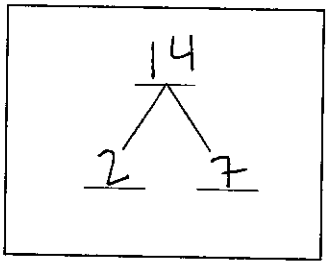
Key

Find the GCF...

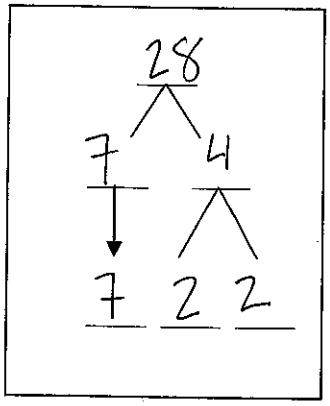
Use Prime Factorization (factor trees)

Step 1: Create a factor tree for each number

Prime Factors of 14:



Prime Factors of 28:



Step 2: List the factors for each number.

bottom branches

14: 2 • 7
28: 2 • 2 • 7

Step 3: Circle the common factors and identify the factor that is shared

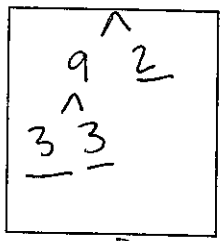
14: 2 • 7
28: 2 • 2 • 7

Multiply the common the factors. 2 x 7 = 14

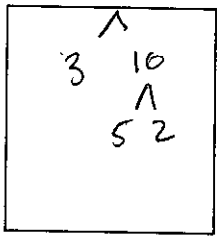
Try It! "The GCF of 14 and 28 is 14"

Find the GCF of the following numbers using prime factorization.

1) 18



30

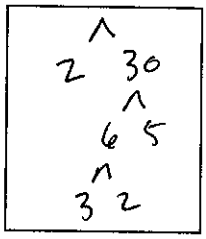


18: 3 · 3 · 2
30: 3 · 5 · 2

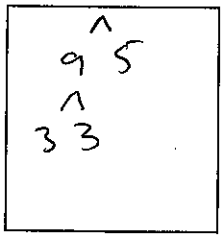
Multiply: 3 · 2

GCF: 6

2) 60



45



60: 2 · 3 · 2 · 5
45: 3 · 3 · 5

Multiply: 3 · 5

GCF: 15

Name _____
Pre-Algebra 8

① Factor Tree
② Line Up
③ Circle Common Factors
④ Multiply Common Factors

Date _____

Extra Practice: Greatest Common Factor

Find the GCF of each pair of numbers below. Show your work.

1. 12, 18

$12 = 3 \cdot 2 \cdot 2$
$18 = 3 \cdot 3 \cdot 2$
GCF $= 3 \cdot 2 = 6$

2. 13, 26

$13 = 13$
$26 = 2 \cdot 13$
GCF $= 13$

3. 30, 38

$30 = 2 \cdot 5 \cdot 3$
$38 = 2 \cdot 19$
GCF $= 2$

4. 9, 24

$9 = 3 \cdot 3$
$24 = 2 \cdot 2 \cdot 2 \cdot 3$
GCF $= 3$

5. 2, 61

Both Prime = NO GCF

6. 48, 120

$48 = 2 \cdot 3 \cdot 2 \cdot 2 \cdot 2$
$120 = 2 \cdot 2 \cdot 3 \cdot 5 \cdot 2$
GCF: $2 \cdot 3 \cdot 2 \cdot 2 = 24$

7. 16, 24

$16 = 2 \cdot 2 \cdot 2 \cdot 2$
$24 = 2 \cdot 2 \cdot 2 \cdot 3$
GCF $= 2 \cdot 2 \cdot 2 = 8$

8. 27, 99

$27 = 3 \cdot 3 \cdot 3$
$99 = 3 \cdot 3 \cdot 11$
GCF $= 3 \cdot 3 = 9$

Find the greatest common factor of the following pairs of monomials.

$a^2 = a \cdot a$

9. $9a^2, 18a$

$9a^2 = 3 \cdot 3 \cdot a \cdot a$
$18a = 3 \cdot 2 \cdot 3 \cdot a$
GCF $= 3 \cdot 3 \cdot a = 9a$

10. $5x^4, 12x^2$

$5x^4 = 5 \cdot x \cdot x \cdot x \cdot x$
$12x^2 = 2 \cdot 2 \cdot 3 \cdot x \cdot x$
GCF $= x^2$

11. $12x^3, 8x^2$

$12x^3 = 2 \cdot 2 \cdot 3 \cdot x \cdot x \cdot x$
$8x^2 = 2 \cdot 2 \cdot 2 \cdot x \cdot x$
GCF $= 4x^2$

12. $16a^5b^3, 36a^4b$

$16a^5b^3 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot a \cdot a \cdot a \cdot a \cdot a \cdot b \cdot b \cdot b$
$36a^4b = 3 \cdot 2 \cdot 3 \cdot 2 \cdot a \cdot a \cdot a \cdot a \cdot b$
GCF $= 4a^4b$

13. $3z^2, 10z^3$

$3z^2 = 3 \cdot z \cdot z$
$10z^3 = 5 \cdot 2 \cdot z \cdot z \cdot z$
GCF $= z^2$

14. x^3y^4, x^2y^2

$x \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y$
$x \cdot x \cdot y \cdot y$
GCF $= x^2y^2$

FACTORING Linear Algebraic Expressions

Step 1 – Find the Greatest Common Factor (GCF) of the 2 numbers, that is the Coefficient (16) and the Constant (36).

16 → 4 4 → 2 2 2 2

36 → 6 6 → 3 2 3 2

16 | 2 2 2 2 x

36 | 3 2 3 2 GCF = 4

$$\underset{4}{16X} + \underset{4}{36}$$

Step 2 – Put down the GCF and add the 2 sets of parentheses beside the GCF.

$$4(4X + 9)$$

Step 3 – Divide the GCF into both of the numbers and put the answers inside the parentheses.

Step 4 – Bring down the variable and the addition (or subtraction) sign.

This is your FINAL ANSWER in Factored Form!!

Check your Work! $4(4x+9) = 16x+36$

(3)

Finding the Greatest Common Factor of Polynomials

In a multiplication problem, the numbers multiplied together are called **factors**. The answer to a multiplication problem is called the **product**.

In the multiplication problem $5 \times 4 = 20$, 5 and 4 are **factors** and 20 is the **product**.

If we reverse the problem, $20 = 5 \times 4$, we say we have **factored** 20 into 5×4.

In this worksheet we will factor polynomials.

multiply

In the multiplication problem $2x(x+4) = 2x^2 + 8x$, $2x$ and $x+4$ are the **factors** and $2x^2 + 8x$ is the **product**.

If we reverse the problem, $2x^2 + 8x = 2x(x+4)$, we say we have **factored** $2x^2 + 8x$ into $2x$ and $x+4$.

Name the factors and the product in each problem.

1. $5(x-7) = 5x - 35$ factors: $5, (x-7)$ product: $5x-35$
2. $3x(x+9) = 3x^2 + 27x$ factors: $3x, (x+9)$ product: $3x^2+27x$
3. $-10x(x-6) = -10x^2 + 60x$ factors: $-10x, (x-6)$ product: $-10x^2+60x$
4. $4xy^2(3x+8y) = 12x^2y^2 + 32xy^3$ factors: $4xy^2, (3x+8y)$ product: $12x^2y^2+32xy^3$

The first step in factoring polynomials is to factor out the **greatest common factor (GCF)**. This is the **largest integer** and **highest degree of each variable** that will divide evenly into each term of the polynomial. GCF (leftover)

Factoring is the reverse of multiplying!

- In the polynomial $5x - 35$, 5 is the largest integer that will divide 5x and 35, and we cannot factor out any variable because the second term, 35, does not have a variable part.

To factor $5x - 35$ we write: $\frac{5x}{5} - \frac{35}{5} = 5(x-7)$.

- In the polynomial $3x^2 + 27x$, 3 is the largest integer that will divide $3x^2$ and $27x$. We can factor out x because each term has at least one factor of x (look for the term with the lowest degree of each variable).

To factor $3x^2 + 27x$ we write: $3x^2 + 27x = 3x(x+9)$.

$\frac{3x^2}{3x} + \frac{27x}{3x}$

- In the polynomial $12x^2y^2 + 32xy^3$, 4 is the largest integer that will divide $12x^2y^2$ and $32xy^3$. We can factor out x and y^2 because each term has at least one factor of x and two factors of y.

To factor $12x^2y^2 + 32xy^3$ we write: $12x^2y^2 + 32xy^3 = 4xy^2(3x+8y)$.

$\frac{12x^2y^2}{4xy^2} + \frac{32xy^3}{4xy^2}$

Finding the Greatest Common Factor of Polynomials

Find the largest integer that will divide all the terms.

5. $9x$ and 45 — 9

6. $7x^2$ and $21x$ — 7

7. $18x^6$ and $12x^3$ — 6

8. $15x^3, 25x^2$, and $55x$ — 5

Find the largest degree of x that can be factored out of all the terms.

9. $9x$ and 45 — None

10. $7x^2$ and $21x$ — x

11. $18x^6$ and $12x^3$ — x^3

12. $15x^3, 25x^2$, and $55x$ — x

Factor the polynomials.

13. $\frac{9x}{9} + \frac{45}{9} = 9(x+5)$

14. $\frac{7x^2}{7x} - \frac{21x}{7x} = 7x(x-3)$

15. $\frac{18x^6}{6x^3} + \frac{12x^3}{6x^3} = 6x^3(3x^3+2)$

16. $\frac{15x^3}{5x} - \frac{25x^2}{5x} + \frac{55x}{5x} = 5x(3x^2-5x+11$

To factor polynomials, find the greatest common factor (GCF) of the coefficients and factor it out- divide each term by the GCF. Then find the greatest common factor (GCF) of the variables by finding the lowest power of each variable that will divide all terms and factor it out- divide each term by GCF. Move the GCF to the outside and write in parenthesis what is remaining, after you factor out the GCF.

Factor each of the following polynomials. check by distributing!

17. $6x^2 - 24x$

$6x(x-4)$

$6x^2 - 24x$ ✓

18. $\frac{14x^2}{7x} - \frac{35x}{7x}$

$7x(2x-5)$

19. $5x^2 + x$

$x(5x+1)$

20. $\frac{20x^2}{4x} + \frac{44x}{4x}$

$4x(5x+11)$

21. $17x^2 + 51x$

$17x(x+3)$

22. $36x^3 + 63x^2 - 27x$

$9x(4x^2+7x-3)$

23. $3x^4y^2 + 15x^3y^3$

$3x^3y^2(x+5y)$

24. $20y^4 - 15y^3 + 30y^2$

$5y^2(14y^2-3y+6)$

25. $9x^7y^5 - 3x^2y^6$

$3x^2y^5(3x^5-y)$

If the leading coefficient is negative, always factor out the negative!

26. $-2m^4 + 14m^2 - 6m$

$-2m(m^3-7m+3)$

27. $-5x^2y + 35xy$

$-5xy(x-7)$

28. $-x^2 + 5x - 6$

$-1(x^2-5x-6)$

Key

Name_____

Factoring Monomials From Polynomials

To **factor a polynomial**, write the polynomial as a product of other polynomials. For example, $4x^2 - 8x$ can be written as $4x(x - 8)$.
$4x$ is the **Greatest Common Factor (GCF)** of $4x^2$ and $8x$.
$4x$ is a **Common Monomial Factor** of the terms of the binomial.
$x - 8$ is a **Binomial Factor** of $4x^2 - 8$.

Factor.

1. $9a^2 - 18a$
   $9a(a-2)$
2. $16a^5b^3 + 32a^4b$
   $16a^4b(ab^2+2)$
3. $x^2 + x^4 + x^3$
   $x^2(1+x^2+x)$
4. $3x^5 + 4x^4 - 5x^2$
   $x^2(3x^3+4x^2-5)$
5. $2x^3 - x$
   $x(2x^2-1)$
6. $3a^5 - a^3$
   $a^3(3a^2-1)$
7. $32b^2 + 16b$
   $16b(2b+1)$
8. $5x^3 - 7x^2$
   $x^2(5x-7)$
9. $3x^2 - 10x^3$
   $x^2(3-10x)$
10. $a^{5n} + a^{3n}$ = skip
11. $x^3 - 5x^2$
    $x^2(x-5)$
12. $9c - 3c^2$
    $3c(3-c)$
13. $5x^4 - 12x^2$
    $x^2(5x^2-12)$
14. $x^2 + x$
    $x(x+1)$
15. $6x^2 - 12x^3 - 18x^4$
    $6x^2(1-2x-3x^2)$
16. $x^3y^4 + x^2y^2$
    $x^2y^2(xy^2+1)$
17. $18b - 9b^2$
    $9b(2-b)$
18. $2x^3 + 6x^2$
    $2x^2(x+3)$
19. $12x^3 + 4x^2$
    $4x^2(3x+1)$
20. $x^5 + 3x^2$ $x^2(x^3+3)$

Date: _____ Name: _____

FUN FACT WORKSHEET - GREATEST COMMON FACTOR

Factor each of the following polynomials using the greatest common factor method. Use the letter for each corresponding answer and place it next to the number for that question in the "fun fact" box below.

T	H	E		M	O	N	A		L	I	S	A
10	1	5		2	7	9	4		8	14	13	4

H	A	S		N	O		E	Y	E	B	R	O	W	S
1	4	13		9	7		5	12	5	11	3	7	6	13

1) $x^2 - 4x$
$x(x-4)$

2) $3x + 6$
$3(x+2)$

3) $5x - 15$
$5(x-3)$

4) $8x^2 + 4x$
$4x(2x+1)$

5) $5x - 20$
$5(x-4)$

6) $5x^2 + 10x - 20$
$5(x^2+2x-4)$

7) $12x^3 - 6x^2 + 8x$
$2x(6x^2-3x+4)$

8) $x^4 + 16x^3 - 10x^2$
$x^2(x^2+16x-10)$

9) $30x + 15$
$15(2x+1)$

10) $12x^3 - 24x^2 + 4$
$4(3x^3-6x^2+1)$

11) $3x^4 + 6x^3 + 9x^2$
$3x^2(x^2+2x+3)$

12) $20x^5 - 18x^4$
$2x^4(10x-9)$

13) $x^6 + x^4 - x^3 + x^2$
$x^2(x^4+x^2-x+1)$

14) $x^5 + x^3 - x^2 + x$
$x(x^4+x^2-x+1)$

I	$x(x^4 + x^2 - x + 1)$	B	$3x^2(x^2 + 2x + 3)$	H	$x(x - 4)$
W	$5(x^2 + 2x - 4)$	R	$5(x - 3)$	A	$4x(2x + 1)$
E	$5(x - 4)$	M	$3(x + 2)$	Y	$2x^4(10x - 9)$
O	$2x(6x^2 - 3x + 4)$	S	$x^2(x^4 + x^2 - x + 1)$	N	$15(2x + 1)$
L	$x^2(x^2 + 16x - 10)$	T	$4(3x^3 - 6x^2 + 1)$		