Your Name

Mrs. Theo

Factoring Trinomials

a = 1

3 / 5 / 2021

Notes

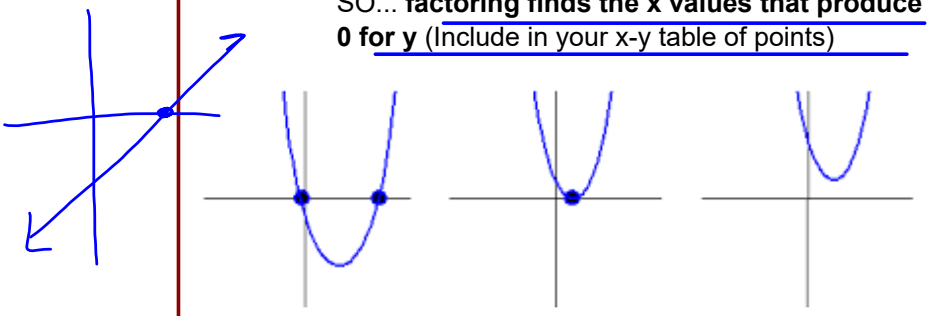
Quadratic Equations

Standard Form: $ax^2 + bx + c = 0$ where $a \neq 0$

Solutions/Roots/Zeros of an equation:

the x intercepts of the function, where y is 0 → (_, 0)

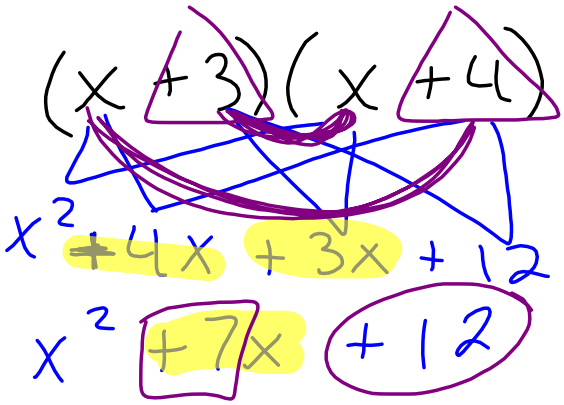
SO... **factoring finds the x values that produce 0 for y** (Include in your x-y table of points)



Graph Description	When the function touches the x-axis twice	When the function touches the x-axis once	When the function doesn't cross the x-axis at all
	$(x_1,0)$ and $(x_2,0)$	(technically it touches twice, it goes to and back within the same point)	
	$x = x_1$ and $x = x_2$		
Type of Factor solutions	**Two Solutions**	**One Solution**	**No Real Solutions**
	Factors are different	Factors are the same	Not Factorable
	(x - 2)(4x + 3)	(3x - 2)(3x - 2)	
	Real Number solutions	Real Number solution	Imaginary solutions

Remember Distributing with Binomials

Every term in the first polynomial factor gets multiplied "distributed" to every term in the second polynomial factor



$3 \cdot 4 = 12$

$3 + 4 = 7$

Factoring a Trinomial

X organizational Tool

$1x^2 + bx + c \longrightarrow (x + m)(x + n)$

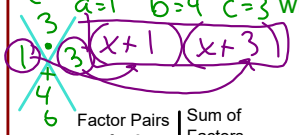
Notice: Three terms and the coefficient of x^2 is 1.

Step 1: Find two numbers that multiply to the last number c, and add to the middle term b.

___ • ___ = c ___ + ___ = b

Step 2: put one number with the (x +) factor and the other number with the other (x +)

ex. $1x^2 + 4x + 3$ $a=1$ $b=4$ $c=3$



Factor Pairs for 3	Sum of Factors

Check your work with a smile!

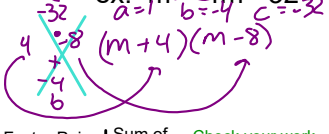
$(x+1)(x+3)$

$x^2 + 3x + x + 3$

$x^2 + 4x + 3$

$ax^2 + bx + c$

ex. $m^2 - 4m - 32$ $a=1$ $b=-4$ $c=-32$



Factor Pairs for -32	Sum of Factors
-1, 32	31
1, -32	-31
-2, 16	14
2, -16	-14
-4, 8	4
4, -8	-4

Check your work with a smile!

3. $r^2 - 3r + 2$

$(r-1)(r-2)$

Factor each trinomial

$r^2 - 3r + 2$

$(r-2)(r-1)$

c: 2; −2, −1; +; −3; b

$x^2 + 6x + 5$

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

a=1 b=6 c=5

c: 5; 1, 5; +; 6; b

$x^2 - x - 6$

$(x-3)(x+2)$

−6; −3, 2; +; −1

$x^2 - 5x - 6$

$(x-6)(x+1)$

−6; −6, 1; +; −5

Distributing

Binomials

Box Method

Area is b·h, so multiplying polynomials is like finding the area of a rectangle!

You find the area of each little rectangle inside of it and then add all the areas together

$(x+3)(2x+4)$

	x	$+3$
$2x$	$2x^2$	$6x$
4	$4x$	12

Area

$2x^2+6x+4x+12$

$2x^2+10x+12$

Factoring a Trinomial

Box Method

Guess and Check

$x^2 + bx + c \longrightarrow (x + m)(x + n)$

Box Method: The polynomial is the area inside the box, and the factors are the length and width we are finding

Guess and check

ex. $x^2 + 4x + 3$

$(x+3)(x+1)$ $3 = 4x$

	x	3
x	x^2	$3x$
1	$1x$	3

Factor Pairs for 3	Sum of Factors

ex. $m^2 - 4m - 32$

$(m-8)(m+4)$ -8

	m	
m	m^2	$-8m$ $= -4m$
4	$4m$	-32

Factor Pairs for -32	Sum of Factors

Factor each trinomial

$r^2 - 4r - 12$

$(r-6)(r+2)$

	r	-6
r	r^2	$-6r$
2	$2r$	-12

$x^2 - 7x + 12$

$(x-4)(x-3)$

	x	-4
x	x^2	$-4x$
-3	$-3x$	12

$x^2 + 8x + 12$

$(x+2)(x+6)$

	x	2
x	x^2	$2x$
6	$6x$	12

$x^2 - 11x - 12$

$(x+1)(x-12)$

	x	1
x	x^2	$1x$
-12	$-12x$	-12

Discussion Time:

What did you notice as you went through these?

Factoring a Trinomial

$x^2 + bx + c \longrightarrow (x + m)(x + n)$

Notice: Three terms and the coefficient of x^2 is 1.

Step 1: Find two numbers that multiply to the last number c, and add to the middle term b.

• = c
+ = b

Step 2: put one number with the (x +) factor and the other number with the other (x +)

last c • + b middle

ex. $x^2 - 8x + 7$

a=1 b=-8 c=7

$(x-1)(x-7)$

-1 • -7 = 7
-1 + -7 = -8

Factor Pairs for 7	Sum of Factors
1, 7	8
-1, -7	-8

ex. $m^2 - 12m - 32$

b=-12 c=-32

Not Factorable

-32 • +
-12

Factor Pairs for -32	Sum of Factors
-1, 32	31
1, -32	-31
-2, 16	14
2, -16	-14
-4, 8	4
4, -8	-4

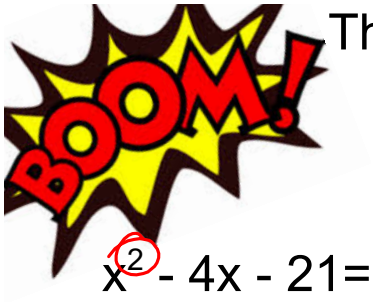
Remember: It is the simple things in life. . . .

The Zero Product Property

Anything times 0 equals 0

a(0)= 0 (0)b = 0

if ab = 0 then **either b was 0 or a was 0**



There it is! Use your new skills to solve the equation.

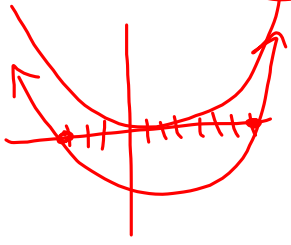
$x^2 - 4x - 21 = 0$

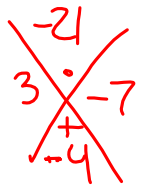
$(x+3)(x-7)=0$

$x+3=0$ $\quad$ $x-7=0$

$-3\ -3$ $\quad$ $+7\ +7$

$x=-3$ $\quad$ $x=7$





make it $=0$

$x^2 - 22x = -121$

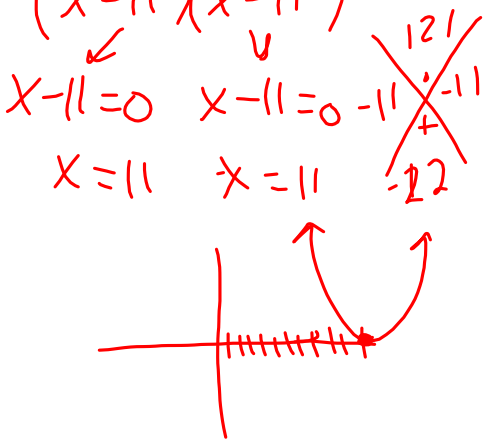
$+121\ \ +121$

$x^2 - 22x + 121 = 0$

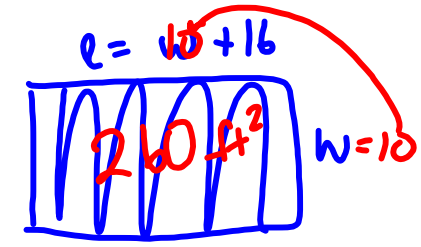
$(x-11)(x-11)=0$

$x-11=0$ $\quad$ $x-11=0$

$x=11$ $\quad$ $x=11$



A rectangle has a length 16 feet longer than its width and an area of 260 feet. What is it's dimensions?



10ft x 26ft

$A = lw$

$A = (w+16)w$

$A = w^2 + 16w$

$260 = w^2 + 16w$

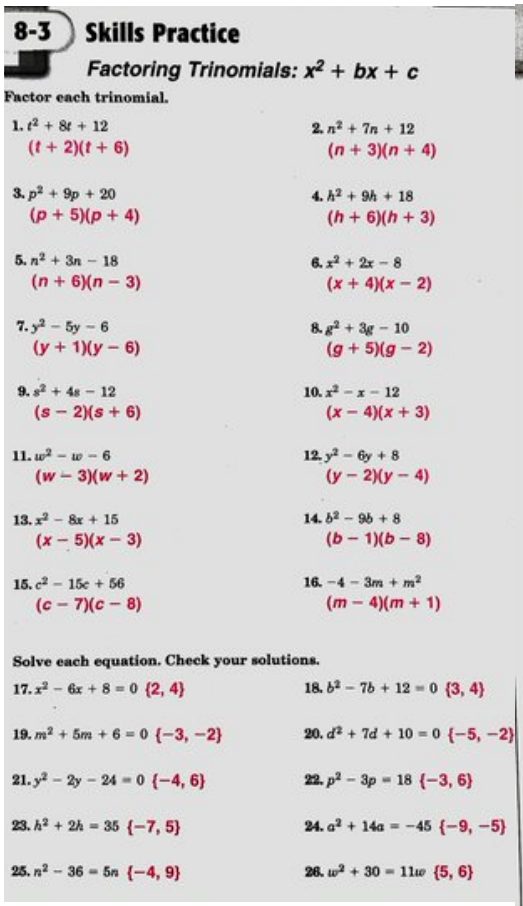
$-260 \quad -260$

$0 = w^2 + 16w - 260$

$0 = (w+26)(w-10)$

$w + 26 = 0 \quad w - 10 = 0$

$w = -26 \quad w = 10$ ft



8-3 Skills Practice

Factoring Trinomials: $x^2 + bx + c$

Factor each trinomial.

1. $t^2 + 8t + 12$ — $(t + 2)(t + 6)$
2. $n^2 + 7n + 12$ — $(n + 3)(n + 4)$
3. $p^2 + 9p + 20$ — $(p + 5)(p + 4)$
4. $h^2 + 9h + 18$ — $(h + 6)(h + 3)$
5. $n^2 + 3n - 18$ — $(n + 6)(n - 3)$
6. $x^2 + 2x - 8$ — $(x + 4)(x - 2)$
7. $y^2 - 5y - 6$ — $(y + 1)(y - 6)$
8. $g^2 + 3g - 10$ — $(g + 5)(g - 2)$
9. $s^2 + 4s - 12$ — $(s - 2)(s + 6)$
10. $x^2 - x - 12$ — $(x - 4)(x + 3)$
11. $w^2 - w - 6$ — $(w - 3)(w + 2)$
12. $y^2 - 6y + 8$ — $(y - 2)(y - 4)$
13. $x^2 - 8x + 15$ — $(x - 5)(x - 3)$
14. $b^2 - 9b + 8$ — $(b - 1)(b - 8)$
15. $c^2 - 15c + 56$ — $(c - 7)(c - 8)$
16. $-4 - 3m + m^2$ — $(m - 4)(m + 1)$

Solve each equation. Check your solutions.

17. $x^2 - 6x + 8 = 0$ {2, 4}
18. $b^2 - 7b + 12 = 0$ {3, 4}
19. $m^2 + 5m + 6 = 0$ {−3, −2}
20. $d^2 + 7d + 10 = 0$ {−5, −2}
21. $y^2 - 2y - 24 = 0$ {−4, 6}
22. $p^2 - 3p = 18$ {−3, 6}
23. $h^2 + 2h = 35$ {−7, 5}
24. $a^2 + 14a = -45$ {−9, −5}
25. $n^2 - 36 = 5n$ {−4, 9}
26. $w^2 + 30 = 11w$ {5, 6}

8-3 Study Guide and Intervention

Factoring Trinomials: $x^2 + bx + c$

Factor $x^2 + bx + c$ To factor a trinomial of the form $x^2 + bx + c$, find two integers m and n, whose sum is equal to b and whose product is equal to c.

Factoring $x^2 + bx + c$	$x^2 + bx + c = (x + m)(x + n)$, where $m + n = b$ and $mn = c$.

Example 1 **Factor each trinomial.**

a. $x^2 + 7x + 10$

In this trinomial, $b = 7$ and $c = 10$.

Factors of 10	Sum of Factors
1, 10	11
2, 5	7

Since $2 + 5 = 7$ and $2 \cdot 5 = 10$, let $m = 2$ and $n = 5$.

$x^2 + 7x + 10 = (x + 5)(x + 2)$

b. $x^2 - 8x + 7$

In this trinomial, $b = -8$ and $c = 7$. Notice that $m + n$ is negative and mn is positive, so m and n are both negative. Since $-7 + (-1) = -8$ and $(-7)(-1) = 7$, $m = -7$ and $n = -1$.

$x^2 - 8x + 7 = (x - 7)(x - 1)$

Example 2 **Factor $x^2 + 6x - 16$**

In this trinomial, $b = 6$ and $c = -16$. mn is negative and mn is ne... means $m + n$ is positive and mn is ne... Make a list of the factors of -16, whe... factor of each pair is positive.

Factors of −16	Sum of Factors
1, −16	−15
−1, 16	15
2, −8	−6
−2, 8	6

Therefore, $m = -2$ and $n = 8$.

$x^2 + 6x - 16 = (x - 2)(x + 8)$

Exercises

Factor each trinomial.

1. $x^2 + 4x + 3$ — $(x + 3)(x + 1)$
2. $m^2 + 12m + 32$ — $(m + 4)(m + 8)$
3. $r^2 - 3r + 2$ — $(r - 2)(r - 1)$
4. $x^2 - x - 6$ — $(x - 3)(x + 2)$
5. $x^2 - 4x - 21$ — $(x - 7)(x + 3)$
6. $x^2 - 22x + 121$ — $(x - 11)(x - 11)$
7. $c^2 - 4c - 12$ — $(c + 2)(c - 6)$
8. $p^2 - 16p + 64$ — $(p - 8)(p - 8)$
9. $9 - 10x + x^2$ — $(9 - x)(1 - x)$
10. $x^2 + 6x + 5$ — $(x + 5)(x + 1)$
11. $a^2 + 8a - 9$ — $(a - 1)(a + 9)$
12. $y^2 - 7y - 8$ — $(y - 8)(y + 1)$
13. $x^2 - 2x - 3$ — $(x - 3)(x + 1)$
14. $y^2 + 14y + 13$ — $(y + 1)(y + 13)$
15. $m^2 + 9m + 20$ — $(m + 4)(m + 5)$
16. $x^2 + 12x + 20$ — $(x + 10)(x + 2)$
17. $a^2 - 14a + 24$ — $(a - 2)(a - 12)$
18. $18 + 11y + y^2$ — $(9 + y)(2 + y)$
19. $x^2 + 2xy + y^2$ — $(x + y)(x + y)$
20. $a^2 - 4ab + 4b^2$ — $(a - 2b)(a - 2b)$
21. $x^2 + 6xy - 7y^2$ — $(x + 7y)(x - y)$