## Unit 8: Factoring Quadratics and Operating with Radicals

I CAN:

- Factor expressions by GCF
- Factor a quadratic expression when a=1
- Factor a quadratic expression when $a \neq 1$
- Factor a difference of squares
- Factor completely using all factoring strategies
- Solve a quadratic equation by factoring
- Simplify radical expressions with integer and variable radicands
- Add and subtract radical expressions
- Multiply radicals and divide/rationalize the denominator

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| Monday | Tuesday | Wednesday |  | Friday |
| 4 Factoring GCF and Trinomials with $a=1$ | 5 Factoring trinomials when $a \neq 1$ | 6 More Practice Factoring Trinomials and Difference of Squares |  | 8 Happy Friday! |
| 11 Solving Quadratic Equations by Factoring | 12 Simplifying Radicals | 13 Adding \& Subtracting Radicals |  | 15 Happy Friday! |
| 18 Review / Unit 8 Test | 19 | 20 | 21 | 22 |

*THIS PLAN IS SUBJECT TO CHANGE. CHECK DAILY NOTES AND BLOG FOR UPDATES.*

Warm up: Recall multiplying polynomials...DISTRIBUTE TO MULTIPLY.
a) $2 x(4 x-3)$
b) $(x+5)(x+2)$

The process of factoring is the reverse of the process of distributing.
The goal is to write an expression that is equivalent to the original, by dividing and
"undistributing" any common factors.

## FIRST: GREATEST COMMON FACTOR

For every factoring problem, you should begin by looking for a $\qquad$ .

Ex 1: Factor each expression.
a. $2 x^{2}+8 x$
b. $15 x^{2}-35 x$

NEXT: After you have checked for a GCF, your strategy will depend on the number of terms in the polynomial.

## THREE TERMS - SUM \& PRODUCT STRATEGIES <br> When $a=1$ :

If the trinomial is a quadratic expression in standard form, $\qquad$ ,
AND $\boldsymbol{a}=\mathbf{1}$, find two factors of $\qquad$ which have a sum equal to $\qquad$ : then write the quadratic as the product of two binomial factors $(x+p)(x+q)$.

a. $x^{2}+7 x+12$
b. $x^{2}-10 x+25$
c. $2 x^{2}+4 x-70$
d. $5 x^{2}-20 x-225$

## When $a \neq 1$ : SLIDE AND DIVIDE

1) Multiply $a \cdot c$
2) Find two factors of $a \cdot c$ that have a sum equal to $b$
3) Set up two binomial factors: $(x+p)(x+q)$
4) Divide $p$ and $q$ by $a \ldots$...then simplify.

Ex 3: Factor each trinomial
a. $2 x^{2}-9 x-18$
b. $8 x^{2}-30 x+7$
C. $6 x^{2}-5 x-4$
d. $3 x^{2}-20 x+32$

TWO TERMS - DIFFERENCE OF SQUARES:
This is also a sum \& product strategy, but notice that the value of the b-term in each example below is $\qquad$ , therefore the sum of the factors must be

Ex 4: Factor each binomial
a. $x^{2}-9$
b. $x^{2}-100$
C. $x^{2}-81$
d. $x^{2}-4$

What pattern do you notice about the factors of a difference of squares?
Ex 5: Use this pattern to factor the following
e. $25 x^{2}-49$
f. $100 x^{2}-121$
g. $16 x^{2}-1$
h. $x^{2}+25$
i. Using multiple strategies: $3 x^{2}-75$

## Solving Quadratic Equations by Factoring

According to the Zero Product Property, if the product of two quantities is equal to zero, then one of the quantities must equal zero.

Step 1: Arrange terms in standard form
Step 2: Factor
Step 3: Set each factor $=0$
Step 4: Solve each mini-equation

Recall: Factoring Strategies

- Look for a GCF first!
- 2 terms: Difference of Squares?
- 3 terms: Sum \& Product or Slide \& Divide

Ex 6: Solve each equation by factoring.
a. $x^{2}+3 x-40=0$
b. $x^{2}-9 x=0$
C. $x^{2}-3 x-28=0$
d. $81 x^{2}-100=0$
e. $2 x^{2}-24 x=-72$
f. $3 x^{2}-8 x+4=0$
g. $6 x+16=x^{2}+9$
h. $5 x^{2}+20 x+20=0$
i. $15 x^{2}-10 x=0$
j. $18 x^{2}+25 x-3=0$

Radical Expressions


| Perfect <br> Square: <br> $x^{2}$ |  |  |  |  |  |  |  |  |  |  |  |
| :---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Square <br> Roots: <br> $\sqrt{x^{2}}$ |  |  |  |  |  |  |  |  |  |  |  |

A radical expression is simplified when there are...
1 no perfect square factors (other than 1 ) in the radicand
2 no fractions under the radical
3 no radicals in the denominator
To Simplify:

- Find the biggest perfect square factor of the radicand and evaluate its square root, bringing it outside the radical.
- The product of the remaining non-perfect-square factors will stay inside the radical.

Ex 1: Simplify each radical WITHOUT USING A CALCULATOR
a. $\sqrt{16}$
b. $\sqrt{8}$
C. $\sqrt{75}$
d. $\sqrt{40}$
e. $\sqrt{45}$
f. $\sqrt{600}$

When we simplify radicals, we are finding perfect squares - or PAIRS - of factors.
We will use a similar process to simplify radicals containing variables.
Ex 2: Simplify
a. $\sqrt{4 x^{2}}$
b. $\sqrt{98 a^{4} b^{10}}$
C. $\sqrt{27 z^{3}}$
d. $\sqrt{48 x y^{5} z^{9}}$
e. $\sqrt{100 x^{12} y^{7}}$
f. $\sqrt{180 a^{3} b^{6}}$

To simplify radical expressions involving addition and subtraction, we must combine "like radicals," which have identical radicands.

When adding and subtracting radicals, we will:

- Simplify each radical expression
- Combine the like radicals by adding or subtracting their coefficients, keeping the like radicand the same

Ex 4: Simplify
a. $\sqrt{3}+5 \sqrt{3}$
b. $2 \sqrt{6}+\sqrt{24}$
c. $3 \sqrt{2}+\sqrt{5}-4 \sqrt{8}$
d. $9 \sqrt{40}-\sqrt{300}-\sqrt{90}$
e. $\sqrt{72}-4 \sqrt{18}$
f. $\sqrt{20}+2 \sqrt{6}-\sqrt{80}$

Multiplying Radical Expressions
When multiplying two radicals, we will multiply OUTSIDE • OUTSIDE and INSIDE • INSIDE, then simplify.

Ex 5: Simplify
a. $\sqrt{2} \cdot 5 \sqrt{6}$
b. $3 \sqrt{2} \cdot 5 \sqrt{10}$
c. $\sqrt{3}(2-\sqrt{3})$
d. $2 \sqrt{6} \cdot \sqrt{48}$
e. $(5+\sqrt{6})(2-\sqrt{2})$
f. $(-4+\sqrt{6})(-1-\sqrt{6})$
g. $(2-\sqrt{3})(2+\sqrt{3})$
h. $(10+\sqrt{2})(10-\sqrt{2})$

Dividing with Radical Expressions \& Rationalizing the Denominator
Simplify OUTSIDE/OUTSIDE and INSIDE/INSIDE, then rationalize the denominator to eliminate radicals from the bottom of the fraction, as needed. Simplify again, if necessary.

Ex 6: Simplify
a. $\frac{\sqrt{10}}{\sqrt{5}}$
b. $\frac{2 \sqrt{15}}{\sqrt{3}}$
C. $\frac{5}{\sqrt{5}}$
d. $\frac{\sqrt{3}}{\sqrt{6}}$
e. $\frac{6 \sqrt{2}}{2 \sqrt{5}}$
f. $-\frac{9}{\sqrt{3}}$
$\qquad$
Factoring: GCF and $\mathrm{a}=1$
Date $\qquad$ Period $\qquad$
Factor the common factor out of each expression.

1) $12 x^{3}-20 x^{2}+12 x$
2) $40 n^{8}-20 n^{4}+5 n^{3}$
3) $24 x^{5}+24 x-32$
4) $32 v^{6}-72 v+8$
5) $-54+45 n-72 n^{2}$
6) $-21 b+70$

Factor each completely.
7) $x^{2}+6 x+8$
8) $r^{2}+5 r$
9) $n^{2}-8 n+15$
10) $n^{2}+5 n-36$
11) $k^{2}+k-42$
12) $3 r^{2}+30 r$
13) $b^{2}-5 b+6$
14) $n^{2}-3 n-28$
15) $2 n^{2}+12 n+16$
16) $6 n^{2}+42 n+60$

Algebra 2 Preview
Name $\qquad$
Factoring $\mathrm{a}>1$
Date $\qquad$ Period

Factor each completely.

1) $3 x^{2}+11 x+6$
2) $7 x^{2}+12 x-4$

## 3) $5 b^{2}+11 b-12$

4) $7 v^{2}+52 v-32$
5) $6 x^{2}+8 x-40$
6) $6 a^{2}-39 a-72$
7) $10 n^{2}+51 n+27$
8) $9 x^{2}-67 x+28$
9) $9 x^{2}-64 x+60$
10) $6 r^{2}-11 r-30$
11) $54 x^{2}-18 x-336$
12) $36 b^{2}-180 b+224$

## Algebra 2 Preview <br> Difference Of Squares

Name
Date $\qquad$ Period

Factor each completely.

1) $4 v^{2}-9$
2) $16 p^{2}-25$
3) $4 a^{2}-25$
4) $a^{2}+9$
5) $16 x^{2}+25$
6) $16 n^{2}-9$
7) $12 p^{2}-3$
8) $16 v^{2}-100$
9) $50 n^{2}-18$
10) $4 a^{2}-1$
11) $k^{2}+9$
12) $5 x^{2}-20$
13) $18 x^{2}-50$
14) $20 k^{2}+125$

## Algebra 2 Preview

Name $\qquad$

## Factoring to Solve

Date $\qquad$ Period

Solve each equation by factoring.

1) $m^{2}-m-12=0$
2) $x^{2}+10 x+16=0$
3) $x^{2}+6 x+8=0$
4) $x^{2}+x-30=0$
5) $n^{2}-9 n+18=0$
6) $x^{2}-12 x+32=0$
7) $7 n^{2}+37 n+10=0$
8) $7 n^{2}-41 n-6=0$
9) $5 k^{2}+18 k+16=0$
10) $5 n^{2}+41 n+8=0$
11) $56 m^{2}+312 m-144=0$
12) $9 a^{2}-78 a+144=0$

## Algebra 2 Preview <br> Simplifying Radicals

Name $\qquad$
Date $\qquad$ Period $\qquad$
Simplify.

1) $\sqrt{36}$
2) $\sqrt{80}$
3) $\sqrt{180}$
4) $\sqrt{96}$
5) $\sqrt{72}$
6) $\sqrt{8}$
7) $\sqrt{16}$
8) $\sqrt{54}$
9) $\sqrt{128 x^{4}}$
10) $\sqrt{20 x^{3}}$
11) $\sqrt{243 x^{2}}$
12) $\sqrt{20 x^{3} y}$
13) $\sqrt{200 x y^{2}}$
14) $\sqrt{72 x^{4} y^{4}}$
15) $\sqrt{5184 u^{5} v^{2}}$
16) $\sqrt{4693 x^{10} y^{12}}$

Algebra 2 Preview
Name $\qquad$

## Adding and Subtracting Radicals

Date $\qquad$ Period

## Simplify.

1) $2 \sqrt{3}+2 \sqrt{3}$
2) $2 \sqrt{3}-\sqrt{3}$
3) $-2 \sqrt{6}-\sqrt{6}$
4) $-2 \sqrt{3}-3 \sqrt{5}+3 \sqrt{3}$
5) $2 \sqrt{2}-\sqrt{2}-\sqrt{2}$
6) $3 \sqrt{6}-3 \sqrt{6}-\sqrt{6}$
7) $-\sqrt{24}-2 \sqrt{20}+3 \sqrt{45}$
8) $3 \sqrt{3}+2 \sqrt{12}-\sqrt{12}$
9) $2 \sqrt{2}-2 \sqrt{54}-\sqrt{2}$
10) $-\sqrt{5}+3 \sqrt{20}-\sqrt{2}$
11) $-\sqrt{3}-3 \sqrt{27}-3 \sqrt{6}$
12) $2 \sqrt{8}+3 \sqrt{5}-\sqrt{2}$
13) $-\sqrt{6}+2 \sqrt{6}-2 \sqrt{2}-2 \sqrt{6}$
14) $3 \sqrt{6}-2 \sqrt{5}-\sqrt{2}-2 \sqrt{5}$
15) $-2 \sqrt{6}-\sqrt{2}-2 \sqrt{6}-2 \sqrt{2}$
16) $-3 \sqrt{6}-\sqrt{5}-3 \sqrt{5}-2 \sqrt{6}$
17) $\sqrt{15} \cdot \sqrt{12}$
18) $5 \sqrt{5} \cdot-4 \sqrt{5}$
19) $-4 \sqrt{8} \cdot-3 \sqrt{8}$
20) $\sqrt{6}(\sqrt{2}+\sqrt{6})$
21) $\sqrt{2}(\sqrt{2}+4)$
22) $4 \sqrt{15}(3 \sqrt{2}+5 \sqrt{3})$
23) $5 \sqrt{6}(2 \sqrt{3}-5 \sqrt{2})$
24) $(\sqrt{5}-3)(\sqrt{5}+3)$
25) $(-3+\sqrt{3})(-4+\sqrt{3})$
26) $(1+3 \sqrt{5})(5-4 \sqrt{5})$
27) $\frac{\sqrt{9}}{\sqrt{15}}$
28) $\frac{\sqrt{5}}{\sqrt{2}}$
29) $\frac{\sqrt{8}}{\sqrt{10}}$
30) $-\frac{2}{\sqrt{2}}$
31) $\frac{2 \sqrt{4}}{4 \sqrt{6}}$
32) $\frac{4 \sqrt{3}}{\sqrt{15}}$
33) $\frac{4 \sqrt{4}}{\sqrt{3}}$
34) $\frac{5 \sqrt{9}}{2 \sqrt{15}}$
35) $\frac{\sqrt{5}}{\sqrt{10}}$
36) $\frac{\sqrt{8}}{4 \sqrt{6}}$
