The only difference is you can't simplify x^2 like you did $3^2 = 9$. You must leave it as x^2.)

When multiplying monomials you must deal with the coefficients.

Coefficients: **Multiply the coefficients**.

Variables: When multiplying the **variables** of monomials you **keep the base and add the exponents**. (Remember if there is no exponent written, the exponent is 1.)

Look at the previous example: $x^1 \bullet x^1 = x^{(1+1)} = x^2$

Simplify: $(3xy^5)(4x^2y^3)$

$(3xy^5)(4x^2y^3) = (3)(4)(x)(x^2)(y^5)(y^3) = 12[x^{(1+2)}][y^{(5+3)}] = \mathbf{12x^3y^8}$

Dividing:

$6^4/6^2 = \frac{(6)(6)(6)(6)}{(6)(6)}$ → cancel → $\frac{\cancel{(6)(6)}\,(6)(6)}{\cancel{(6)(6)}} = (6)(6) = 6^2 = 36$

$x^3/x = \frac{(x)(x)(x)}{(x)}$ → cancel → $\frac{(x)(x)\,\cancel{(x)}}{\cancel{(x)}} = (x)(x) = x^2$

Just like multiplying, when dividing monomials you must deal with the coefficients.

Coefficients : **Divide the coefficients.**

Variables: When dividing the **variables** of monomials you **keep the base and subtract the exponents**.

Look at the previous example: $x^3/x = x^{3-1} = x^2$

Simplify: $(12xy^5)/(4xy^3)$ =

$12/4 = 3$ $x^{1-1} = x^0$ $y^{5-3} = y^2$

What is x^0 equal to? : _____ Any number or variable with an exponent of 0 = ? _____

Final answer = _____

Do all examples in NB.

Show all steps!

1) Multiply:

a) $(5x^3y^2z^{11})(12\,xy^7z^{-4})$ b) $(9x^5y^2z^4)^3$ c) $(4x^3y^7z^6)^4(3x^8y^{-5}z^{-12})^2$

2) Multiply:

a) $(6x^3y^2z^{-12})(11x^5y^{-3}z^7)$ b) $(8x^5y^{-2}z^4)^4$ c) $(3x^6y^5z^8)^3(5x^{-9}y^5z^{-15})^2$

3) Divide:

a) $\dfrac{27x^3y^2z^5}{9x^3y^5z^4}$. b) $\dfrac{(4x^4y^5z)^3}{16x^4y^{13}z^4}$ c) $\dfrac{(2x^5yz^6)^5}{(4x^{11}y^5z^{14})^2}$

4) Divide:

a) $\dfrac{45x^3y^9z^5}{18x^6y^5z}$. b) $\dfrac{24x^8y^{12}z^9}{72x^{10}y^{12}z^8}$ c) $\dfrac{32x^5y^{12}z^{28}}{8x^7y^{-12}z^{14}}$

5) $\dfrac{(3x^5y^8z^5)^5}{(9x^{14}y^{20}z^{12})^2}$ 6) $\dfrac{(6x^5y^4z^6)^3}{(12x^7y^8z^{-9})^2}$

7) $5a(8a^2 - 6a + 3) - 3a(11a^2 - 10a - 5)$ 8) $8b(7b^2 - 4b + 2) - 5(6b^2 + 3b - 1)$

9) $7x(4x^2 - 11x + 3) - 4x(8x^2 - 18x + 5)$ 10) $5x(7x^2 - 6x + 4) - 3x(10x^2 - 7x - 1)$

11) $6y^2(5y^3 - 4y^2 + 8y - 7) - 8y(3y^3 + 6y^2 - 5y - 9)$

When MULTIPLYING monomials you _____ the coefficients and _____ the exponents.

When DIVIDING monomials you _____ the coefficients and _____ the exponents.

1) $(3x^9y)(6x^{11}y^4)$

2) $\frac{36x^9y^6z^5}{12x^{-9}y^6z^4}$

3) $(7x^2yz^3)^3$

4) $\frac{45x^4y^3z^7}{18x^6y^{-3}z^5}$

5) $\frac{(4x^5yz^3)^3}{(2x^3y^6z^{-2})^5}$

6) $(5x^2y^2z^{-4})(2x^{-5}y^3z)^3$

7) $(6x^7y^4z^3)^2(2x^{-5}y^3z)^3$

8) $\frac{(9x^2y^5z^{-11})^2}{(3x^{-2}y^2z^4)^5}$

9) $\frac{(6x^2y^5z^3)^2}{(2x^{-3}y^2z^2)^5}$

10) $4x(9x^2 - 15x - 12) - 12x(3x^2 + 5x - 4)$

11) $3y^2(5y^3 – 4y^2 + 8y – 7) – 7y(3y^3 + 6y^2 – 5y – 9)$

Q1 Quiz 6 Review:

Multiplication

1) $(10x^3y^{11}z^8)(-11xy^7z^3)$

2) $(7x^3yz^6)^3$

3) $(2x^3y^5z^6)^4(5x^6y^9z^{-12})^2$

4) $(-6x^4y^2z^{-5})^3(-8x^5y^{-3}z^8)^2$

5) $(4xy^4z^8)^3(9x^9y^5z^{-10})^2$

Division:

6) $\frac{42x^5y^4z^5}{63x^{-5}y^4z^9}$.

7) $\frac{(4x^2yz^5)^3}{16x^7y^{-3}z^{10}}$

8) $\frac{(2x^4y^2z^6)^5}{(4x^7y^3z^{10})^3}$

9) $\frac{(9x^3y^5z^8)^2}{(3xy^2z^{-3})^5}$

10) $\frac{(8x^{-6}y^4z^5)^3}{(10x^9y^{-6}z^2)^2}$

11) $10x(3x^2 - 5x + 6) - 6x(5x^2 + 8x + 10)$

12) $3x(7x^2 + 6x - 4) - 8(10x^2 - 7x - 1)$

Multiplying binomials:

We have a special way of remembering how to multiply binomials called FOIL:

F:	first	$x \bullet x = x^2$	$(x + 7)(x + 5)$
O:	outer	$x \bullet 5 = 5x$	
I:	inner	$7 \bullet x = 7x$	$x^2 + 5x + 7x + 35$ (then simplify)
L:	last	$7 \bullet 5 = 35$	$x^2 + 12x + 35$

1) $(x - 5)(x + 4)$ 2) $(x - 6)(x - 3)$ 3) $(x + 4)(x + 7)$ 4) $(x + 3)(x - 7)$

5) $(3x - 5)(2x + 8)$ 6) $(11x - 7)(5x + 3)$ 7) $(4x - 9)(9x + 4)$ 8)$(x - 2)(x + 2)$

9) $(x - 2)(x - 2)$ 10) $(x - 2)^2$ 11) $(5x - 4)^2$ 12) $(3x + 2)^2$

Multiplying a *TRINOMIAL* by a binomial:

13) $(4x^2 – 3x + 6)(2x – 7)$

Method 1: Split, distribute, and combine like terms:

$2x(4x^2 – 3x + 6) -7(4x^2 – 3x + 6)$

Method 2: Line up vertically and line up like terms:

$4x^2 – 3x + 6$
$\underline{\quad\quad 2x – 7}$

Do now:

14) $(5x^2 + 6x – 8)(9x + 4)$ 15) $(7x^2 – 3x – 4)(6x^2 + 2x – 5)$ 16) $(4x – 3)^3$

Multiplying Binomials: Use all three methods (Double Distribute, FOIL, and "boxes") to find the product:

1) $(3x - 2)(4x + 7)$:
Double Distribute FOIL Boxes

2) $(9x - 2)(x + 7)$
Double Distribute FOIL Boxes

3) $(7x - 3)^2$
Double Distribute FOIL Boxes

4) $(2x + 9)^2$
Double Distribute FOIL Boxes

Multiplying Polynomials

1) $(5x + 8)(9x – 7)$

2) $(6x – 5)(4x – 3)$

3) $(5x – 2)^2$

3) $(5x – 2)^3$

4) $(7x + 3)^3$

5) $(2x^2 + 5x + 4)(8x + 3)$

6) $(6x^2 - 4x - 3)(2x^2 - 3x -1)$

7) $(5x^2 – 6x + 1)(4x^2 – 9)$

8) $(7x^2 - 6x + 4)(8x^2 + 5x -2)$

Q1 Quiz 7 Review:

1) $6x(9x^2 – 4x + 8) + 4x(6x^2 + 12x – 9)$

2) $8x^2(7x^2 – 3x – 12) – 6x(4x^2 – 16x – 3)$

3) $(x + 8)(x – 7)$

4) $(x – 9)(x – 12)$

5) $(x – 4)(x + 7)$

6) $(x – 11)^2$

7) $(5x – 4)^2$

8) $(3x + 4)^3$

9) $(3x^2 – 5x + 3)(5x – 4)$

10) $(4x^2 – 7x + 2)(10x^2 – 3x – 5)$

11) $(3x + 2)^3$

Factoring using GCF:

Take the greatest common factor (GCF) for the numerical coefficient. When choosing the GCF for the variables, if all the terms have a common variable, take the one with the lowest exponent.

ie) $9x^4 + 3x^3 + 12x^2$

GCF: coefficients: 3

Variable (x) : x^2

GCF: $3x^2$

What's left? Division of monomials:

$9x^4/3x^2$ $3x^3/3x^2$ $12x^2/3x^2$

$3x^2$ x 4

Factored Completely: $3x^2(3x^2 + x + 4)$

Factor each problem using the GCF and check by distributing:

1) $14x^9 - 7x^7 + 21x^5$

2) $26x^4y - 39x^3y^2 + 52x^2y^3 - 13xy^4$

3) $32x^6 - 12x^5 - 16x^4$

4) $16x^5y^2 - 8x^4y^3 + 24x^2y^4 - 32xy^5$

5) $24b^{11} + 4b^{10} - 6b^9 + 2b^8$

6) $96a^5b + 48a^3b^3 - 144ab^5$

7) $11x^3y^3 + 121x^2y^2 - 88xy$

8) $75x^5 + 15x^4 - 25x^3$

9) $132a^5b^4c^3 - 48a^4b^4c^4 + 72a^3b^4c^5$

10) $16x^5 + 12xy - 9y^5$

HOW TO FACTOR TRINOMIALS

Remember your hints:

A. When the last sign is addition

$x^2 - 5x + 6$ 1)Both signs the same
2) Both minus (1st sign)

(x -)(x -)
3) Factors of 6 w/ a sum of 5. (3 and 2)

(x - 3)(x - 2)

B. When the last sign is subtraction

$x^2 + 5x - 36$ 1) signs are different

(x -)(x +) 2) Factors of 36 w/ a difference of 5 (9 and 4)

3) Bigger # goes 1st sign, +

(x - 4)(x + 9)

FOIL Check!!!!!

Factor each trinomial into two binomials check by using FOIL:

1) $x^2 + 7x + 6$	2) $x^2 - 8x + 12$	3) $x^2 - 10x + 16$
4) $x^2 + 4x - 21$	5) $x^2 - 8x - 33$	6) $x^2 + 5x - 6$
7) $x^2 + 16x + 64$	8) $x^2 + 11x - 26$	9) $x^2 - 12x + 27$
10) $x^2 - 17x + 72$	11) $x^2 + 6x - 72$	12) $x^2 + 5x - 66$
13) $x^2 - 17x + 52$	14) $x^2 - 22x + 121$	15) $x^2 + 8x + 16$
16) $x^2 + 6x - 7$	17) $x^2 - 11x - 42$	18) $x^2 + 24x + 144$
19) $x^2 + 2x - 35$	20) $x^2 - 5x - 66$	21) $x^2 - 14x + 48$
22) $x^2 + x - 42$	23) $x^2 + x - 56$	24) $x^2 - 14x + 45$
25) $x^2 + 15x + 36$	26) $x^2 + 7x - 18$	27) $x^2 + 10x - 24$
28) $x^2 + 14x + 24$	29) $x^2 + 29x + 28$	30) $x^2 - 3x - 18$
31) $x^2 - 9$	32) $x^2 - 36$	33) $x^2 - 121$
34) $9x^2 - 25$	35) $144x^2 - 49$	36) $64x^2 - 81$
37) $x^2 + 100$	38) $x^2 - 44$	39) $x^2 - x - 9$

Two Step Factoring with a GCF:

$6x^2 - 6x - 72$ $8x^7 + 88x^6 + 240x^5$ $3x^2 - 108$

Step 1: Take out the GCF

$6(x^2 - x - 12)$ $8x^5(x^2 + 11x + 30)$ $3(x^2 - 36)$

Step 2: Factor what's left (if possible) using your factoring rules:

$6(x+3)(x-4)$ $8x(x+6)(x+5)$ $3(x+6)(x-6)$

Factor using GCF and then factor the trinomial (then check):

40) $4x^2 + 20x + 24$	41) $10x^2 - 80x + 150$	42) $9x^2 + 90x - 99$
43) $3x^3 + 27x^2 + 60x$	44) $12x^6 + 27x^5 + 60x^4$	45) $8x^9 + 24x^8 + 192x^7$
46) $12x^2 - 12$	47) $25x^2 - 100$	48) $5x^5 - 320x^3$

Case II Factoring

Factoring a trinomial with a coefficient for x^2 other than 1

Factor: $6x^2 + 5x - 4$

1) Look for a GCF:
   a. There is no GCF for this trinomial
   b. The only way this method works is if you take out the GCF (if there is one.)
2) Take the coefficient for x^2 (6) and multiply it with the last term (4):
   $6x^2 + 5x - 4$ $6 \cdot 4 = 24$
   * Now find factors of 24 with a difference of 5
   8 and 3 [with the 8 going to the + (+5x)]
   $6x^2 + 8x - 3x - 4$
3) **SPLIT THE MIDDLE** and reduce each side:

   $6x^2 + 8x \mid - 3x - 4$ *When you're done the binomial on each side should be the same.
   Take Out: 2x and -1
   $2x(3x + 4) - 1(3x + 4)$

4) Your binomial factors are (2x -1) and (3x + 4)

5) **FOIL CHECK**

   $(2x - 1)(3x + 4)$

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

   $6x^2 + 5x - 4$

Extra Problems: (Remember... GCF 1st)

1) $7x^2 + 19x - 6$
2) $36x^2 - 21x + 3$
3) $12x^2 - 16x + 5$
4) $20x^2 + 42x - 20$
5) $9x^2 - 3x - 42$
6) $16x^2 - 10x + 1$
7) $24x^2 + x - 3$
8) $9x^2 + 35x - 4$
9) $16x^2 + 8x + 1$
10) $48x^2 + 16x - 20$

Way #2

Case II Factoring

Factoring a trinomial with a coefficient for x^2 other than 1

Factor: $6x^2 + 5x - 4$

1) Look for a GCF:
   a. There is no GCF for this trinomial
   b. The only way this method works is if you take out the GCF (if there is one.)

2) Take the coefficient for x^2 (6) and multiply it with the last term (4):
   $6x^2 + 5x - 4$ $6 * 4 = 24$
   $x^2 + 5x - 24$

3) Factor the new trinomial:
   $x^2 + 5x - 24$
   $(x + 8)(x - 3)$

4) Take the coefficient that you multiplied in the beginning (6) and put it back in the parenthesis (only with the x):
   $(x + 8)(x - 3)$
   $(6x + 8)(6x - 3)$

5) Find the GCF on each factor (on each set of parenthesis):
   $(6x + 8)$ ➔ $2(3x+ 4)$
   $(6x - 3)$ ➔ $3(2x - 1)$

6) Keep the factors left in the parenthesis:
   $(3x + 4)(2x - 1)$

7) FOIL CHECK: $(3x + 4)(2x - 1)$

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

   $6x^2 + 5x - 4$

Pg. 12 Answer Key

1) (x+6)(x+1)	2) (x-6)(x-2)	3) (x-8)(x-2)
4) (x+7)(x-3)	5) (x+3)(x-11)	6) (x+6)(x-1)
7) (x+8)(x+8)	8) (x+13)(x-2)	9) (x-9)(x-3)
10) (x-8)(x-9)	11) (x+12)(x-6)	12) (x+11)(x-6)
13) (x-13)(x-4)	14) (x-11)(x-11)	15) (x+4)(x+4)
16) (x+7)(x-1)	17) (x+3)(x-14)	18) (x+12)(x+12)
19) (x+7)(x-5)	20) (x-11)(x+6)	21) (x-8)(x-6)
22) (x+7)(x-6)	23) (x+8)(x-7)	24) (x-9)(x-5)
25) (x + 12)(x + 3)	26) (x + 9)(x - 2)	27) (x + 12)(x - 2)
28) Prime (no f of 24 w a s=13)	29) (x + 28)(x + 1)	30) (x + 3)(x - 6)
31) (x + 3)(x -3)	32)(x + 6)(x – 6)	33) (x + 11)(x – 11)
34) (3x + 5)(3x – 5)	35) (12x +7)(12x – 7)	36) (8x + 9)(8x – 9)
37) Prime (SOTS not DOTS)	38) Prime (44 is not a perfect square)	39) Prime (No f of 9 w/ a diff = 1)
40) 4(x+2)(x+3)	41) 10(x-5)(x-3)	42) 9(x+11)(x-1)
43) 3x(x+4)(x+5)	44) $12x^4(x+5)(x+1)$	45) $8x^7(x+8)(x-3)$
46) 12(x +1)(x-1)	47) 25(x+2)(x-2)	48) $5x^3(x+8)(x-8)$

Do Now:

1) $(5x + 9) – (11x – 9)$ 2) $(3x – 2)(5x + 7)$ 3) $(9x – 4)^2$

Factor using the GCF:

4) $16x^5y^2 - 8x^4y^3 + 24x^2y^4 - 32xy^5$ 5) $24b^{11} + 4b^{10} - 6b^9 + 2b^8$

Factor using Case I rules

6) $x^2 – 14x + 48$ 7) $x^2 – 3x – 54$ 8) $x^2 + 2x – 80$ 9) $x^2 + 17x + 66$

10) $x^2 – 14x - 15$ 11) $x^2 + 4x – 96$ 12) $x^2 + 22x + 121$ 13) $x^2 - 17x + 66$

Factor each trinomial and FOIL Check:

1) $x^2 - 6x - 72$ 2) $x^2 + 14x + 13$ 3) $x^2 - 19x + 88$

4) $x^2 + 2x - 63$ 5) $x^2 - 196$ 6) $x^2 - 1$

7) $x^2 + 20x + 64$ 8) $x^2 + 11x - 12$ 9) $x^2 - 12x + 35$

10) $x^2 - 17x + 70$ 11) $x^2 + 14x - 72$ 12) $x^2 + 5x - 36$

13) $x^2 - 20x + 96$ 14) $x^2 - 24x + 144$ 15) $x^2 + 10x + 25$

Factor using the GCF:

16) $24x^{10} - 144x^9 + 48x^8$ 17) $64x^5y^3 - 40x^4y^4 + 32x^3y^4 - 8x^2y^3$

Factor using the GCF and then factor the quadratic:

18) $x^4 - 15x^3 + 56x^2$ 19) $4x^2 + 24x - 240$ 20) $5x^3 - 5x^2 - 360x$

21) $12x^2 - 243$ 22) $16x^2 - 16$ 23) $8x^{17} - 512x^{15}$

Mixed Problems:

24) $49x^2 - 25$ 25) $4x^2 - 121$ 26) $x^4 - 36$

27) $x^{16} - 64$ 28) $x^{100} - 169$ 29) $48x^8 - 12$

30) $25x^2 - 100$ 31) $36x^4 - 9$ 32) $100x^2 - 225$

33) $x^2 + 64$ 34) $x^2 - 48$ 35) $x^2 - 2x + 24$

36) $x^2 + 11x - 30$ 37) $5x^2 + 20$ 38) $7x^2 - 7x - 84$

Factor each and FOIL check:

1) $x^2 - 5x - 84$

2) $x^2 + 2x - 80$

3) $x^2 + 15x + 54$

4) $x^2 - 21x + 90$

5) $x^2 - 121$

6) $9x^2 - 196$

7) $8x^2 - 24x - 320$

8) $x^9 + 13x^8 + 36x^7$

9) $9x^7 + 9x^6 - 504x^5$

10) $7x^8 - 175$

11) $36x^2 - 16$

12) $144x^4 - 64$

13) $9x^{16} - 81$

14) $100x^8 - 4x^2$

15) $10x^2 + 30x - 700$

16) $6x^{10} - 84x^9 + 270x^8$

17) $7x^2 - 63x - 154$

18) $12x^5 + 144x^4 + 384x^3$

19) $225x^2 - 36$

20) $81x^{36} - 144$

21) $196x^{15} - 49x^7$

Factor each and FOIL check:

1) $x^2 + 5x + 6$ 2) $x^2 – 7x + 6$ 3) $x^2 - 15x + 54$

4) $x^2 + 11x + 24$ 5) $x^2 – 5x – 36$ 6) $x^2 + 8x – 48$

7) $x^2 – 2x – 48$ 8) $x^2 + 13x – 48$ 9) $x^2 – x – 72$

10) $x^2 + 6x – 72$ 11) $x^2 + 27x – 28$ 12) $x^2 – 34x + 33$

13) $x^2 – 6x – 55$ 14) $x^2 + 3x – 54$ 15) $x^2 + 14x + 49$

16) $x^2 – 12x + 36$ 17) $x^2 – 64$ 18) $x^2 -1$

19) $x^2 – 196$ 20) $x^2 – 225$ 21) $x^2 + 25$

22) $x^2 - 63$ 23) $14x – 49$ 24) $22x – 121$

25) $5x^4 – 15x^2$ 26) $3x^3 + 6x^2 – 3x$ 27) $x^2 - 169$

28) $x^2 – x – 30$ 29) $x^2 + x + 20$ 30) $x^2 – 8x – 20$

31) $x^2 + 6x – 27$ 32) $x^2 – 2x – 80$ 33) $x^2 + x – 132$

34) $3x^2 – 27$ 35) $4x^2 – 36$ 36) $16x^2 – 144$

37) $5x^2 – 80$ 38) $6x^2 – 150$ 39) $10x^5 – 10x^3$

40) $25x^2 – 1$ 41) $49x^2 – 64$ 42) $4x^6 – 196x^4$

43) $16x^2 – 81$ 44) $48x^3 – 75x$ 45) $72x^5 – 2x^3$

46) $3x^2 - 6x – 72$ 47) $5x^2 + 60x – 135$ 48) $7x^4 – 28x^3 – 224$

49) $8x^3 + 24x^2 – 144x$ 50) $12x^{10} + 36x^9 + 24x^8$ 51) $6x^2 – 12x + 144$

52) $9x^4 + 135x^3 + 324x^2$ 53) $2x^{11} – 18x^{10} + 40\ x^9$ 54) $4x^5 + 16x^4 + 20x^3$

55) $3x^2 – 66x + 363$ 56) $5x^3 – 5x^2 – 150x$ 57) $18x^4 + 18x^3 – 54x^2$

58) $25x^2 – 50x – 200$ 59) $100x^2 - 25$ 60) $200x^{16} - 8$

Two Step Factoring with a GCF:

$6x^2 - 6x - 72$ $8x^7 + 88x^6 + 240x^5$ $3x^2 - 108$

Step 1: Take out the GCF

$6(x^2 - x - 12)$ $8x^5(x^2 + 11x + 30)$ $3(x^2 - 36)$

Step 2: Factor what's left (if possible) using your factoring rules:

$6(x+3)(x-4)$ $8x(x+6)(x+5)$ $3(x+6)(x-6)$

Do Now:

1) $6x^5 - 6x^4 - 252x^3$ 2) $12x^2 - 108x + 168$ 3) $8x^{10} - 200x^8$

4) $7x^2 - 112$ 5) $4x^2 + 16x - 128$ 6) $10x^8 + 550x^7 + 540x^6$

7) $144x^2 - 36$ 8) $100x^2 - 225$ 9) $81x^5 - 9x^3$

10) $x^2 - x - 1{,}056$ 11) $x^2 + x - 1{,}980$ 12) $x^2 - 2x - 1{,}368$

13) $x^2 + 25x + 126$ 14) $x^2 – 30x + 176$ 15) $x^2 + 50x + 561$

16) $x^2 + 3x – 1{,}054$ 17) $x^2 – 40x + 351$ 18) $x^2 – 1{,}089$

19) $x^2 – 2{,}704$ 20) $x^2 – 4{,}225$ 21) $x^2 – 4{,}625$

22) $x^2 + 3x – 108$ 23) $x^2 + 20x + 64$ 24) $x^2 – 2x – 168$

Answer Key:

Pg. 10:

16) $x^2 + 3x – 1{,}054$ **$(x+34)(x - 31)$** 17) $x^2 – 40x + 351$ **$(x-27)(x-13)$** 18) $x^2 – 1{,}089$ **$(x+33)(x-33)$** 19) $x^2 – 2{,}704$ **$(x+52)(x-52)$** 20) $x^2 – 4{,}225$ **$(x+65)(x-65)$**

Pg. 6

16) $24x^{10} - 144x^9 + 48x^8$ **$24x^8(x^2 - 6x + 2)$**

17) $64x^5y^3 – 40x^4y^4 + 32x^3y^4 – 8x^2y^3$ **$8x^2y^3(8x^2 - 5x^2y + 4xy -1)$**

18) $x^4 – 15x^3 + 56x^2$ **$x^2(x-8)(x-7)$**

19) $4x^2 + 24x – 240$ **$4(x+10)(x-6)$**

20) $5x^3 – 5x^2 –360x$ **$5x(x-9)(x+8)$**

21) $12x^2 – 243$ **$3(2x+9)(2x-9)$**

22) $16x^2 – 16$ **$16(x+1)(x-1)$**

23) $8x^{17} – 512x^{15}$ **$8x^{15}(x+8)(x-8)$**

24) $49x^2 – 25$ **$(7x+5)(7x-5)$**

25) $4x^2 – 121$ **$(2x+11)(2x-11)$**

26) $x^4 – 36$ **$(x^2+6)(x^2-6)$**

27) $x^{16} – 64$ **$(x^8+8)(x^8-8)$**

28) $x^{100} – 169$ **$(x^{50}+13)(x^{50}-13)$**

29) $48x^8 – 12$ **$12(x^4+ 1)(x^2+1)(x+1)(x-1)$**

Do now on sheet:

1) $x^2 – 60x + 644$ 2) $x^2 – 4x – 572$ 3) $x^2 + 2x – 1{,}023$ 4) $x^2 + 40x + 336$

5) $x^2 + 49$ 6) $x^2 + x + 30$ 7) $x^2 - 10x – 24$ 8) $x^2 – 9x – 24$

9) $5x^9 – 80x^7$ 10) $12x^4 + 36x^3 – 480x^2$ 11) $8x^2 – 104x + 288$

12) $x^2 + 20x + 51$ 13) $x^2 – 22x - 48$ 14) $100x^2 - 4$

Case II Practice:

1) $36x^2 - 15x - 9$

2) $6x^2 + 5x - 6$

3) $12x^2 - 20x + 7$

4) $90x^2 + 60x - 80$

5) $32x^4 - 4x^3 - 10x^2$

6) $8x^2 - 9x - 14$

Factor using GCF w/ Case I, Case II, GCF w/ Case II, or D.O.T.S.

1) $12x^2 – 168x + 540$

2) $12x^2 – 3x – 9$

3) $12x^2 – 35x – 3$

4) $14x^2 + 17x + 3$

5) $14x^2 - 22x + 8$

6) $14x^2 + 70x – 336$

7) $8x^2 – 12x – 36$

8) $8x^2 + 88x - 96$

9) $8x^2 – 6x – 9$

10) $81x^2 – 121$

11) $81x^2 – 9$

12) $81x^2 – 144$

Solving Equations

Golden Rule of Algebra:

"Do unto one side of the equal sign as you will do to the other…"

Whatever you do on one side of the equal sign, you MUST do the same exact thing on the other side. If you multiply by -2 on the left side, you have to multiply by -2 on the other. If you subtract 15 from one side, you must subtract 15 from the other. You can do whatever you want (to get the x by itself) as long as you do it on both sides of the equal sign.

Solving Single Step Equations:

To solve single step equations, you do the *opposite* of whatever the operation is. The opposite of addition is subtraction and the opposite of multiplication is division.

Solve for x:

1) $x + 5 = 12$ 2) $x - 11 = 19$ 3) $22 - x = 17$
4) $5x = -30$ 5) $(x/-5) = 3$ 6) $\frac{2}{3} x = -8$

Solving Multi-Step Equations:

$3x - 5 = 22$ To get the x by itself, you will need to get rid of the 5 and the 3.

$+5 \quad +5$ We do this by going in opposite order of PEMDAS. We get rid of addition and subtraction first.

$\frac{3x}{3} = \frac{27}{3}$ Then, we get rid of multiplication and division.

$x = 9$

We check the answer by putting it back in the original equation:

$3x - 5 = 22$, $x = 9$

$3(9) - 5 = 22$

$27 - 5 = 22$

$22 = 22$ (It checks)

Simple Equations:

1) $9x - 11 = -38$ 2) $160 = 7x + 6$ 3) $32 - 6x = 53$

4) $-4 = 42 - 4x$ 5) $\frac{3}{4}x - 11 = 16$ 6) $37 = 25 - (2/3)x$

7) $4x - 7 = -23$ 8) $12x + 9 = -15$ 9) $21 - 4x = 45$

10) $(x/7) - 4 = 4$ 11) $(-x/5) + 3 = 7$ 12) $26 = 60 - 2x$

Equations with more than 1 x on the same side of the equal sign:

You need to simplify (combine like terms) and then use the same steps as a multi-step equation.

Example:

$9x - 5x = 4x$ and $11 + 10 = 21$

$9x + 11 - 5x + 10 = -15$

$4x + 21 = -15$ Now it looks like a multistep eq. that we did in the 1st

$-21 \quad -21$ Use subtraction to get rid of the addition.

$\frac{4x}{4} = \frac{-36}{4}$ Now divide to get rid of the multiplication

$x = -9$

13) $15x - 24 - 4x = -79$ 14) $102 = 69 - 7x + 3x$ 15) $3(2x - 5) - 4x = 33$

16) $3(4x - 5) + 2(11 - 2x) = 43$ 17) $9(3x + 6) - 6(7x - 3) = 12$

18) $7(4x - 5) - 4(6x + 5) = -91$ 19) $8(4x + 2) + 5(3x - 7) = 122$

Equations with x's on BOTH sides of the equal sign:

You need to "Get the X's on one side and the numbers on the other." Then you can solve.

Example: $12x - 11 = 7x + 9$

$-7x \quad -7x$ Move the x's to one side.

$5x - 11 = 9$ Now it looks like a multistep equation that we did in the 1st section.

$+11 \quad +11$ Add to get rid of the subtraction.

$\frac{5x}{5} = \frac{20}{5}$ Now divide to get rid of the multiplication

$x = 4$

20) $11x - 3 = 7x + 25$ 21) $22 - 4x = 12x + 126$ 23) $\frac{3}{4}x - 12 = \frac{1}{2}x - 6$

24) $5(2x + 4) = 4(3x + 7)$ 25) $12(3x + 4) = 6(7x + 2)$ 26) $3x - 25 = 11x - 5 + 2x$

Solving Quadratic Equations

Solving quadratic equations (equations with x^2 can be done in different ways. We will use two different methods. What both methods have in common is that the equation has to be set to = 0. For instance, if the equation was $x^2 – 22 = 9x$, you would have to subtract 9x from both sides of the equal sign so the equation would be $x^2 – 9x – 22 = 0$.

***Solve by factoring*:** After the equation is set equal to 0, you factor the trinomial.

$x^2 – 9x – 22 = 0$

$(x-11)(x+2) = 0$

Now you would set each factor equal to zero and solve. Think about it, if the product of the two binomials equals zero, well then one of the factors has to be zero.

$x^2 – 9x – 22 = 0$

$(x-11)(x+2) = 0$

$x – 11 = 0$ $x + 2 = 0$

$+11 \quad +11$ $-2 \quad -2$

$x = 11$ or $x = -2$ * Check in the ORIGINAL equation!

Solving Quadratics by Factoring:

20) $x^2 - 5x - 14 = 0$ 21) $x^2 + 11x = -30$ 22) $x^2 - 45 = 4x$

23) $x^2 = 15x - 56$ 24) $3x^2 + 9x = 54$ 25) $x^3 = x^2 + 12x$

26) $25x^2 = 5x^3 + 30x$ 27) $108x = 12x^2 + 216$ 28) $3x^2 - 2x - 8 = 2x^2$

29) $10x^2 - 5x + 11 = 9x^2 + x + 83$ 30) $4x^2 + 3x - 12 = 6x^2 - 7x - 60$

Proportions and Percents

Proportions:

A proportion is a statement that two ratios are equal. When trying to solve proportions we use the Cross Products Property of Proportions.

$\frac{A}{B} = \frac{C}{D}$ $A(D) = B(C)$

Example:

$\frac{6}{11} = \frac{x}{121}$

$6(121) = 11x$

$726 = 11x$

$\frac{726}{11} = \frac{11x}{11}$

$66 = x$

$\frac{x+5}{12} = \frac{1.5}{6}$

$6(x + 5) = 12(1.5)$

$6x + 30 = 18$

$-30 \quad -30$

$\frac{6x}{6} = \frac{-12}{6}$

$x = -2$

1) $\frac{x}{14} = \frac{16}{35}$

2) $\frac{x-3}{x+3} = \frac{12}{30}$

Percents:

$\frac{Is}{Of} = \frac{\%}{100}$

Example:

What number is 20% of 50?

Is: ? → x

Of: of 50

%: 20%

100: 100

$\frac{x}{50} = \frac{20}{100}$.

$100x = 20(50)$

$100x = 1{,}000$

$\frac{100x}{100} = \frac{1{,}000}{100}$

$x = 10$

a) What number is 40% of 160?

b) 48 is what percent of 128?

c) 28 is 75% of what number?

d) What number is 36% of 400?

Part I:

1) $\frac{x}{12} = \frac{18}{54}$ 2) $-\frac{13}{x} = \frac{65}{90}$ 3) $\frac{x+4}{9} = \frac{6x}{18}$

4) $-\frac{16}{6x-2} = \frac{8}{11}$ 5) $\frac{14}{16} = \frac{3x}{3x+3}$

6) What is 20% of 32?

7) 72 is 40% of what number?

8) 21.56 is what percent of 98?

9) - 31 is what percent of -124?

10) What is 62% of 140?

Part II:

1) $\frac{x}{12} = \frac{13}{78}$ 2) $\frac{-13}{x} = \frac{195}{150}$ 3) $\frac{x+4}{9} = \frac{6x}{18}$

4) $\frac{-16}{5x-2} = \frac{8}{11}$ 5) $\frac{x+5}{x-3} = \frac{x}{9}$ 6) $\frac{x-4}{12} = \frac{9}{x+8}$

7) 12 is 40% of what number?

8) 21.56 is what percent of 98?

9) 45 is what percent of 180?

10) What is 62% of 70?

Part III:

1) $\frac{23}{x} = \frac{57.5}{45}$ 2) $\frac{3x-5}{13} = \frac{5x+1}{52}$ 3) $\frac{5x-1}{10x+5} = \frac{33}{45}$

4) $\frac{x+1}{x+6} = \frac{2}{x}$ 5) $\frac{2x-4}{x+5} = \frac{x-2}{x+1}$ 6) $\frac{x+7}{2x-1} = \frac{x+6}{x-2}$

10) What is 80% of 850?

8) 128 is 32% of what number?

9) 72 is what percent of 120?

10) What is 80% of 850?

Mixed Equations: Figure out what type of equation you have and then pick a strategy to solve.

1) $20 - (5/8)x = 40$ 2) $6(7x - 2) = 8(4x + 1)$ 3) $2(5x - 4) - 3(4x + 3) = -43$

4) $x^2 + 44 = 15x$ 5) $3x^2 + 18x = 81$ 6) $3x^2 = 2x + 5$

7) $11x - 5 = 7x - 53$ 8) $6(3x + 1) + 5(10 - 4x) = 39$ 9) $\frac{1}{4}x - 33 = -49$

10) $7x^2 - 1 = 3x$ 11) $9(3x + 1) = 8(5x + 6)$ 12) $15x = x^2 – 16$

13) $x^2 + 8x = 12$ 14) $9(4x + 7) - 6(7x + 10) = -54$ 15) $44 = 20 - 2x$

16) $4x^2 - 128 = 16x$ 17) $3x^2 - 8x + 6 = x + 6$ 18) $7(6x + 2) = 10(3x + 5)$

19) $3x^2 + 13x - 12 = 9x^2 - 11x - 12$ 20) $2x^2 - 14 = 10x$