

# Factoring "Cheat Sheet"

## Factoring by GCF

- ① Find the GCF of the terms
- ② Factor out the GCF

Ex:  $10y^3 + 20y^2 - 5y$   
 $5y(2y^2 + 4y - 1)$

Ex:  $12x^2 + 4x$   
 $4x(3x + 1)$

## Factoring by Grouping

- ① Pair up the first two terms and the last two terms
- ② Factor out the GCF of the pairs of terms
- ③ Factor out the common binomial

Ex:  $12a^3 - 9a^2 + 20a - 15$   
 $3a^2(4a - 3) + 5(4a - 3)$   
 $(3a^2 + 5)(4a - 3)$

## Factoring $x^2 + bx + c$ ( $a=1$ )

- ① Find two numbers that add to  $b$  + multiply to  $c$
- ② Create parentheses  $(x \quad)(x \quad)$
- ③ Fill in the blanks with the numbers you found in step 1

Ex:  $x^2 + 6x + 8$   
 $(x + 4)(x + 2)$   
Add: 6  
Multiply: 8  
4 + 2 are the #s

Ex:  $x^2 - 10x + 16$   
 $(x - 2)(x - 8)$   
Add: -10  
Multiply: 16  
-2 + -8 are the #s

## Factoring $ax^2 + bx + c$ ( $a > 1$ )

Method 1: Guess + check

Ex:  $2x^2 + 11x + 12$   
think about factors of 2 + factors of 12  
pick the "middle" factors to start your guess  
think about whether they should be positive or negative

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

turn to back  
→

## Factoring $ax^2+bx+c$ ( $a>1$ )

Method 2:

- ① Find two numbers that multiply to  $a \cdot c$  and add to  $b$
- ② split apart the middle term
- ③ factor by grouping.

Ex:  $2x^2+11x+12$

$2x^2+8x+3x+12$   
add: 11  
multiply: 24  
#s: 8+3

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

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

Ex:  $5x^2-14x+8$

$5x^2-10x-4x+8$   
add: -14  
multiply: 40  
#s: -4+ -10

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

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

## Special Products

### Perfect Square Trinomial

turn out to be a binomial times a binomial

Ex:  $4x^2-12x+9$

$(2x-3)^2$

### Difference of Squares

If two terms are perfect squares with subtraction in between, think about each term's square root in order to factor.

Ex:  $x^2-81$   $\sqrt{x^2}=x$   
 $\sqrt{81}=9$

$(x-9)(x+9)$

$9p^4-16q^2$   $\sqrt{9p^4}=3p^2$   
 $\sqrt{16q^2}=4q$

$(3p^2-4q)(3p^2+4q)$

## Factoring Review Homework I

Factor by taking out the GCF

1)  $8x^2 - 16x$

2)  $24r^2 - 6r^4$

3)  $64ab^4 - 16a$

Factor by Grouping

4)  $x^3 + 2x^2 + 5x + 10$

5)  $x^3 - 4x^2 + x - 4$

6)  $2x^3 - 8x^2 - 3x + 12$

Factor Trinomials (always take out the GCF first!!!)

7)  $7x^2 - 31x - 20$

8)  $4x^2 + 34x + 42$

9)  $x^2 - 5x + 6$

Factor Special Products (perfect square trinomials and difference of squares)

10)  $49x^2 - 100$

11)  $9x^2 - 6x + 1$

Why are these not factorable?

12)  $x^2 + x + 5$

13)  $2x^2 - x - 7$

Solve by Factoring (Get everything to one side first! Then factor. Then use the Zero Product Property.)

14)  $4x^2 - 9x + 2 = 0$

15)  $x^2 + 2x = 15$

16)  $3x^2 = 2x + 1$

17)  $2x^2 = 13x + 7$

There is a back!

18)  $6x^2 + x = 5$

19)  $5x^2 - x - 18 = 0$

**Word Problems**

20) The height of a diver above the water during a dive can be modeled by  $h = -16t^2 + 8t + 48$ , where  $h$  is height in feet and  $t$  is time in seconds. Find the time it takes for the diver to reach the water.

21) The length of a rectangle is 1 foot less than 3 times the width. The area is  $310 \text{ ft}^2$ .

Find the dimensions of the rectangle.

**Critical Thinking**

22) Can you solve  $(x - 2)(x + 3) = 5$  by solving  $x - 2 = 5$  and  $x + 3 = 5$ . Why or why not?