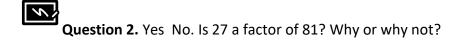
Unit 3. Section 4. Factor Form.

Warm-up.

Question 1. A *factor* of a number is a number that divides that number without a remainder. Write the factors of the following numbers:

- (A)24
- (B) 15
- (C)7



- Question 3. What pairs of integers multiply to 12?
- Question 4. What pairs of integers multiply to -6?

Question 5. Complete the following factorizations.

$$(A)x^2 + 2x = x(\underline{\hspace{1cm}})$$

(B)
$$5x^2 + 10x = 5x(\underline{\hspace{1cm}})$$

(C)
$$x(x + 1) + 2(x + 1) = ($$
_____) $(x + 1)$

$$(D)3x(2x+1) + 5(2x+1) = (\underline{\hspace{1cm}})(2x+1)$$

Forms of quadratic functions

Form Name	Form Equation	Examples
Standard	$f(x) = ax^2 + bx + c, a \neq 0$	$f(x) = x^2 + x - 3$
Vertex	$f(x) = a(x-h)^2 + k, a \neq 0$	$f(x) = (x-1)^2 - 3$
Factored	$f(x) = a(x - p)(x - q), a \neq 0$	f(x) = (x-2)(x+3)

Practice 1. Given the function f(x) = 3(x-1)(x-2) in factor form, what are the values for the constants a, p, q?

$$a =$$
__

$$q = _$$

What is the standard form of the function f?

Method 1: The crab claws

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

$$f(x) = \underline{\hspace{1cm}}$$

Method 2: The box method

	x	-2
x		
-1		

Conversions between the standard form and factor form

To convert the equation of a quadratic function from the factor form, we use the distributive property and simplification using the following steps:

- 1. Multiply the binomials x p and x q.
- 2. Simplify the expression by adding the x-terms.
- 3. Multiply the trinomial from step 2 by a.

To convert the equation of a quadratic function in standard form to factor form is called **factoring**. We will learn several strategies to factor.

Split the Middle

We are given a function in standard form. For example, $f(x) = x^2 - 8x + 12$.

Our goal is to calculate p and q such that $f(x) = x^2 - 8x + 12 = (x - p)(x - q)$

First, we simplify the right-hand side of the equation.

Method 1: The crab claws

$$= x^2 - (p+q)x + pq$$

(x-p)(x-q)

Method 2: The square method

$$x$$
 x^2

-px

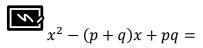
-q

-qx

pq

-p

Set the two equations equal.



These are equal if the coefficients of x^2 , x and the constant term are equal.

$$-(p+q) =$$

3.4. Factor Form



Search for pairs of numbers that multiply to 12 and add up to 8.

Pair	Sum
1,	13
2,	
3,	
4,	

We found
$$p =$$
____ and $q =$ ____

The factor form is
$$f(x) =$$

Check the result

3.4. Factor Form

General strategy

Given a quadratic function in standard form with a=1, $f(x)=x^2+bx+c$, to convert the function to the factored form we

- 1. List pairs of numbers that multiply to c.
- 2. If a pair adds up to a number different than -b we discard the pair.
- 3. If a pair adds up to -b we keep the pair. We will use the variables p and q to denote the pair.
- 4. The factor form is f(x) = (x p)(x q).

Suggestions to reduce the number of pairs checked:

	pq > 0	pq < 0
p+q>0	Check positive divisors of pq .	Check one positive and one negative divisor with the positive one greater than the absolute value of the negative divisor.
p+q<0	Check negative divisors of pq .	Check one positive and one negative divisor with the positive one smaller than the absolute value of the negative divisor.