Unit 3A Factoring

- GCF
- Grouping
- $a = 1$
- $a > 1$
- Special Cases

Name: _____

Name: _____ Date: _____

GCF Factoring

Introduction to Factoring out GCF

★ "Factor" simply means to UNDISTRIBUTE. ★

Distributed Version	Factored Version
	$5x(x+3)$
	$2x^2(x-4)$
$2x^2-4x$	
$15x^2-5x+30$	

More formal Definition:

◎ ***Factoring:*** *Writing the polynomial as a product.*

Steps to Factoring Out a GCF:

- ★ Find the GCF of all its terms (number and/or variables). For variables ALL the terms must have the variable. *Choose the <u>smallest</u> exponent!*
- ★ The GCF goes to the LEFT!
- ★ Write the polynomial as a product by *<u>dividing</u>* the original terms of the polynomial by the GCF.
- ★ The remaining factors in each term will form a polynomial. You'll always have the same number of terms you started with.

Factor using a GCF:

◎ $4x+6y$

◎ $6x^3-9x^2+12x$

◎ $y^8-y^5+y^2$

PRACTICE: Factor each polynomial using a GCF.

1. $10x + 45$
2. $28x - 63$
3. $18a + 42$
4. $8x + 25$
5. $18x^2 - 15x + 39$
6. $27a^2 + 81$
7. $72a^8 + 33a^5 - 42a^3$
8. $15x^7 + 30x^6 - 45x^3$
9. $4x^3 + 16x^2 - 43$
10. $14x^2 + 7x - 42$

Review

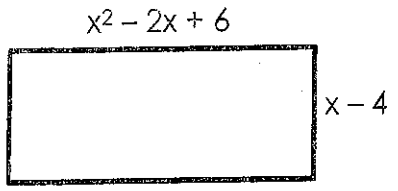
Simplify each expression.

11. $(7b^2 - b) + (2b^2 + 6b)$
12. $(5 - 5m^4) - (m^3 - 6)$
13. $(2n + 6n^4) - (5n + 4n^3 + 8n^4)$
14. $(-3x^2 + x) + (-3x^2 + 4x + 7)$

Given the functions f(x) = 3x – 2 and g(x) = x^2 – 6x + 2

15. Find f(6)
16. Find g(-2)
17. Find f(-1) + g(3)

Find the area and perimeter of the rectangle.



Algebra 1

Name_____ ID: 1

Factoring with GCF

Date_____ Period____

Factor the common factor out of each expression.

1) $8 + 6x^4$

2) $2n - 4$

3) $4n^9 + 12n$

4) $3r + 9$

5) $-12a - 3$

6) $5r + 4r^4$

7) $12n^5 + 16n^3$

8) $-9x^3 - 12x$

9) $5k^2 - 40k + 10$

10) $63m^6 - 49m^5 - 21m$

11) $-60 + 60n^2 + 50n^3$

12) $81r^2 - 36r - 18$

13) $-36n^3 - 12n - 28$

14) $18n^3 - 24n - 21$

15) $63n^3 + 81n + 18$

16) $72x^5 - 72x^3 - 80x^2$

17) $-24a^2b^2 + 36ab - 60a$

18) $-77x^2 - 21y + 49$

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Algebra I Name_____ ID: 2

Factoring with GCF

Date_____ Period____

Factor the common factor out of each expression.

1) $-12b - 16$

2) $-4n^2 + 4n$

3) $-4x^3 - 16x$

4) $n^2 + n$

5) $2b^3 - 3b^2$

6) $5v^6 - 15v^5$

7) $r^4 + r^2$

8) $-12v - 4v^5$

9) $21x^9 + 7x^5 + 49x^3$

10) $10x^7 - 5x^6 + 10x^5$

11) $-6n^2 + 9n - 9$

12) $-14n^5 + 56n^2 + 49$

13) $-20n^5 - 10n^4 + 2n^3$

14) $-20n^6 + 14n^4 - 12n^2$

15) $-25x^8 + 40x^7 + 15x^2$

16) $-42x^5 - 12x^2 - 30x$

17) $18x - 6xy^2 + 10xy^9$

18) $-9a^8b - 5a^5b^3 - 10a^6b$

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Algebra 1 Name_____ ID: 1

GCF, Grouping Practice

Date_____ Period____

Factor the common factor out of each expression (GCF only).

1) $32x^5 - 8x^4 + 72x^3$

2) $3v^2 + 21v + 3$

3) $-24v^4 + 9v + 21$

4) $-70x^2 - 50x + 30$

5) $18 + 27n + 24n^2$

6) $-64x^4 + 40x + 8$

Factor each completely by grouping. Factor GCF first if possible.

7) $28m^3 + 21m^2 - 4m - 3$

8) $6a^3 + 7a^2 + 18a + 21$

5

9) $12p^3 - 14p^2 + 30p - 35$

10) $30b^3 - 24b^2 + 35b - 28$

11) $49m^3 - 7m^2 - 35m + 5$

12) $12m^3 + 14m^2 + 30m + 35$

13) $6r^3 + 42r^2 - r - 7$

14) $7x^3 + 35x^2 - 5x - 25$

15) $5m^3 + 40m^2 - 7m - 56$

16) $9p^3 - 12p^2 + 3p - 4$

17) $96x^3 + 64x^2 - 36x - 24$

18) $6x^3 - 36x^2 + 15x - 90$

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Notes on Factoring Trinomials when a = 1

Name_____ Date_____

Steps to take when Factoring Trinomials with a Leading Coefficient of One:

- Always look for a GCF first. If there is one take it out and this number/variable will remain out if front of your final answer.
- Make sure your trinomial is written in Standard Quadratic Form: $ax^2 + bx + c$
- Find two numbers that multiply to give you "c" and combine (add or subtract) to give you "b."
- Your answer will be the product of two binomials. The GCF will be out in front if there is one.

Sign Rules:

- When the last term is **POSITIVE**...
  - The signs inside the parenthesis will be the **SAME** as the **middle number's sign**
- When the last term is **NEGATIVE**...
  - The parenthesis will have **DIFFERENT SIGNS**.
  - The **LARGER** factor will have the **SAME** sign as the middle number

Examples:

1) $x^2 + 7x + 6$

2) $x^2 + 9x + 14$

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

4) $n^2 + 2n - 48$

5) $x^2 - 9x - 36$

6) $2x^2 - 16x + 24$

Factoring Trinomials with a Leading Coefficient of One Practice Worksheet B

Name_____ Date_____

Factor completely. If there is a GCF, remember to factor it out first!

1. c^2+8c+7

2. $n^2-11n+10$

3. m^2+m-90

4. $2r^2+8r-24$

5. $p^2-10p+9$

6. $x^2+16x+64$

7. $3n^2+6n-72$

8. $w^2-4w+24$

9. $k^2-13k+40$

10. $a^2+11a+18$

11. p^2-p-56

12. n^2-5n+6

Algebra 1 Name_____ ID: 1

HW Factoring a = 1

Date_____ Period____

Factor each completely.

1) $x^2 - 4x - 60$

2) $r^2 - 10r + 9$

3) $v^2 - 4v - 32$

4) $r^2 + 17r + 70$

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

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

7) $x^2 + 6x - 16$

8) $x^2 - 10x + 16$

9) $6n^2 - 84n + 288$

10) $5p^2 - 85p + 350$

11) $2n^2 + 26n + 60$

12) $2p^2 + 6p - 80$

13) $2n^2 - 12n + 16$

14) $3m^2 + 39m + 120$

15) $4a^2 - 48a + 128$

16) $4m^2 + 16m - 84$

Notes and Practice on Factoring Trinomials when $a \neq 1$

Name_____ Class Period_____

To Factor: $ax^2 + bx + c$ when $a \neq 1$

- Put the Expression in Standard Form.
- Take out the GCF if there is one.

<u>OPTION #1 - GUESS AND CHECK</u>: You may use guess and check to find factors of a and factors of c that fit together in your two binomials to produce the answer.

OR

<u>OPTION #2 - GROUPING</u>: Find two numbers that **MULTIPLY** to give you the product of $a \cdot c$ and combine (**ADD OR SUBTRACT**) to give you b. Use your rules for signs to help you!

- Rewrite your original expression with 4 terms. Replace the original middle term of your expression with the two numbers you came up with as your middle two terms.
- Then factor by grouping.

******You only have to go through factoring by grouping IF the leading coefficient is NOT one. If the leading coefficient is equal to one then you go directly to your factors.***

Algebra 1 Name_____ ID: 1

Factoring a > 1 Homework

Date_____ Period____

Factor each completely.

1) $2x^2 - x - 10$

2) $2a^2 - 7a - 4$

3) $3n^2 + 5n - 2$

4) $3r^2 - 11r + 10$

5) $4r^2 + 6r$

6) $3x^2 - 13x + 12$

7) $3x^2 + 7x + 4$

8) $10v^2 + 58v + 40$

9) $10k^2 + 46k - 28$

10) $3x^2 - 5x + 2$

11) $10r^2 + 16r + 6$

12) $5x^2 - 17x + 6$

13) $5k^2 + 26k + 5$

14) $5a^2 + 24a + 16$

15) $9k^2 - 30k - 24$

16) $6p^2 - 3p - 9$

What Happened When the Boarding House Blew Up?

Factor each trinomial below. Find one of the factors in **each** column of binomials. Notice the letter next to one factor and the number next to the other. Write the letter in the box at the bottom of the page that contains the matching number.

(1) $3x^2 + 7x + 2$
(2) $2x^2 + 5x + 3$
(3) $3x^2 - 16x + 5$
(4) $7x^2 - 9x + 2$
(5) $6u^2 + 5u + 1$
(6) $8u^2 - 9u + 1$
(7) $10u^2 + 17u + 3$
(8) $9u^2 - 9u + 2$
(9) $5u^2 + 11u + 6$

(5) $(5u + 3)$
(3) $(x - 1)$
(8) $(3x + 1)$
(14) $(3u - 1)$
(6) $(2u + 3)$
(15) $(x + 1)$
(9) $(5u + 6)$
(7) $(2u + 1)$
(11) $(3x - 1)$
(17) $(u - 1)$

(Y) $(3u - 2)$
(E) $(x - 5)$
(G) $(8u - 1)$
(O) $(7x - 2)$
(R) $(5u + 1)$
(W) $(x + 2)$
(L) $(7x + 2)$
(I) $(2x + 3)$
(E) $(u + 1)$
(S) $(3u + 1)$

(10) $3n^2 + 2n - 1$
(11) $5n^2 - 4n - 1$
(12) $2n^2 + 5n - 3$
(13) $7n^2 - 13n - 2$
(14) $3t^2 + 14t - 5$
(15) $4t^2 - 11t + 7$
(16) $6t^2 + 5t - 1$
(17) $3t^2 - 20t - 7$

(12) $(3t - 1)$
(5) $(n - 1)$
(4) $(3t + 1)$
(10) $(n - 2)$
(13) $(t + 1)$
(2) $(3n - 1)$
(16) $(2n - 1)$
(4) $(3t - 7)$
(1) $(4t - 7)$

(N) $(n + 3)$
(R) $(t - 1)$
(P) $(2t + 1)$
(O) $(n + 1)$
(F) $(t + 5)$
(E) $(5n + 1)$
(M) $(t - 7)$
(R) $(7n + 1)$
(L) $(6t - 1)$

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

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Algebra 1 Name_____ ID: 1

Factoring Special Cases Homework Practice

Date_____ Period____

Factor each completely.

1) $36x^2 - 25y^2$

2) $81a^2 - 169b^2$

3) $25u^2 - 169v^2$

4) $169y^2 + 144x^2$

5) $121y^2 - 100x^2$

6) $81x^2 - 16y^2$

7) $u^2 - 25v^2$

8) $81b^2 - 49a^2$

9) $100m^2 + 169n^2$

10) $x^2 - 121y^2$

11) $81m^2 - n^2$

12) $49a^2 - 4b^2$

H

13) $x^2 + 8xy + 16y^2$

14) $9a^2 + 12ab + 4b^2$

15) $25m^2 - 40mn + 16n^2$

16) $a^2 - 10ab + 25b^2$

17) $x^2 + 10xy + 25y^2$

18) $25u^2 - 10uv + v^2$

19) $9x^2 + 6xy + y^2$

20) $25a^2 + 40ab + 16b^2$

21) $u^2 + 2uv + v^2$

22) $9m^2 - 24mn + 16n^2$

23) $27m^2 + 90mn + 75n^2$

24) $2x^2 - 12xy + 18y^2$

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Algebra 1
Test Review – Factoring

Name _____
Date _____ Period __

Method 1: Remove the GCF

1. $7x^2 + 28x$
2. $12a^2b - 15ab^2$
3. $9m^4 - 12m^2 + 3m$
4. $2t^3 - 6t^2 + 10t$

Method 2: Trinomials with a lead coefficient of 1 (a = 1)

5. $x^2 + 9x + 18$
6. $w^2 - 6w - 40$
7. $y^2 - 14yz + 24z^2$
8. $x^4 + 2x^2 - 3$

Method 3: Trinomials with a lead coefficient greater than 1 (a > 1)

9. $2x^2 + 9x + 10$
10. $6n^2 + 13n - 8$
11. $10z^2 + 10z - 120$
12. $3x^2 + 8x + 4$

Method 4: Grouping

13. $ax + 3ay + 2x + 6y$
14. $4m^2n - 2mn^2 - 6m + 3n$
15. $4xy - 12x + 8y - 24$

16. $x^3 - 11x^2 + 20x + 32$
17. $x^4 - 4x^3 + 2x^2 - 8x$
18. $3x^3 - 6x^2 + 15x - 30$

Method 5: Difference of Squares

19. $x^2 - 100$
20. $36m^4 - 1$
21. $64a^8 - b^{20}$
22. $16x^2 + 4$

Putting it all together!

1. $x^2 - 12x + 36$
2. $5a^2 - 5a - 30$
3. $2s^2 - 3s - 5$

4. $49x^4 - 144y^{12}$
5. $n^3 + 9n^2 - 25n - 225$
6. $2x^3 + 20x^2 - 3x - 30$