

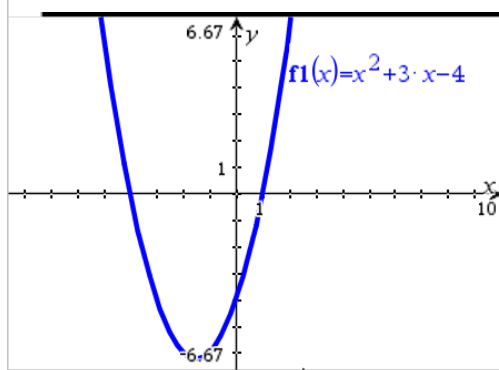
# Factoring

**Learning Goals**  
- review factoring from grade 10

## Why is Factoring Important ????

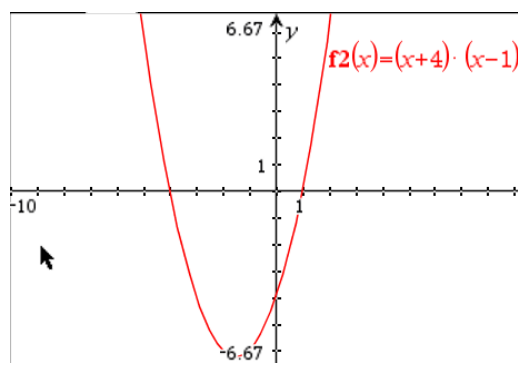
Graph on your Nspire ...

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

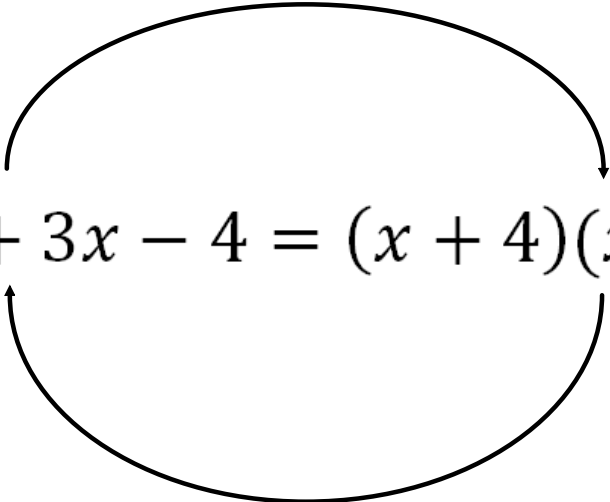


Now Graph on your Nspire ...

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



Introduced in Grade 10  
Mastered in Grade 11U  
Used extensively in Grade 12U

$$x^2 + 3x - 4 = (x + 4)(x - 1)$$
A diagram illustrating the factoring process. The equation  $x^2 + 3x - 4 = (x + 4)(x - 1)$  is shown. Two curved arrows are drawn around the equation. One arrow starts at the  $x^2$  term on the left and points to the  $x$  term in the first factor  $(x + 4)$  on the right. The other arrow starts at the  $-4$  term on the left and points to the  $-1$  term in the second factor  $(x - 1)$  on the right.

**Let's get our brain moving...**

**What two numbers ...**

**Multiply to : 12**  
**Add to: 7**

**Answer: 3 & 4**



**Multiply to : 56**  
**Add to: 15**

**Answer: 7 & 8**



**What two numbers ...**

**Multiply to : 36**

**Add to: 15**

**Answer: 12 & 3**

**Multiply to : 12**

**Add to: -7**

**Answer: -3 & -4**

**What two numbers ...**

**Multiply to : -12**

**Add to: 4**

**Answer: 6 & -2**

**Multiply to : -40**

**Add to: -6**

**Answer: -10 & 4**

**Factor** - express a polynomial as the product of 2 or more algebraic expressions

**Common Factor** - take out (divide) what all the terms have in common

$$\begin{aligned} \underline{ex} \quad 3x + 6 \\ = 3(x + 2) \end{aligned}$$

## On the Boards...

Today you are teaching yourself!

- encourages thinking
- look for patterns
- you have done factoring in grade 10
- for the first questions you can use your TI-Nspire to get the answers and then figure out a pattern / rule to do it without the calculator

## Worksheet #1

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Session: \_\_\_\_\_

## Sum &amp; Product Puzzle: Set 1

In each diagram below, write the two numbers on the sides of the "X" that are *multiplied* together to get the top number of the "X," but *added* together to get the bottom number of the "X."

1. 
$$\begin{array}{c} \diagup 9 \diagdown \\ \diagdown -6 \diagup \end{array}$$

2. 
$$\begin{array}{c} \diagup 4 \diagdown \\ \diagdown 4 \diagup \end{array}$$

3. 
$$\begin{array}{c} \diagup -30 \diagdown \\ \diagdown -13 \diagup \end{array}$$

4. 
$$\begin{array}{c} \diagup -84 \diagdown \\ \diagdown 5 \diagup \end{array}$$

5. 
$$\begin{array}{c} \diagup -24 \diagdown \\ \diagdown -5 \diagup \end{array}$$

6. 
$$\begin{array}{c} \diagup 6 \diagdown \\ \diagdown -5 \diagup \end{array}$$

7. 
$$\begin{array}{c} \diagup -15 \diagdown \\ \diagdown -14 \diagup \end{array}$$

8. 
$$\begin{array}{c} \diagup -75 \diagdown \\ \diagdown -10 \diagup \end{array}$$

9. 
$$\begin{array}{c} \diagup 12 \diagdown \\ \diagdown 7 \diagup \end{array}$$

## Common Factor

$$10x^2 - 5x$$

$$= 5x(2x - 1)$$

$$15a^3 + 10a^2 + a$$

$$= a(15a^2 + 10a + 1)$$

$$3a^5 + 5a^3$$

$$= a^3(3a^2 + 5)$$

$$3(a+2) + 5a(a+2)$$

$$= (a+2)(3+5a)$$

## Trinomial Factoring

**Note: Always common factor FIRST if possible.**

Case 1:  $x^2$  has a coefficient of 1

$$f(x) = x^2 + 5x + 6$$

$$= (x + 3)(x + 2)$$

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

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

$$f(x) = x^2 - 7x + 12$$

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

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

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

$$= 2(x - 3)(x - 1)$$

Case 2:  $x^2$  has a coefficient other than 1

$$y = 6a^2 + 5a - 4$$

$$\begin{array}{ccc} & -24 & \\ 8 & \times & -3 \\ & 5 & \end{array}$$

$$\begin{array}{l} 3a \\ 4 \end{array}$$

	$2a$	$-1$
$6a^2$	$-3x$	
$8x$	$-4$	

$$y=12x^2-5x-3$$

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

$$y=6x^2-14x+4$$

$$= 2(3x^2 - 7x + 2)$$

$$= 2(x-2)(3x-1)$$

$$y=21x^2-34x+8$$

$$= (7x-2)(3x-4)$$

$$y=3x^2+17x+10$$

$$= (3x+2)(x+5)$$

**What do I need to know...**

**- must be able to factor without the calculator**

**Seatwork**

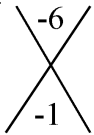
**Handout**

Name: \_\_\_\_\_ Period: \_\_\_\_\_ Session: \_\_\_\_\_

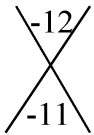
**Sum & Product Puzzle: Set 2**

In each diagram below, write the two numbers on the sides of the "X" that are multiplied together to get the top number of the "X," but added together to get the bottom number of the "X."

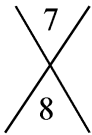
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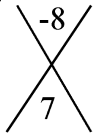
2.



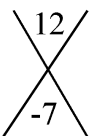
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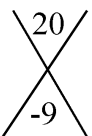
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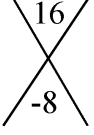
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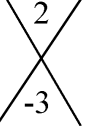
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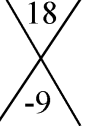
7.



8.



9.



### Worksheet #2

**Factoring by Using the GCF Worksheet**

For each problem below, factor by finding the GCF.

1) $2a^4 + 8a$	2) $5x^3 - 10$
3) $8ab^3 - 12a^3b^3$	4) $10c^3d^3 - 15cd^3$
5) $15f - 20g^2$	6) $3y^4 + 9y^2 - 15$
7) $10d^7 + 2d^5$	8) $7w^5 - 35w^2$
9) $2x + 2y$	10) $-32y^2 - 24y$
11) $6x^3yz + 2xy^2z - 4xyz$	12) $12a^3b^2c^2 - 4a^2bc^2 + 8a^2c - 16ab$



### Worksheet #3

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_  
 MCR3U, Worksheet, Factoring Quadratic Expressions

Factor each of the following completely (Remember to look for greatest common factor):

1. $z^2 + 8z + 16$	2. $y^2 - 8y - 48$	3. $x^2 - 7x + 12$
4. $x^2 - 2x - 24$	5. $x^2 - x - 30$	6. $d^2 - 16$
7. $3v^2 + 9v - 30$	8. $2s^2 + 4s - 6$	9. $7a^2 - 21$
10. $5c^2 - 25c - 30$	11. $25x^2 - 4$	12. $3x^2 - 27x - 30$
13. $100 - 4x^2$	14. $p^2 - 4p - 21$	15. $9 - a^2$
16. $-8s^2 + 50$	17. $4h^2 - 12h - 16$	18. $4a^2 + 8a$
19. $2a^2 + 6a - 8$	20. $-2w^2 + 32$	21. $z^4 - 13z^2 + 36$

### Worksheet #2

#### Factoring by Using the GCF Worksheet

For each problem below, factor by finding the GCF.

1) $2a^2 + 8a$ $= 2a(a^2 + 4)$	2) $5x^3 - 10$ $= 5(x^3 - 2)$
3) $8ab^3 - 12a^2b^3$ $4ab^3 \left( \frac{8ab^3 - 12a^2b^3}{4ab^3} \right)$ $= 4ab^3(2 - 3ab)$	4) $10c^3d^3 - 15cd^3$ $= 5cd(2c^2d - 3d^2)$
5) $15f - 20g^2$ $= 5(3f - 4g^2)$	6) $3y^4 + 9y^2 - 15$ $= 3(y^4 + 3y^2 - 5)$
7) $10d^7 + 2d^5$ $2d^5(5d^2 + 1)$	8) $7w^5 - 35w^2$ $= 7w^2(w^3 - 5)$
9) $2x + 2y$ $2(x + y)$	10) $-32y^2 - 24y$ $= -8y(4y + 3)$
11) $6x^2yz + 2xy^2z - 4xyz$ $= 2xyz(3x + y - 2)$	12) $12a^3b^2c^2 - 4a^2bc^2 + 8a^2c - 16ab$ $= 4ab(3a^2bc^2 - 1a^2c^2 - 4)$

Answers

NAME: \_\_\_\_\_ DATE: \_\_\_\_\_

MCR3U, Worksheet, Factoring Quadratic Expressions

Factor each of the following completely (Remember to look for greatest common factor):

1. $z^2 + 8z + 16$ $= (z+4)(z+4)$ $= (z+4)^2$ <del><math>\frac{16}{8} \times 4</math></del>	2. $y^2 - 8y - 48$ $= (y+4)(y-12)$ <del><math>\frac{-48}{-8} \times 4</math></del>	3. $x^2 - 7x + 12$ $= (x-3)(x-4)$ <del><math>\frac{12}{-3} \times 4</math></del>
4. $x^2 - 2x - 24$ $= (x-12)(x+10)$ <del><math>\frac{-24}{-2} \times 10</math></del>	5. $x^2 - x - 30$ $= (x-6)(x+5)$ <del><math>\frac{-30}{-1} \times 5</math></del>	6. $d^2 - 16$ $= (d+4)(d-4)$
7. $3v^2 + 9v - 30$ $= 3(v^2 + 3v - 10)$ $= 3(v+5)(v-2)$ <del><math>\frac{-10}{3} \times 2</math></del>	8. $2s^2 + 4s - 6$ $= 2(s^2 + 2s - 3)$ $= 2(s+3)(s-1)$	9. $7a^2 - 21$ $= 7(a^2 - 3)$
10. $5c^2 - 25c - 30$ $= 5(c^2 - 5c - 6)$ $= 5(c-6)(c+1)$	11. $25x^2 - 4$ $= (5x+2)(5x-2)$	12. $3x^2 - 27x - 30$ $= 3(x^2 - 9x - 10)$ $= 3(x-10)(x+1)$
13. $100 - 4x^2$ $= 4(25 - x^2)$	14. $p^2 - 4p - 21$ $= (p-7)(p+3)$	15. $9 - a^2$ $= (3+a)(3-a)$
16. $-8s^2 + 50$ $= -2(4s^2 - 25)$ $= -2(2s+5)(2s-5)$	17. $4h^2 - 12h - 16$ $= 4(h^2 - 3h - 4)$ $= 4(h-4)(h+1)$	18. $4a^2 + 8a$ $= 4a(a+2)$
19. $2a^2 + 6a - 8$ $= 2(a^2 + 3a - 4)$ $= 2(a+4)(a-1)$	20. $-2w^3 + 32$ $= -2(w^3 - 16)$ $= -2(w^2 - 4)(w^2 + 4)$ $= 2(w+2)(w-2)(w^2 + 4)$	21. $z^4 - 13z^2 + 36$ $?$