Name: _____ Per: ____

Factoring…*when a ≠ 1*

You know how to factor problems like $f(x) = x^2 - 3x + 2$. All you have to do is find two numbers that multiply to $c = +2$ and add to $b = -3$ →-1 & -2. So, your factors would be $f(x) = (x - 1)(x - 2)$.

The process for factoring problems when $a \neq 1$ is very similar…with an added step or two.

Step 1: Find two numbers that multiply to *ac* and add to *b*.
Step 2: Split *bx* into two pieces using these two numbers.

EXAMPLE: Factor $f(x) = 2x^2 + 2x - 4$

$ac = (2)(-4) = -8$	$b = 2$
Factors of -24: $1 \& -8$ $\quad -1 \& 8$ $2 \& -4$ $\quad -2 \& 4$ *I found it, so I can stop!*	Do they add to +2? $1 + -8\ NO$ $\quad -1 + 8\ NO$ $2 + -4\ NO$ $\quad \boxed{-2 + 4\ YES}$

Use these to split up the *bx* term

$f(x) = 2x^2 + 2x - 4$
$f(x) = 2x^2 - 2x + 4x - 4$

Step 3: Factor out what you can from the group of the first two terms & from the group of the second two terms
The goal is to make what's left in each group the same!

EXAMPLE (cont'd): $f(x) = 2x^2 - 2x + 4x - 4$

Group 1:	$2x^2 - 2x$	Group 2:	$4x - 4$
They're both divisible by $2x$—factor it out!	$2x(x - 1)$	They're both divisible by 4—factor it out!	$4(x - 1)$

Notice that when I factor them, I end up with $(x - 1)$ *for both groups!*

$$f(x) = 2x(x - 1) + 4(x - 1)$$

Step 4: Do the opposite of distribution, and factor the matching group out.

$$\boxed{f(x) = (x - 1)(2x + 4)}$$

EXAMPLE
Factor. $f(x) = 3x^2 + 7x + 2$

$ac = (3)(2) = 6 \qquad b = 7$
Factors of 6:
1 & 6 YES!!!

$f(x) = 3x^2 + 1x + 6x + 2$
$f(x) = 3x^2 + x \quad + 6x + 2$
$f(x) = x(3x + 1) \quad + 2(3x + 1)$
$\boxed{f(x) = (3x + 1)(x + 2)}$

1. Factor. $f(x) = 5x^2 - 8x - 4$

2. Factor. $f(x) = 2x^2 + 8x + 6$

EXAMPLE
Factor. $f(x) = 15x^2 + 7x - 2$

$ac = (15)(-2) = -30 \qquad b = 7$
Factors of -30:
1 & -30 NO -1 & 30 NO
2 & -15 NO -2 & 15 NO
3 & -10 NO -3 & 10 YES!!!

$f(x) = 15x^2 - 3x + 10x - 2$
$f(x) = 15x^2 - 3x \quad + 10x - 2$
$f(x) = 3x(5x - 1) \quad + 2(5x - 1)$
$\boxed{f(x) = (5x - 1)(3x + 2)}$

3. $f(x) = 2x^2 + 2x - 12$

4. $f(x) = 14x^2 + 25x + 3$

Now, we'll add the next step—solving quadratics. Factor and solve for the zeros.

EXAMPLE

$0 = 4x^2 - 16x + 7$

$ac = (4)(7) = 28 \qquad b = -16$

Factors of 28:

-1 & -28 NO

-2 & -14 YES!!!

$0 = 4x^2 - 2x - 14x + 7$

$0 = 4x^2 - 2x \quad - 14x + 7$

We could factor +7 from the end…

$0 = 2x(2x - 1) \quad + 7(-2x + 1)$

BUT we want the (group) to match…

So, factor out -7 instead!

$0 = 2x(2x - 1) \quad - 7(2x - 1)$

$0 = (2x - 1)(2x - 7)$

Now, split it up and solve.

$2x - 1 = 0$ or $2x - 7 = 0$

$2x = 1 \qquad 2x = 7$

$x = \frac{1}{2} \qquad x = \frac{7}{2}$

$x = \boxed{\left\{\frac{1}{2}, \frac{7}{2}\right\}}$

5. $0 = 8x^2 - 37x - 15$

6. $0 = 3x^2 + 19x + 28$

EXAMPLE

$0 = 10x^2 + 11x - 18$

$ac = (10)(-18) = -180 \quad b = 8$

Factors of 28:

-1 & 180 NO 1 & -180 NO

-9 & 20 YES!!!

$0 = 10x^2 - 9x + 20x - 18$

$0 = 10x^2 - 9x \quad + 20x - 18$

$0 = x(10x - 9) \quad + 2(10x - 9)$

$0 = (10x - 9)(x + 2)$

Now, split it up and solve.

$10x - 9 = 0$ or $x + 2 = 0$

$10x = 9 \qquad x = -2$

$x = \frac{9}{10}$

$x = \boxed{\left\{-2, \frac{9}{10}\right\}}$

7. $0 = 4x^2 + 42x - 22$

8. $0 = 6x^2 + 13x + 6$