

Expand/Multiply $2x(x + 4)$
(use the dimensions to find the area)

The diagram illustrates the expansion of $2x(x + 4)$ using an area model. It shows a large rectangle divided into several colored sections: a blue square labeled x^2 , a red square labeled $-x^2$, a green rectangle labeled x , and a red rectangle labeled $-x$. To the right, a horizontal bar is divided into a green section labeled x and four yellow squares labeled 1 . Below this, a vertical bar is divided into two green sections labeled x . At the bottom left, there are two vertical bars labeled x and $x-$, and two small squares labeled -1 and 1 .

Learning Goal: By the end of today, I will be able to determine the greatest common factor for a collection of numbers AND I will be able to common factor a simple polynomial expression.

FACTOR means to use the area to find the dimensions of the rectangular area.

There may be more than one answer.

Ex. Find the dimensions of the rectangle with an area of 16 m^2

x^2

$-x^2$

x

-x

x

x-

-1

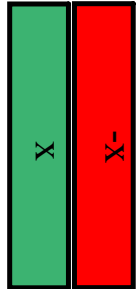
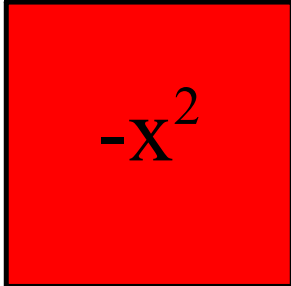
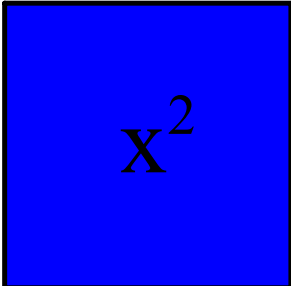
1

Factor $4x + 6$
 (use the area to find the dimensions)

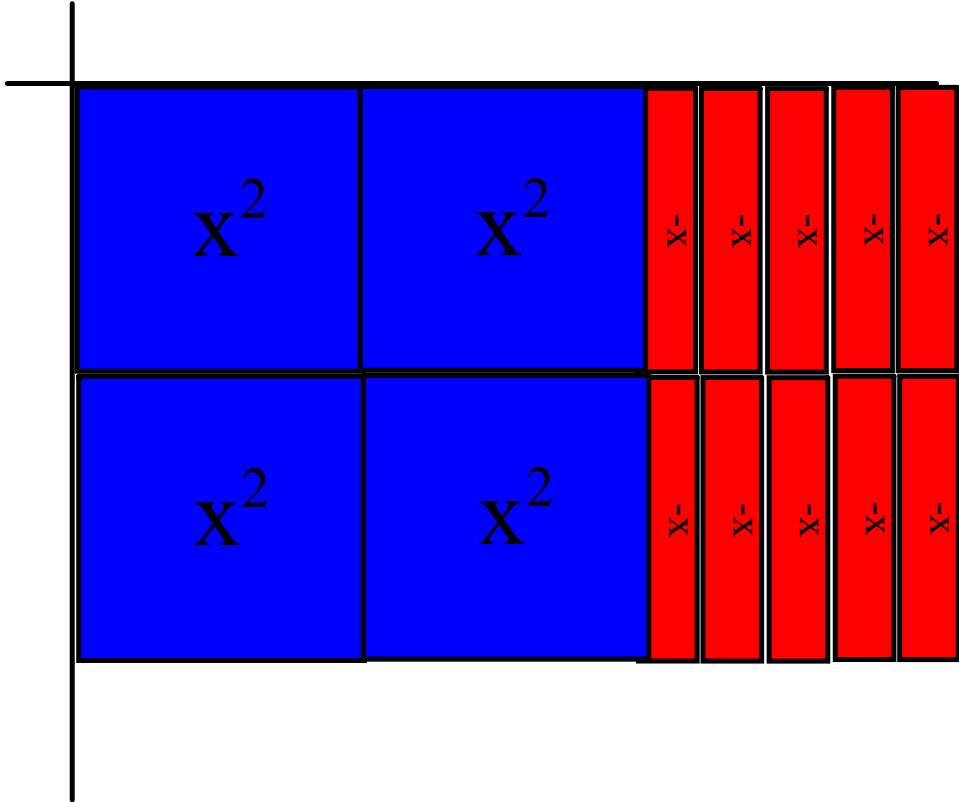
x	x	1	1	1
x	x	1	1	1

Factor $2x^2 + 6x$
(use the area to find the dimensions)

The diagram illustrates the factoring process for the expression $2x^2 + 6x$. On the left side, the terms are represented by colored shapes: a blue square labeled x^2 , a red square labeled $-x^2$, a green rectangle labeled x , and a red rectangle labeled $-x$. Below these are two vertical bars, one green labeled x and one red labeled $-x$, and two small squares, one red labeled -1 and one yellow labeled 1 . On the right side, a large rectangle is formed by two blue squares labeled x^2 and six green rectangles labeled x , arranged in a 2x3 grid. A vertical line separates the two diagrams.



Factor $4x^2 - 10x$
 (use the area to find the dimensions)



Factor the following using your Algetiles
or by drawing a picture:

(a) $6x + 12$

(b) $5x^2 - 10x$

x^2

$-x^2$

x

$-x$

x

$-x$

-1

1

Factor $6x + 12$
 (use the area to find the dimensions)

x	1	1
x	1	1
x	1	1
x	1	1
x	1	1
x	1	1

Factor $5x^2 - 10x$
 (use the area to find the dimensions)

The diagram illustrates the factoring process for $5x^2 - 10x$ using an area model. On the left, a legend shows the components: a blue square labeled x^2 , a red square labeled $-x^2$, a green rectangle labeled x , a red rectangle labeled $-x$, a green vertical strip labeled x , a red vertical strip labeled $-x$, a red square labeled -1 , and a yellow square labeled 1 . The main diagram shows a large rectangle divided into five horizontal sections, each containing an x^2 term. The first section is blue and labeled x^2 . The second section is blue and labeled x^2 . The third section is blue and labeled x^2 . The fourth section is blue and labeled x^2 . The fifth section is blue and labeled x^2 . To the right of each x^2 section are two red vertical strips, each labeled $-x$. This represents the factored form $x(5x - 10)$.

Greatest Common Factor

(Finding the GCF between two or more terms)

An algebraic approach to factoring.

Greatest Common Factor - Definitions

Factors - factors are numbers that act as "building blocks" to create larger numbers, through the operation of multiplication

ie. $12 = 4 \times 3$ Therefore, 4 and 3 are factors of 12

$12 = 6 \times 2$ Therefore, 6 and 2 are also factors of 12

Prime Factors - Prime factors consist of the "prime" numbers; numbers that are divisible by themselves and "1" only

Prime Numbers

1, 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41,....

ie. $12 = 2 \times 2 \times 3$ (broken down into its Prime Factors)

ie. $36 = 2 \times 2 \times 3 \times 3$ (broken down into its Prime Factors)

Finding the Greatest Common Factor

The Greatest Common Factor (GCF) is the largest factor (number/building block) that is shared between two or more terms.

ie. The GCF of the numbers 18 and 27 would be 9.

We can see this by writing each number in a factored form.

$$18 = 9 \times 2 \quad \text{and} \quad 27 = 9 \times 3$$

The difficulty in finding the GCF arises when we have more challenging numbers and when unknowns are introduced.

Finding the Greatest Common Factor

Find the Greatest Common Factor (GCF) between the following three terms: 24, 48, 60

24

$24 = 12 \times 2$

$24 = 6 \times 2 \times 2$

$24 = 3 \times 2 \times 2 \times 2$

48

$48 = 12 \times 4$

$48 = 6 \times 2 \times 2 \times 2$

$48 = 3 \times 2 \times 2 \times 2 \times 2$

60

$60 = 10 \times 6$

$60 = 5 \times 2 \times 3 \times 2$

$60 = 5 \times 3 \times 2 \times 2$

What factors do ALL of the terms have in common?

$24 = \mathbf{3} \times \mathbf{2} \times \mathbf{2} \times 2 \quad 48 = \mathbf{3} \times \mathbf{2} \times \mathbf{2} \times 2 \times 2 \quad 60 = 5 \times \mathbf{3} \times \mathbf{2} \times 2$

All of the terms have a "2 x 2 x 3" in common,
when
this is multiplied out it is a product of "12".

Therefore the GCF for 24, 48 and 60, is "12".

$24 = \mathbf{12} \times 2$

$48 = \mathbf{12} \times 4$

$60 = 5 \times \mathbf{12}$

Finding the Greatest Common Factor

Find the Greatest Common Factor (GCF) between the following three terms: $8a^2$, $16a$, $12a^3$

$$\underline{8a^2}$$

$$\underline{16a}$$

$$\underline{12a^3}$$

$$8a^2 = (4) (2) (a) (a) \quad 16a = (4) (4) (a) \quad 12a^3 = (4) (3) (a) (a) (a)$$

$$8a^2 = (2) (2) (2) (a) (a) \quad 16a = (2) (2) (2) (2) (a) \quad 12a^3 = (2) (2) (3) (a) (a) (a)$$

What factors do ALL of the terms have in common?

$$8a^2 = (2) \mathbf{(2)} \mathbf{(2)} \mathbf{(a)} (a) \quad 16a = (2) (2) \mathbf{(2)} \mathbf{(2)} \mathbf{(a)} \quad 12a^3 = \mathbf{(2)} \mathbf{(2)} (3) \mathbf{(a)} (a) (a)$$

All of the terms have a "2 x 2 x a" in common, when this is multiplied out it is a product of "4a".

Therefore the GCF for $8a^2$, $16a$ and $12a^3$, is "4a".

$$8a^2 = \mathbf{(4a)} (2a) \quad 16a = \mathbf{(4a)} (4) \quad 12a^3 = \mathbf{(4a)} (3a^2)$$

Self Check

Find the Greatest Common Factor (GCF) between the following three terms: 16, 24, 40

162440

What factors do ALL of the terms have in common?

Self Check

Find the Greatest Common Factor (GCF) between the following three terms: $18a^2$, $27a$, $45a^3$

$18a^2$

$27a$

$45a^3$

What factors do ALL of the terms have in common?

Factor (find the dimensions) of the following:

$$4x + 6 = (\quad) (\quad)$$

$$2x^2 + 6x = (\quad) (\quad)$$

$$4x^2 - 10x = (\quad) (\quad)$$

Task - Factoring handout