No quiz today, 3.2 HW is due today.

Questions on 3.3 HW??

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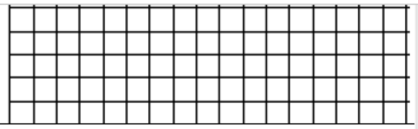
as $x \to -\infty$, $y \to$ ____

as $x \to \infty$, $y \to$ ____



10.	Equation: $h(x) = 2(x-3)+1$

$2x - 6 + 1$

What I know about this function: $2x - 5$

linear

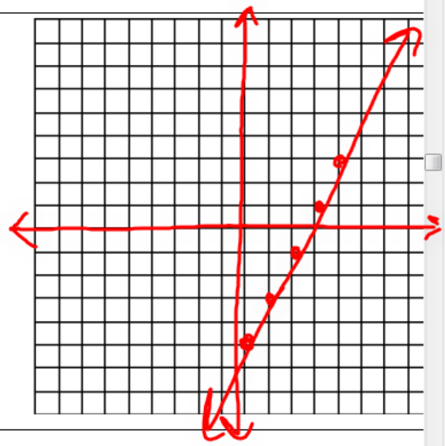
m is $+2$

End behavior:

as $x \to -\infty$, $h(x) \to$ $-\infty$

as $x \to \infty$, $h(x) \to$ ∞

Graph:



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Linear:

1. Standard form: $ax + by = c$

$\frac{by}{b} = \frac{-ax + c}{b}$

$y = -\frac{a}{b}x + \frac{c}{b}$

$-\frac{a}{b}$: slope

$\frac{c}{b}$: y-intercept

2. Slope-intercept form: $y = mx + b$

m: slope

b: y-intercept

3. Point-slope form: $y = m(x - x_1) + y_1$

m: slope

(x_1, y_1): point on graph

Quadratic:

4. Standard form: $y = ax^2 + bx + c$

c : y-intercept

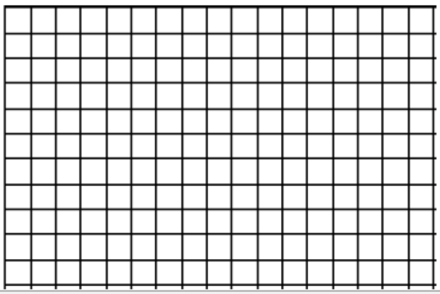
5. Factored form: $y = a(x - r_1)(x - r_2)$

r_1 & r_2 : x-intercepts, roots, solutions, zeroes

6. Vertex form: $y = a(x - h)^2 + k$

vertex: (h, k)

For each, write what you know about the function (including end behavior) and then graph.

7.	Equation: $f(x) = (x - 3)(x + 4)$	Graph:
	What I know about this function: End behavior:	

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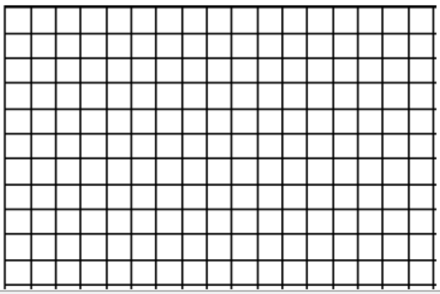
End behavior:

Graph:



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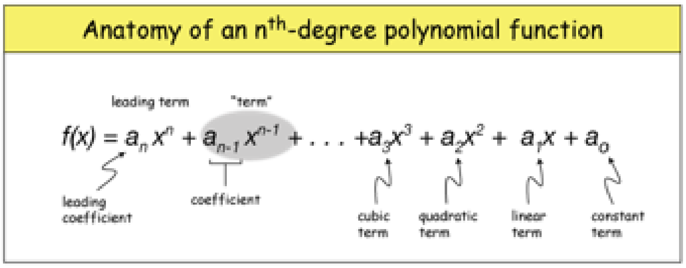
Factoring Review

Notation for polynomials:



A **trinomial** has three terms.

A **binomial** has two terms

Greatest common factor:

The first thing you should do when factoring a polynomial is to look for the largest factor common to every term. The greatest common factor of a polynomial is the greatest common factor of the coefficients times the greatest common factor of the variable(s) in the terms.

EXAMPLE: Factor $8p^6q^2 - 4p^5q^3 + 10p^4q^4$.

$2 \cdot 2 \cdot 2 \cdot p \cdot p \cdot p \cdot p \cdot p \cdot p \cdot q \cdot q - 2 \cdot 2 \cdot p \cdot p \cdot p \cdot p \cdot p \cdot q \cdot q \cdot q + 2 \cdot 5 \cdot p \cdot p \cdot p \cdot p \cdot q \cdot q \cdot q \cdot q$

$2p^4q^2(4p^2 - 2pq + 5q^2)$

The greatest common factor of the coefficients 8, -4, and 10 is **2**.
The greatest common factor of p^6, p^5, and p^4 is $\boldsymbol{p^4}$.
The greatest common factor of q^2, q^3, and q^4 is $\boldsymbol{q^2}$.

So we can factor out $2p^4q^2$, and

$$8p^6q^2 - 4p^5q^3 + 10p^4q^4 = 2p^4q^2 \cdot 4p^2 - 2p^4q^2 \cdot 2pq + 2p^4q^2 \cdot 5q^2 = 2p^4q^2(4p^2 - 2pq + 5q^2)$$

Check your factorization by distributing. You should end up with your original polynomial.

If the terms of a polynomial have no common factors, the polynomial is **prime**.

When the leading coefficient is a negative number, we generally factor out a common factor with a negative coefficient. Thus: $-2x^3+6x^2-2x=-2x(x^2-3x+1)$

YOUR TURN: Factor out the greatest common factor.

a) $6a^2x^3+20a^3x^8-4a^5x^3$

$2a^2x^3(3+10ax^5-2a^3)$

$\frac{6\cancel{a^2}\cancel{x^3}}{2\cancel{a^2}\cancel{x^3}}=3$ $\frac{\cancel{20}^{10}a^{\cancel{3}}x^{\cancel{8}5}}{\cancel{2}\cancel{a^2}\cancel{x^3}}=10ax^5$

b) $-4x-24$

$-4(x+6)$

c) $-3a^4-6a^2+3a$

$-3a(a^3+2a-1)$

d) $16t^8+40t^6-24t$

$8t(2t^7+5t^5-3)$

Factoring trinomials of the type x^2+bx+c ***:***

Recall the FOIL method of multiplying two binomials:

$$(x+3)(x+5)=x\cdot x+x\cdot 5+3\cdot x+3\cdot 5=x^2+3x+5x+15=x^2+8x+15$$

To factor a trinomial in the form x^2+bx+c, we undo the FOILing process. If a trinomial in this form can be factored, the factorization will look like this: $(x+p)(x+q)$, where p and q are two numbers whose product is c and whose sum is b.

EXAMPLE: Factor x^2+9x+8.

$x^2+9x+8=(x+\_\_\_\_\_)(x+\_\_\_\_\_)$. To fill in the blanks, find two numbers whose product is 8 and whose sum is 9.

Factors of 8: 2, 4 and 8, 1
2 + 4 = 6, 8 + 1 = 9. The two numbers we are looking for are 8 and 1

So $x^2+9x+8=(x+8)(x+1)$

Use these patterns when factoring a trinomial in the form $x^2 + bx + c$:

If c is **negative**, one of its factors will be negative, one will be positive.
If c is **positive** and b is **negative**, both factors of c will be negative.
If c is **positive** and b is **positive**, both factors of c will be positive.

If a trinomial cannot be factored, it is **prime**.

Check your factorization by FOILing it out. You should get the original trinomial.

YOUR TURN: Factor each of the following trinomials.

a) $y^2 + 5y + 6$

$(y+2)(y+3)$

b) $x^2 - 7x + 12$

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

c) $y^2 + 5y - 36$

$(y+9)(y-4)$

d) $x^2 - 7x - 30$

$(x-10)(x+3)$

e) $x^3 - x^2 - 30x$ (HINT: Factor out the greatest common factor first.)

$x(x^2 - x - 30) = x(x-6)(x+5)$

Factoring trinomials of the type ax^2+bx+c:

Let's work through this using the trinomial $3x^2-10x-8$. If this factors, it will factor to two binomials (___ + ___)(___ + ___)

1. List possible **F**irst terms whose product is ax^2. Write them as the first terms in each binomial factor.
   $3x^2 = 3x \cdot x$ so the factorization starts looking like this: $(3x + \_\_\_)(x + \_\_\_)$

2. List possible **L**ast terms whose product is c.
   Factors of -8 : 1, -8   -8, 1   2, -4   -4, 2
   -1, 8   1, -8   -2, 4   4, -2

3. Use the correct set of factors, in the correct order, so that the sum of the products of the **O**utside terms and the **I**nside terms is equal to bx.
   Try: $(3x+1)(x-8)$. Since $(3x)(-8)+(1)(x) = -23x \neq -10x$, this doesn't work
   HINT: Changing the signs on 1 and -8 will give $23x$, which also won't work.
   $(3x-8)(x+1)$. Since $(3x)(1)+(-8)(x) = -5x \neq -10x$, this doesn't work.
   $(3x+2)(x-4)$. Since $(3x)(-4)+(2)(x) = -10x$, this is the correct factorization!

Check your factorization by FOILing it out. You should get your original trinomial.

$3x^2-10x-8$

$(3x^2-12x)+(2x-8)$

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

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

a · c
3 · -8 =
-24

12x   2x

-10

b

-24

-12   2

3x   -10   3x

$\frac{-4}{x} \leftarrow \frac{-12}{3x}$

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

YOUR TURN: Factor each of the following trinomials.

-40

10   -4

6

a) $2y^2-y-6$

b) $8x^2+6x-5$

$(8x^2-4x)+(10x-5)$

$4x(2x-1)+5(2x-1)$

$(2x-1)(4x+5)$

-40

$(4x+5) \leftarrow \frac{5}{4x} \leftarrow \frac{10}{8x}$ $\frac{-4}{8x} \rightarrow \frac{-1}{2x} \rightarrow (2x-1)$

6

$(4x+5)(2x-1)$

c) $6t^2+t-15$

d) $2y^2+9y+9$

Special patterns to watch for:

1. $a^2 + 2ab + b^2 = (a+b)^2$

EXAMPLE: $16 + 8x + x^2$ - Notice that $16 = 4^2$, so $a = 4$ and $x^2 = b^2$, so $b = x$. In addition, $8x = 2 \cdot 4 \cdot x = 2ab$. This fits the pattern, so the factorization is $(4+x)^2$.

2. $a^2 - 2ab + b^2 = (a-b)^2$

EXAMPLE: $25x^2 - 20x + 4$ - Notice that $25x^2 = (5x)^2$, so $a = 5x$ and $4 = 2^2$, so $b = 2$. In addition, $20x = 2 \cdot 5x \cdot 2 = 2ab$. This fits the pattern, so the factorization is $(5x-2)^2$.

3. $a^2 - b^2 = (a+b)(a-b)$

EXAMPLE: $9t^2 - 64$ - Notice that $9t^2 = (3t)^2$, so $3t = a$, and $64 = 8^2$, so $8 = b$. This fits the pattern, so the factorization is $(3t+8)(3t-8)$.

YOUR TURN: Factor each of the following.

a) $x^2 - 49$

b) $36y^2 - 12y + 1$

c) $n^2 + 18n + 81$

d) $25y^4 - 100$

Summary:

- Always factor out any common factors first.
- Factor any remaining trinomials or binomials, if possible, using the instructions given above. If the remaining trinomial or binomial cannot be factored, leave it.

Homework

Factoring Worksheet