Section 4 – Topic 2
Solving Quadratic Equations by Factoring

To solve a quadratic equation by factoring. Write the quadratic in standard form, $ax^2 + bx + c = 0$ and factor out the greatest common factor, if possible.

There are two ways to factor.

Master Product Method

- Use the [redacted] to factor the trinomial.
- Use factoring by grouping.

Then, use the zero product property to find the solutions.

ax^2+bx+c

Let's Practice!

A(C) 1. Consider the equation $2c^2 - 9 = 3c$.

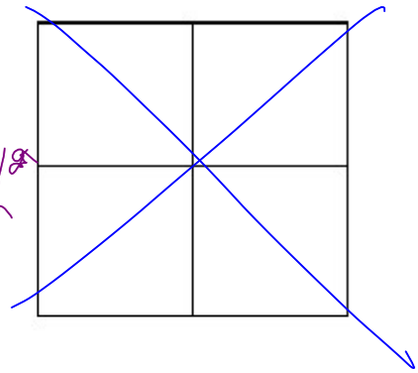
$2c^2-3c-9=0$

$-3c \quad -3c$

$a=2$

a. Use the area model to factor.

Product	Sum (b)
-18	-3
$2(9)$	
$3(6)$	$\frac{3}{2}-\frac{6}{2}$ ÷ by a
	$\frac{3}{2} \quad -3$



$2c^2+3c-6c-9$

$(2c^2+3c)(-6c-9)$

$c(2c+3)-3(2c+3)$

$(2c+3)(c-3)$

b. Factor by grouping.

$(c+\frac{3}{2})(c-3)$

$(2c+3)(c-3)$

Try it!

2. Solve the quadratic equation below using factoring by grouping. Identify the property used in each step to solve the equation.

$$11x + 2 = -5x^2$$

$5x^2 + 11x + 2 = 0$

$a \quad b \quad c$

10	11
$1(10)$	$1 + 10$
	$\frac{1}{5} \quad \frac{10}{5}$
	(2)

$\left(x + \frac{1}{5}\right)(x + 2)$

$(5x + 1)(x + 2)$

Let's investigate factoring by substitution.

Consider the quadratic equation $36x^2 + 60x + 21 = 0$.

Let $u^2 = 36x^2$ in the trinomial.

$\sqrt{u^2} = \sqrt{36x^2}$

$10 \quad 6x$

u

What does $60x$ equal in terms of u?

$u = 6x$

Rewrite the quadratic equation in terms of u. Factor and solve for u.

$u^2 + 10u + 21$

$21 \mid 10$

$3 \quad 7 \mid 3+7$

$(u+3)(u+7) = 0$

$u = -3 \quad u = -7$

Solve for x.

$u = 6x$

$\frac{-3}{6} = 6x$ $\quad x = -\frac{1}{2}$

$\frac{-7}{6} = 6x$ $\quad x = \frac{-7}{6}$

Let's Practice!

3. Use factoring by substitution to solve the equation below.

$$25x^2 + 15x - 18 = 0$$

$u^2 = 25x^2$

$u = 5x$

$u^2 + 3u - 18 = 0$

$(u+6)(u-3) = 0$

$u = -6 \quad u = 3$

$15x = 3(5x)$

$= 3u$

$-18 \mid 3$

$2(9)$

$3(6) \mid 6 \; -3$

$\frac{-6}{5} = 5x \qquad \frac{3}{5} = 5x$

$\frac{-6}{5} = x \qquad \frac{3}{5} = x$

Try It!

4. Use factoring by substitution to solve for x in the equation below.

$$9x^4 - 18x^2 + 8 = 0$$

$6\ 3x^2$

u

$u^2 = 9x^4$

$u = 3x^2$

$u^2 - 6u + 8 = 0$

8	-6
$2(4)$	$-2-4$

$(u-2)(u-4) = 0$

$u = 2, 4$

$\frac{2}{3} = \frac{3x^2}{3}$ $\quad \frac{2}{3} = x^2$

$4 = 3x^2$

$\frac{\sqrt{3}}{\sqrt{3}} \frac{\sqrt{2}}{\sqrt{3}} = x$

$\frac{4}{3} = x^2$ $\quad \frac{\sqrt{4}}{\sqrt{3}} = x$

$= \frac{\sqrt{6}}{3} = x$

$\frac{2}{\sqrt{3}} = x$

$\frac{2\sqrt{3}}{3} = x$

BEAT THE TEST!

1. A rectangle has an area of $4x^2 - 8x + 3$ square units. Which of the following could represent the perimeter of the rectangle in terms of x?

   Ⓐ $2x - 1$
   Ⓑ $2x - 3$
   Ⓒ $4x - 4$
   Ⓓ $8x - 8$

$12 \mid -8$

$2(6) \mid -2 \quad -6$

$3(4) \mid 4 \quad 4$

$\left(x - \frac{1}{2}\right)\left(x - \frac{3}{2}\right)$

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

$P = 2L + 2W = 4x - 2 + 4x - 6 =$

$u=3 \quad u=-1$

2. Giovanni factored $16x^2 - 8x - 3 = 0$ as $(u - 3)(u + 1) = 0$.

Which of the following are solution(s) to $16x^2 - 8x - 3 = 0$? Select all that apply.

- ☐ -1
- ☒ $-\frac{1}{4}$
- ☐ 0
- ☒ $\frac{3}{4}$
- ☐ 3

$u^2 = 16x^2$

$u = 4x$

$3 = 4x \qquad -1 = 4x$

$\frac{3}{4} = x \qquad \frac{-1}{4} = x$