Factor GCF

What is Factoring?

Factoring
Factoring means to find out which two expressions you multiplied together to get one single expression. Factoring is like "splitting" an expression into a product of simpler expressions. Factoring is also the opposite of expanding or distributing.

Numbers have factors:

$2 \times 3 = 6$

Factor Factor

Expressions have factors too:

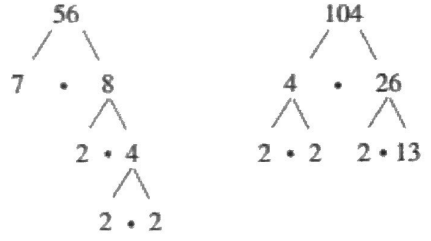
$(x+3)(x+1) = x^2 + 4x + 3$

Factor Factor

Review: Finding the GCF of Two Numbers

Factors that are shared by two or more numbers are called common factors. The greatest of the common factors is called the **Greatest Common Factor (GCF)**. To find the greatest common factor, you can make a factor tree and complete the prime factorization of both numbers. The GCF is the product of the common prime factors.

Example: Find the GCF of 56 and 104

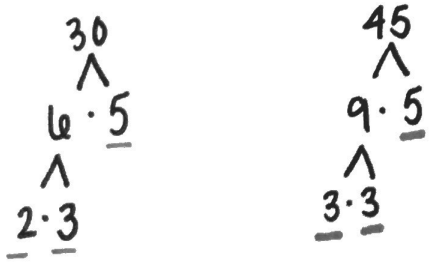


$56 = 2 \cdot 2 \cdot 2 \cdot 7$
$104 = 2 \cdot 2 \cdot 2 \cdot 13$

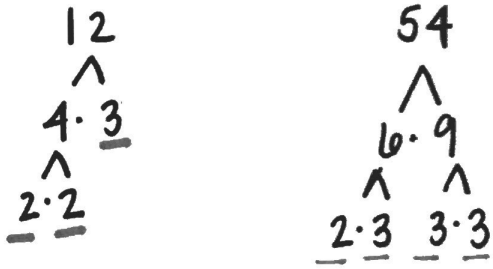
So, the GCF of 56 and 104 is $2 \cdot 2 \cdot 2 = 8$.

Practice: Find the GCF of the following numbers.

a. 30, 45



b. 12, 54



$30 = 2 \cdot 3 \cdot 5$
$45 = 3 \cdot 3 \cdot 5$

$GCF = 3 \cdot 5 = 15$

$12 = 2 \cdot 2 \cdot 3$
$54 = 2 \cdot 3 \cdot 3 \cdot 3$

$GCF = 2 \cdot 3 = 6$

Finding the GCF of Two Expressions

Just like the GCF of two numbers, to find the GCF of two expressions, you can make a factor tree and complete the prime factorization of both numbers AND expand the variables. Circle what is common to both.

Example: Find the GCF of $36x^2y$ and $16xy$

$36x^2y^1$

$6 \cdot 6 \cdot x \cdot x \cdot y$

$2 \cdot 3 \quad 2 \cdot 3$

$36x^2y = 2 \cdot 2 \cdot 3 \cdot 3 \cdot x \cdot x \cdot y$

$16xy = 2 \cdot 2 \cdot 2 \cdot x \cdot y$

$16xy$

$8 \cdot 2 \cdot x \cdot y$

$2 \cdot 4$

$2 \cdot 2$

The GCF is $2 \cdot 2 \cdot x \cdot y = \boxed{4xy}$

Practice: Find the GCF of the following expressions.

a. $35mn^2$ and $21m^2n$

$7 \cdot 5 \cdot m \cdot n \cdot n$

$7 \cdot 3 \cdot m \cdot m \cdot n$

$GCF = 7 \cdot m \cdot n = 7mn$

b. $36xy^3$ and $24y^2$

Factoring by GCF with Area Model *on separate sheet*

When you factor an expression, you break each term down into its prime factors and expand the variables. The GCF of the terms goes on the left side of the area model and what is leftover goes on the top of the area model. **Practice:** Factor each expression.

1. $x^2 + 5x$

2. $x^2 - 8x$

3. $28x - 63$

4. $4x^2 - 4x$

5. $4x^3 + 6x^2 - 8x$

6. $15x^3y^2 + 10x^2y^4$

Factoring by GCF with Area Model

1. x^2+5x

	x	$+5$
x	x^2	$5x$

x^2: $x \cdot x$; $5x$: $5 \cdot x$

$x(x+5)$

Check: $x(x+5)$

	x	$+5$
x	x^2	$5x$

x^2+5x ✓

2. x^2-8x

	x	-8
x	x^2	$-8x$

x^2: $x \cdot x$; $-8x$: $-8 \cdot x$

$x(x-8)$

3. $28x-63$

	$4x$	-9
7	$28x$	-63

$28x$: $7 \cdot 4 \cdot x$, $4 = 2 \cdot 2$

$2 \cdot 2 \cdot x = 4x$

-63: $-1 \cdot 63$, $63 = 9 \cdot 7$, $9 = 3 \cdot 3$

$-1 \cdot 3 \cdot 3 = -9$

$7(4x-9)$

5. $4x^3+6x^2-8x$

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

$4x^3$: $2 \cdot 2 \cdot x \cdot x \cdot x$

$6x^2$: $2 \cdot 3 \cdot x \cdot x$

$-8x$: $-1 \cdot 8 \cdot x$, $8 = 4 \cdot 2$, $4 = 2 \cdot 2$

$2 \cdot x \cdot x = 2x^2$

$3 \cdot x = 3x$

$GCF = 2 \cdot x = 2x$

$-1 \cdot 2 \cdot 2 = -4$

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

4. $4x^2-4x$

	x	-1
$4x$	$4x^2$	$-4x$

$4x^2$: $2 \cdot 2 \cdot x \cdot x$

$-4x$: $-1 \cdot 4 \cdot x$, $4 = 2 \cdot 2$

$GCF = 2 \cdot 2 \cdot x = 4x$

$4x(x-1)$

6. $15x^3y^2+10x^2y^4$

	$3x$	$2y^2$
$5x^2y^2$	$15x^3y^2$	$10x^2y^4$

$15x^3y^2$: $3 \cdot 5 \cdot x \cdot x \cdot x \cdot y \cdot y$

$10x^2y^4$: $2 \cdot 5 \cdot x \cdot x \cdot y \cdot y \cdot y \cdot y$

$GCF = 5 \cdot x \cdot x \cdot y \cdot y = 5x^2y^2$

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