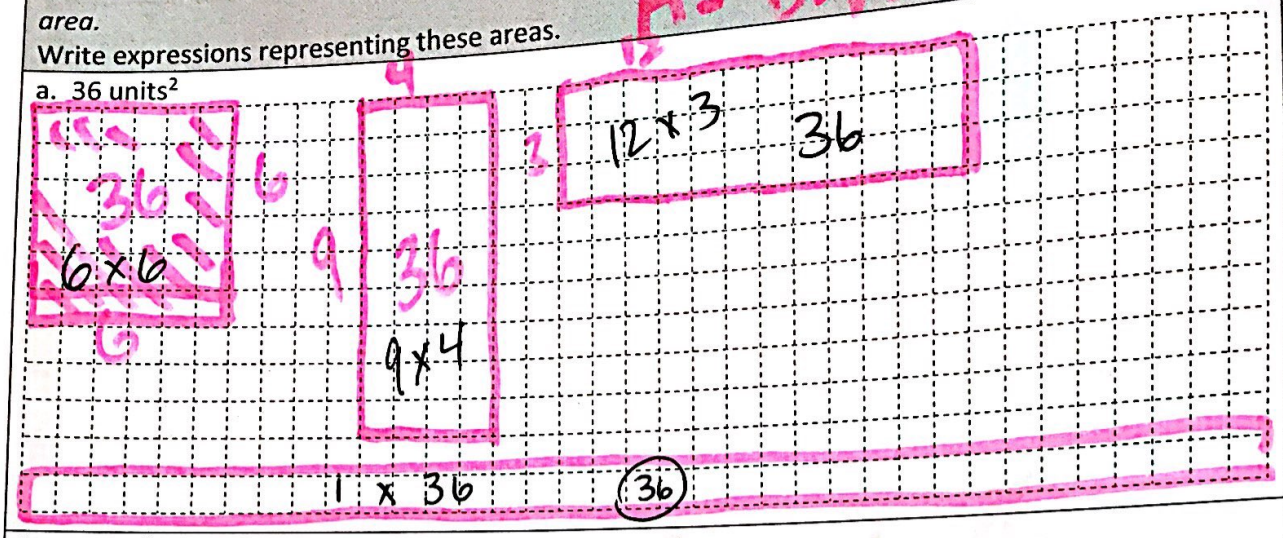
Unit 4, Lesson 1: Factors and Greatest Common Factors; Factoring by Grouping

Part 1: Using the graph paper, draw as many rectangles as you can which have with the given area.

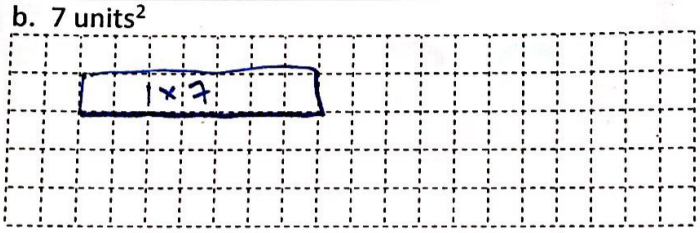
Write expressions representing these areas.

A = b·h

a. 36 units^2



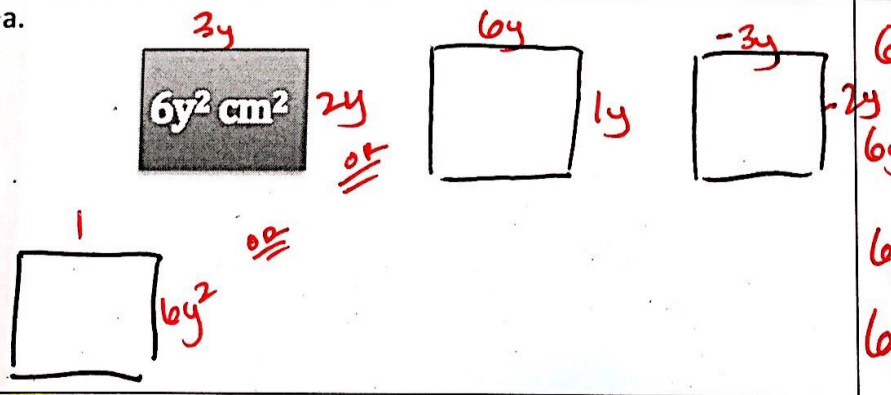
b. 7 units^2



What's different between a and b?

THERE ARE MANY WAYS TO WRITE 36 AS A PRODUCT → COMPOSITE NUMBER

THERES ONLY ONE WAY TO WRITE 7 AS A PRODUCT → 7 IS A PRIME NUMBER: ITS ONLY FACTORS ARE ITSELF AND 1. (7)

Part 2: You are given area of the rectangle. List any possible dimensions for the rectangle.	Write expression(s) representing these areas.
a. 	$6y^2 = 3y \cdot 2y$ // $-3y \cdot -2y$ $6y^2 = 6y \cdot 1y$ $6y^2 = 1 \cdot 6y^2$ $6y^2 = 3 \cdot 2y^2$ $6y^2 = 2 \cdot 3y^2$

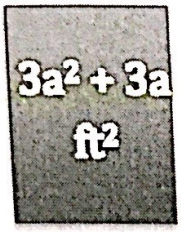
Product Simplified product

Factored form written as a product of factors

$6y^2$ = ex: $3y \cdot 2y$ (write as multiplication)

These are Equivalent Expressions! (EQUAL ALIKE)

THE QUANTITY CAN BE WRITTEN IN MULTIPLE WAYS

Part 2 continued: You are given area of the rectangle. List any possible dimensions for the rectangle.	Write expression(s) representing these areas.
b. 	$3(1a^2+1a)$ or $a(3a+3)$ or $3a(a+1)$

Product Simplified product	**Factored form** written as a product of factors
$3a^2+3a$	=

Ex1: Compare these expressions:

$3 \cdot (1a^2+1a)$

$1 \cdot (3a^2 + 3a)$

$a \cdot (3a+3)$

$3a \cdot (a+1)$ ← greatest common factor

What do these expressions have in common? What is different about them?

Which one is factored the best? How do you know?

IF NO OTHER FACTORS CAN BE DIVIDED OUT OF REMAINING EXPRESSION IN ( )

Finding GCF.

Ex2: Find the GCF of the monomials. ⟸ What does this mean?

(When finding the GCF, it may help to use a table).

a. $4f^6$ and $3f^4$

GCF: f^4

	Prime Factors	GCF ??left over
$4f^6$	→ 4 · f·f·f·f·f·f	$f^4 \cdot 4f^2$
$3f^4$	→ 3 · f·f·f·f	$f^4 \cdot 3$

c. $6x^2y$, $9xy^4$, and $18y^5$ (÷3, ÷3, ÷3)

GCF: $3y$

	Prime Factors	GCF ??left over
$6x^2y$	x x y	$3y \cdot 2x^2$
$9xy^4$,	x y y y y	$3y \cdot 3xy^3$
$18y^5$	y y y y y	$3y \cdot 6y^4$

d. $6(x+3)^4$ and $3(x+3)^2$

GCF: $3(x+2)^2$

	Prime Factors	GCF ??left over
$6(x+3)^4$	2 · 3 · (x+3)(x+3)(x+3)(x+3)	$3(x+3)^2 \cdot 2(x+3)^2$
$3(x+3)^2$	3 · (x+3)(x+3)	$3(x+3)^2$

MAKE MULTIPLICATION

Ex 3: Factor the polynomial using the GCF.

GCF

$$\frac{-4y^3}{2} + \frac{6y}{2} - \frac{2}{2}$$

$2(-2y^3 + 3y - 1)$

Check $-4y^3 + 6y - 2$ ✓

How to factor a GCF out of a polynomial

1. *Identify GCF for polynomial*
   a. *What can be divided into each?* 2, 1
2. *Divide GCF from each term and put outside ( )*
3. *Inside ( ) should be remaining factors.*
4. Check: Multiply GCF by polynomial in ( ); should get original expression.

a. $\frac{8x^3}{4x^2} - \frac{12x^2}{4x^2}$

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

Check...

b. $\frac{x^2}{1x^2} - \frac{4x^4}{1x^2}$

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

Check... $1x^2 - 4x^4$ ✓

c. $\left(\frac{-5m^4}{5m^2} - \frac{5m^3}{5m^2} + \frac{5m^2}{5m^2}\right)$

$5m^2(-m^2 - 1m + 1)$

$-5m^4 - 5m^3 + 5m^2$

Factoring by Grouping: May be used to further factor.

Ex 4:

$$x^4 - 2x^3 + 6x^2 - 12x$$

Check...

How to Factor by Grouping

1. Factor out GCF if possible.
2. Regroup:
   a. Put first two terms together in ( )
   b. Put second 2 terms together in ( )
3. Take out GCF of each pair.
4. Bring GCFs together as a binomial.
5. Check!

Algebra Unit 4 Factoring Map

Def Factor:
- Numbers that divide into another
- Write an expression as multiplication of factors

Nums
Vars

1. What can be factored out?
GCF (greatest common factor)

$\frac{8x^2}{2x} - \frac{4x^2}{2x} + \frac{6x}{2x}$

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

What does factoring look like?

2. How many terms does the polynomial have?

Two Terms

Difference of Squares: need subtraction of two perfect squares

$x^2 - 9$	$8x^3 - 50x$

Three Terms...a = 1

c
b

$x^2 + 8x + 15$	$x^2 - 8x + 12$	$x^2 - 4x - 21$

Four Terms

Factor by Grouping!

$x^3 - 5x^2 - 8x + 40$	$2x^3 - 4x^2 + 3x -$

Three Terms...a > 1

$4x^2 + 4x - 3$

1. *Multiply a to c; rewrite.*
2. *Factor using X*
3. *Divide each constant in each*

ms Up!