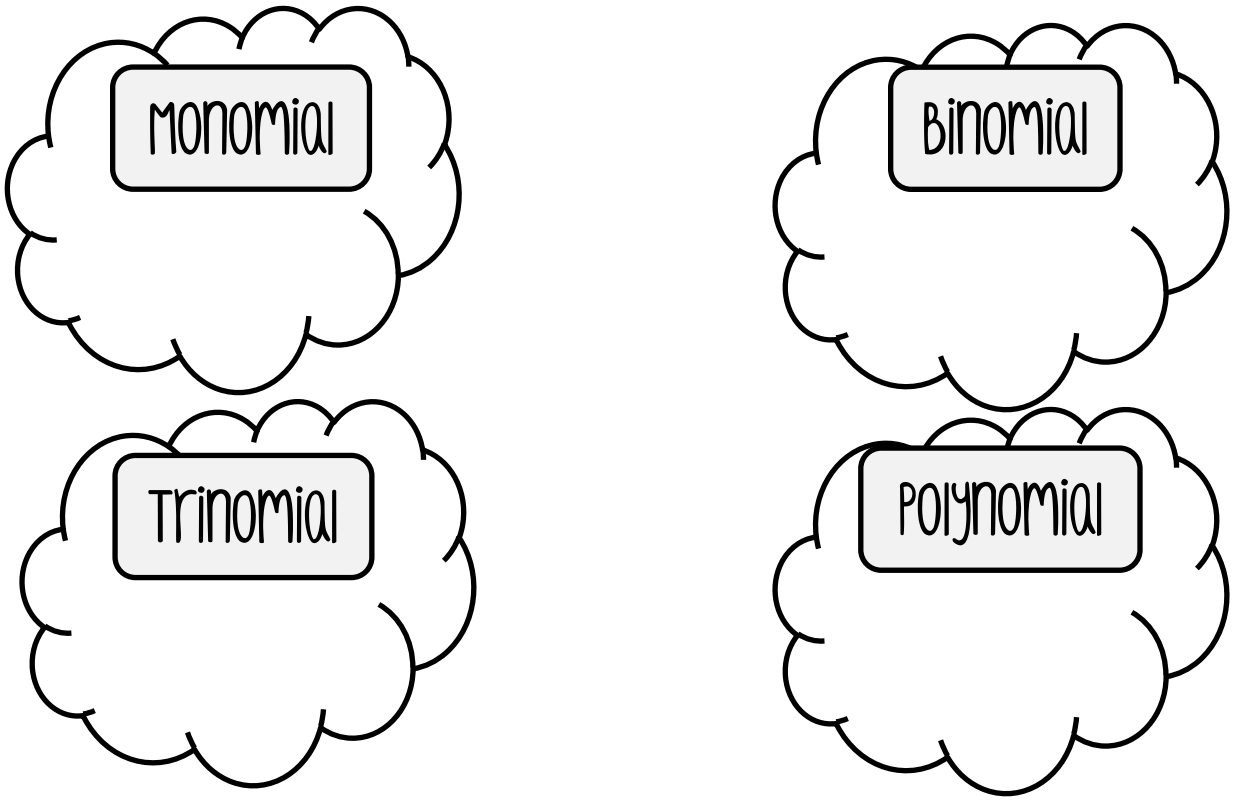
Name: _____

Algebra

Unit 7

Polynomials

NAMING POLYNOMIALS



Degree

Term

Standard Form

$((2p^3 + 6p^2 + 10p) + (9p^3 + 11p^2 + 3p)$

TO REMEMBER

Adding and Subtracting Polynomials

TO REMEMBER

$((30d^3 - 29d^2 - 3d) - (2d^3 + d^2)$

MULTIPLYING POLYNOMIALS

MONOMIALS

BINOMIALS

TRINOMIALS

Factoring

Steps:

1.

2.

If there are 2 variables:

$x^2 + bx + c$

Example 1:

Example 2:

Factoring

$ax^2 + bx + c$

Steps:

Example:

Example:

FACTORING SPECIAL CASES

PERFECT SQUARE

COMMON FACTORS

DIFFERENCE OF TWO SQUARES

FACTORING BY GROUPING

Look for _____
of two pairs of terms.

Example 1:

Example 2:

Factoring using an area model

STEPS

1.

2.

3.

4.

5.

6.

Example 1:

Example 2:

Naming Polynomials

A **monomial** is an expression that is a number, a variable, or a product of a number and one or more variables. Each of the following is a monomial.

$12 \qquad y \qquad -5x^2y \qquad \frac{c}{3}$

The **degree of a monomial** is the sum of the exponents of its variables. For a nonzero constant, the degree is 0. Zero has no degree.

1 EXAMPLE **Degree of a Monomial**

Find the degree of each monomial.

a. $\frac{2}{3}x$	Degree: 1	$\frac{2}{3}x = \frac{2}{3}x^1$. **The exponent is 1.**
b. $7x^2y^3$	Degree: 5	**The exponents are 2 and 3. Their sum is 5.**
c. -4	Degree: 0	**The degree of a nonzero constant is 0.**

A **polynomial** is a monomial or the sum or difference of two or more monomials.

$$\begin{array}{rcccc} & 3x^4 & + 5x^2 & - 7x & + 1 \\ & \uparrow & \uparrow & \uparrow & \uparrow \\ \textbf{degree} \rightarrow & 4 & 2 & 1 & 0 \end{array}$$

The polynomial shown above is in standard form. **Standard form of a polynomial** means that the degrees of its monomial terms decrease from left to right. The **degree of a polynomial** in one variable is the same as the degree of the monomial with the greatest exponent. The degree of $3x^4 + 5x^2 - 7x + 1$ is 4.

Fill in the chart with the missing information.

Polynomial	Degree	Name using Degree	Number of Terms	Name using Number of Terms
$7x + 4$				
$3x^2 + 2x + 1$				
$4x^3$				
$9x^4 + 11x$				
5				
$4x^5 + 7x^2 + 3x + 4$				

Write the following polynomials in standard form.

$x^3 + 4x^5 + 7 + 2x^2$	
$5x + 2 + x + 5x^2$	
$2y^4 + z^2 + 2y^3 + 7y^4z^3$	
$y(5y + y^3 + y^2)$	
$y^2m^4 + m^5y^2 + y^2m$	

Find the degree of each monomial.

1.) $4x$ 2.) $7c^3$ 3.) -16 4.) $6y^2w^8$

5.) $8ab^3$ 6.) 6 7.) $-9x^4$ 8.) 11

Adding & Subtracting Polynomials – Individual Exploration

Solve each of these problems. Show all work.

$(2p^3 + 6p^2 + 10p) + (9p^3 + 11p^2 + 3p)$

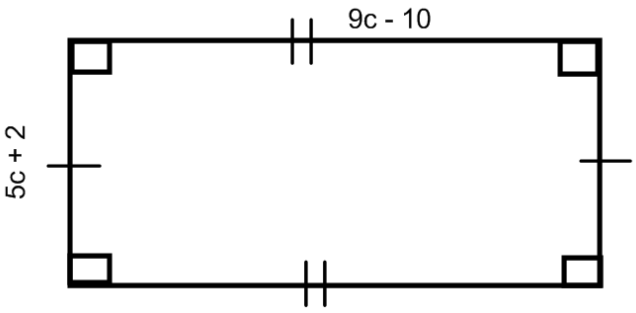
$(8g^6 - 12g^3 + 2g^2 + g + 6) + (19g^6 + g^5 + 13g^3 - 6g^2 + 10)$

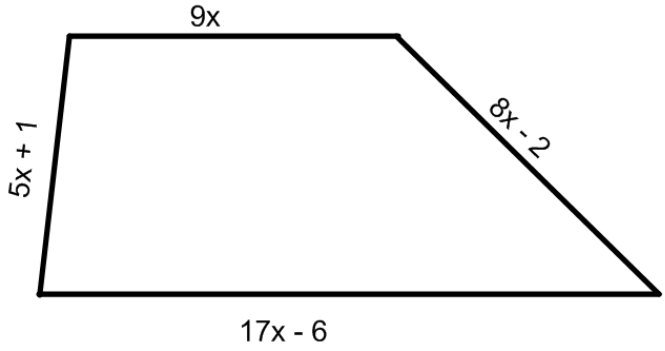
$(30d^3 - 29d^2 - 3d) - (2d^3 + d^2)$

$(15z^9 - 3z^3 - 7z^2 - 7) - (14z^9 + 9z^5 - 13z^3 - 7z^2 + 7)$

Adding and Subtracting Polynomials Activity

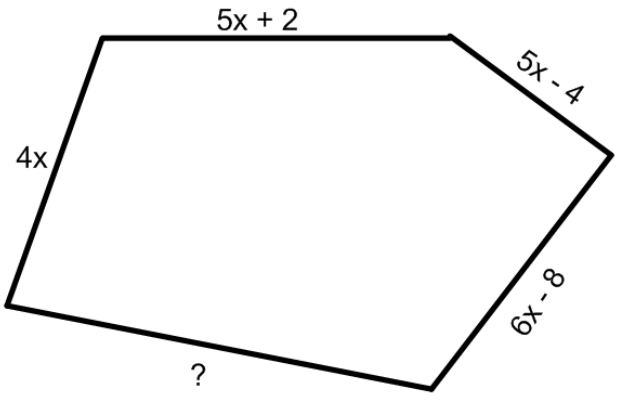
Find an expression for the perimeter of each figure.



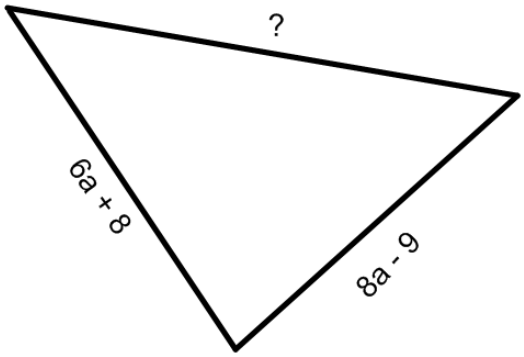


Find an expression for each missing length.

Perimeter = 25x + 8



Perimeter = 23a - 7



Multiplying Monomial by a Polynomials

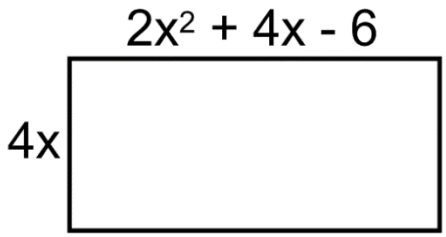
1. $4b\ (5b^2 + 6)$

2. $-7h(3h^2 - 8h - 1)$

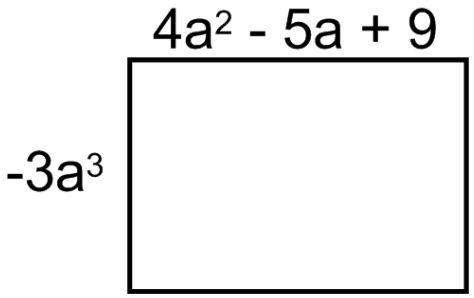
3. $(x^2 - 6x + 5)(2x)$

4. $-4y^2(5y^4 - 3y^2 + 2)$

5.) Find the area.

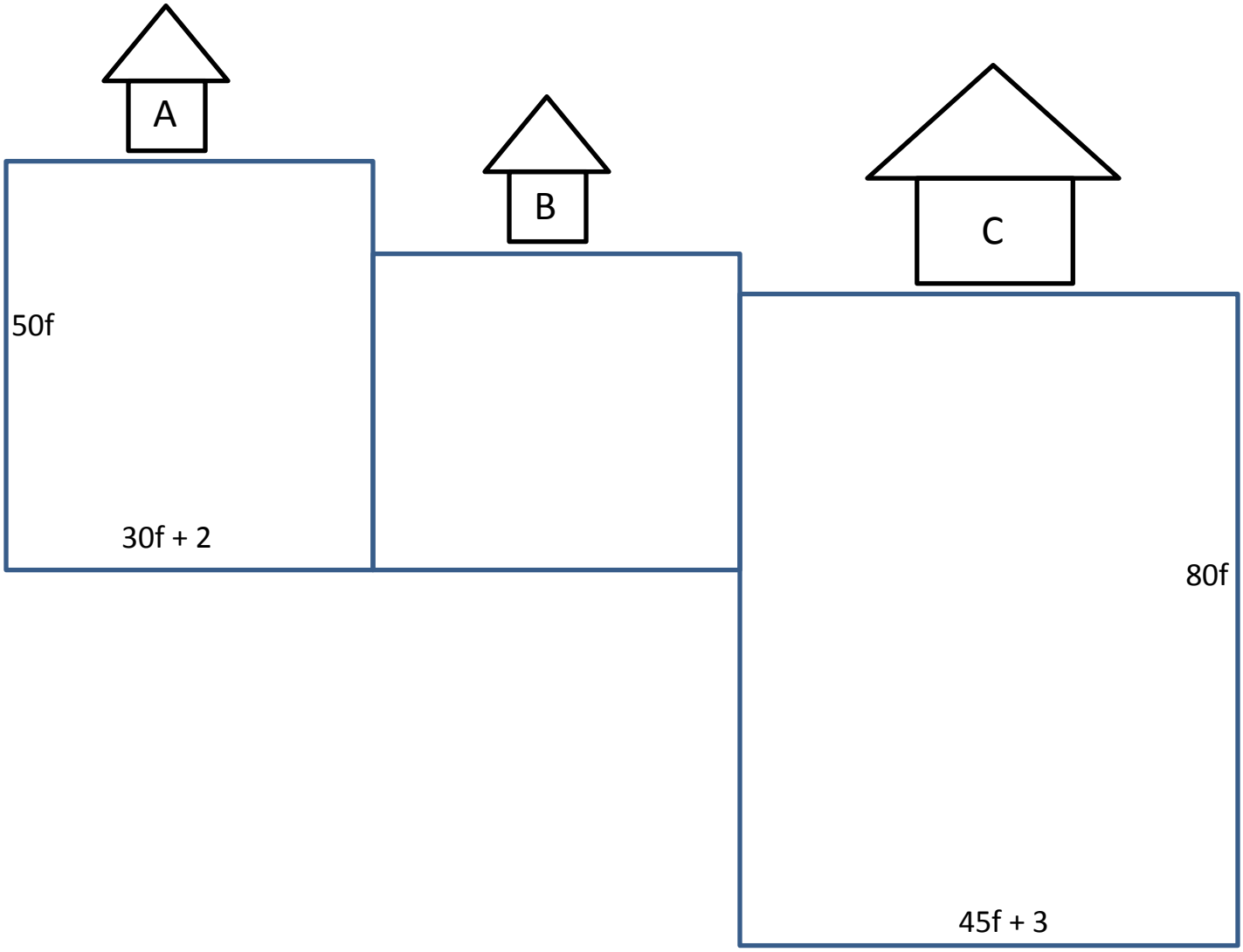


6.) Find the area.



WELCOME TO BOXY LAKE

This lake is divided into three segments because different families own each part of the lake. The families are looking to sell the whole lake to a big corporation, but the corporation wants to know the entire area of the lake. The families will measure the length and width of their segments in footsteps (f). Family B is on vacation, so Family A and Family C help them. Family A knows that Family B has the same width as them. Family C knows that Family B has ½ the length of their lake. They need your assistance to find the area of the whole lake.



MULTIPLYING BINOMIALS USING FOIL

Simplify $(3x - 5)(2x + 7)$.

	First		Outer		Inner		Last
$=$	$(3x)(2x)$	$+$	$(3x)(7)$	$-$	$(5)(2x)$	$-$	$(5)(7)$
$=$	$6x^2$	$+$	$21x$	$-$	$10x$	$-$	35
$=$	$6x^2$	$+$	$11x$			$-$	35

The product is $6x^2 + 11x - 35$.

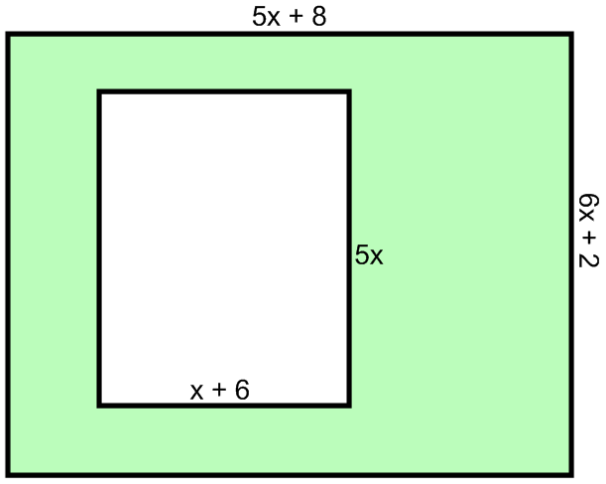
1. $(x - 7)(x + 9)$

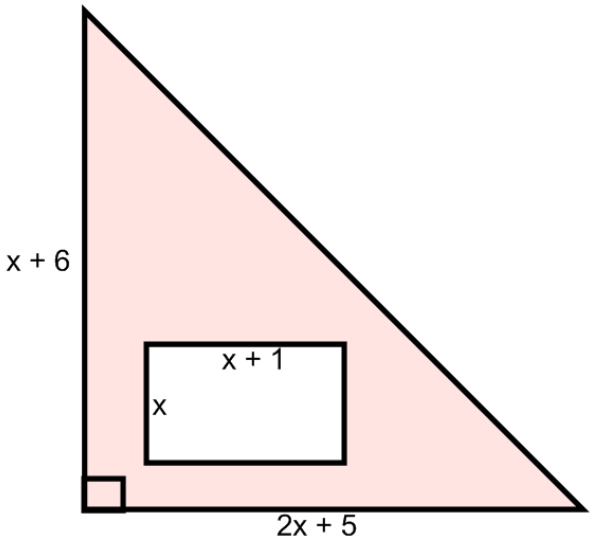
2. $(y + 4)(5y - 8)$

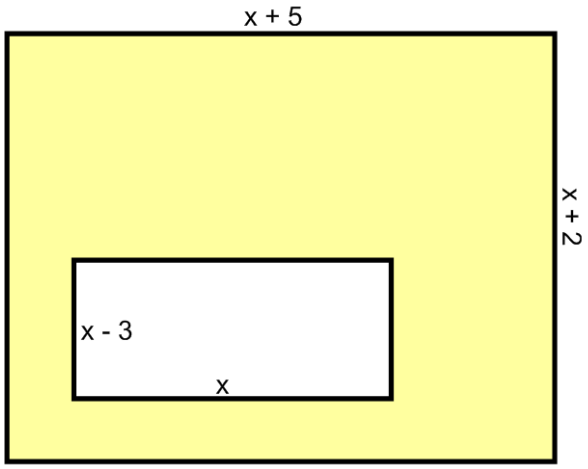
3. $(n^2 + 3)(n + 11)$

4. $(2x + 9)(x + 2)$

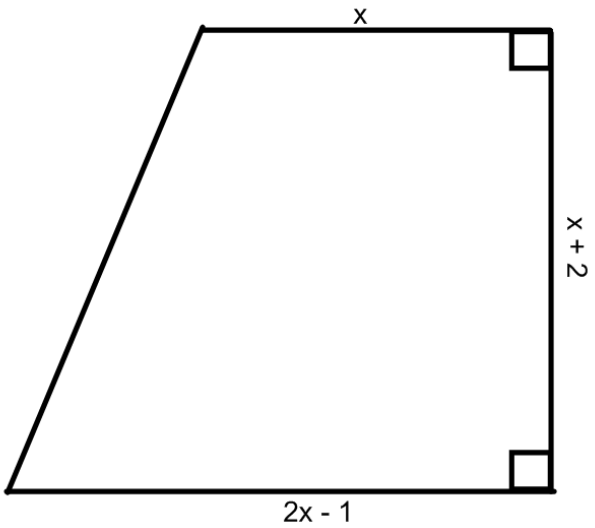
Find an expression for the area of the shaded region. Simplify your answer.







Find the area of the whole region.



MULTIPLYING BINOMIALS BY TRINOMIAL

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

$= 2x(4x^2) + 2x(x) + 2x(-6) - 3(4x^2) - 3(x) - 3(-6)$

$= 8x^3 + 2x^2 - 12x - 12x^2 - 3x + 18$

$= 8x^3 - 10x^2 - 15x + 18$ **Add like terms.**

The product is $8x^3 - 10x^2 - 15x + 18$.

1. $(x + 9)(x^2 - 4x + 1)$

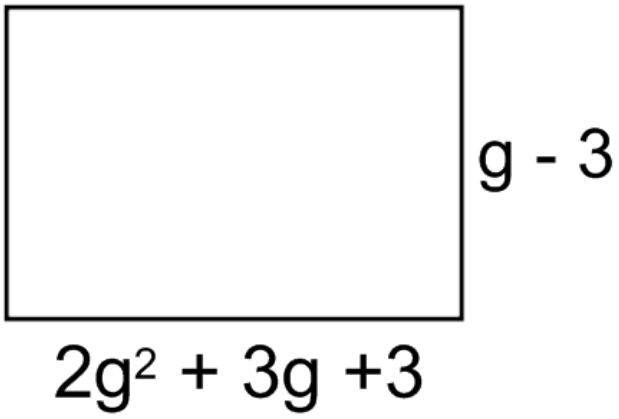
2. $(k + 8)(3k^2 - 5k + 7)$

3. $(9y^2 + 2)(y^2 - y - 1)$

4. $(12w^3 - 2w - 1)(4w - 2)$

Find the area of each figure.

5.



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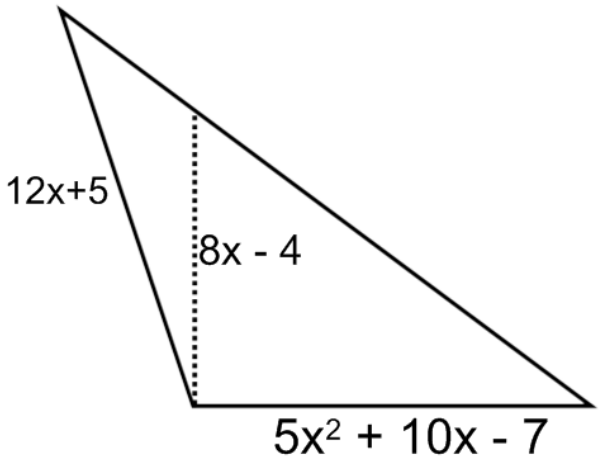
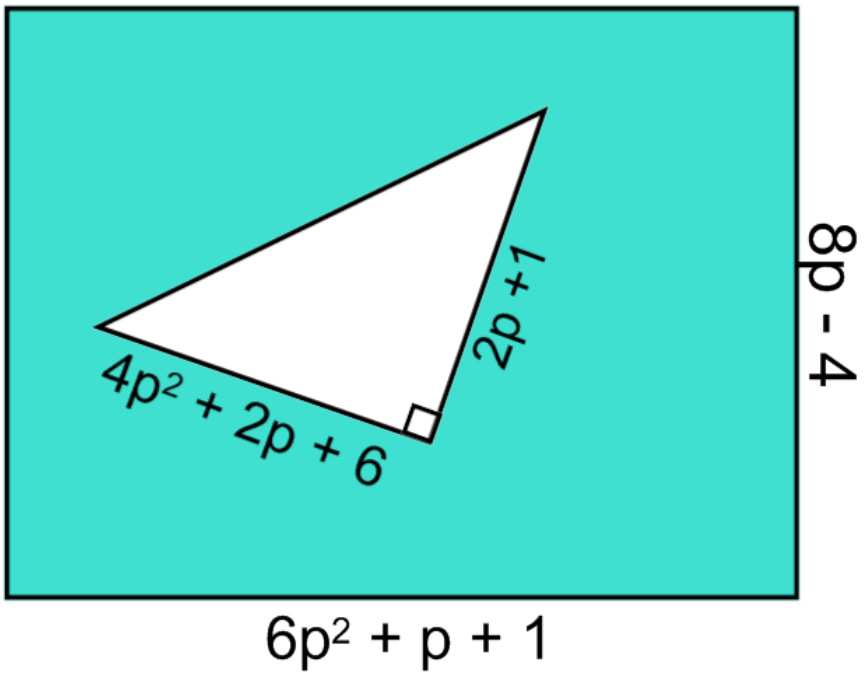


Find the area of the shaded region.

7.



Factoring Trinomials of the type $x^2 + bx + c$

Steps to Factoring the type $x^2 + bx + c$

1. Set up parenthesis in order to factor the trinomial into two binomials. ( )( )
2. Write x as the first term in each binomial. (x)(x)

3. List factors of c.
4. Identify the factors of c that also have a sum of b.

Factors of c	Addends of b

5. Use the factors of c that that have a sum of b as your last term in each binomial. (x factor 1)(x factor 2)

***If your factor is negative, carry the sign into the parenthesis, otherwise use a "+" sign in your parenthesis

---

1. Factor the trinomial $x^2 + 5x – 6$. Write each step on the lines to the left and demonstrate your work to the right.

1._____

2._____

3._____

4._____

5._____

2. Factor the trinomial $x^2 + 8x + 15$. Write each step on the lines to the left and demonstrate your work to the right.

1._____

2._____

3._____

4._____

5._____

3. Factor the trinomial $x^2 - 10x + 24$ into two binomials. Create a chart for the factors of "c" and the addends of "b".

4. Factor the trinomial $p^2 + 3p - 54$ into two binomials. Create a chart for the factors of "c" and the addends of "b".

5. Factor the trinomial $m^2 + 15m + 44$ into two binomials.

6. Factor the trinomial $n^2 + 10n - 56$ into two binomials.

CHALLENGE

7. Factor the trinomial $x^2 + 29xy + 100y^2$ into two binomials.

Factoring $ax^2 + bx + c$ Polynomials

Factor the following polynomials.

1.) $2x^2 - x - 6$

2.) $3x^2 - 6x - 24$

3.) $4x^2 - 14x - 8$

4.) $5m^2 + 13m - 6$

5.) $4x^2 + 20x + 24$

6.) $5x^2 - 20$

7.) In the trinomial, $8x^3 + 4x^2 + 2x$...

What is the GCF?

When the GCF is factored out, what is left?

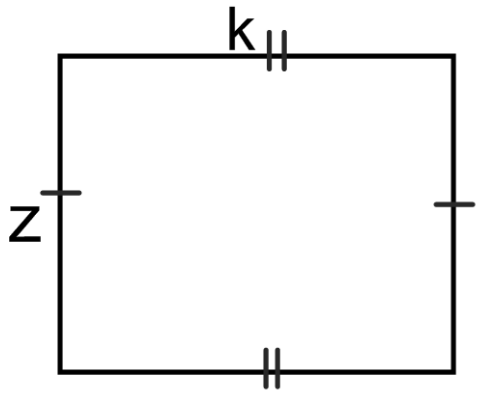
Can you factor the left over polynomial?

8.) The area of this rectangle is $15n^3 - 3n^2 + 12n$

If z = 3, what does *k* equal?

If z = n, what does *k* equal?

If z = 3n, what does *k* equal?

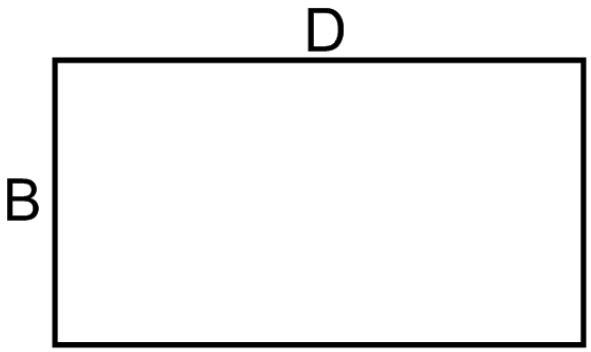


9.) If the area of a rectangle is $6p^5 + 3p^4 + 9p^2$, find all possible dimensions of this rectangle.

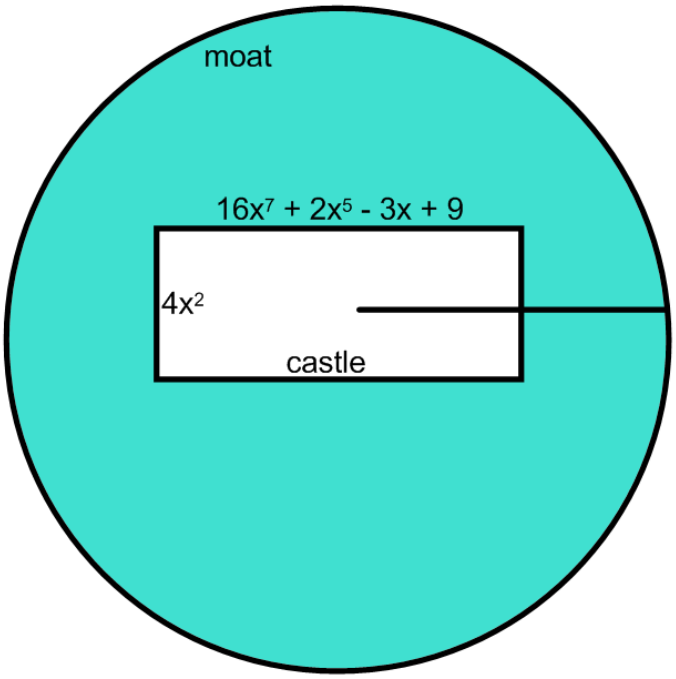
10.) The area of the rectangle is $6p^6 + 24p^5 + 18p^3$. If the length of *B* is the GCF of the rectangle's area;

What is the length of *B*?

What is the length of *D*?



11.) Suppose you are building a model of the rectangular castle shown in the picture. The moat of the model castle is made of blue paper. The area of the whole circle is $14x^9 + 2x^4 - 3x^2 + 8$. Find the area of the moat.



Factoring $ax^2 + bx + c$ Polynomials

Factor each expression.

1. $2x^2 + 3x + 1$

2. $2x^2 + 5x + 3$

3. $2n^2 + n - 6$

4. $3x^2 - x - 4$

5. $2y^2 - 9y - 5$

6. $5x^2 - 2x - 7$

7. $7n^2 + 9n + 2$

8. $3c^2 - 17c - 6$

9. $3x^2 + 8x + 4$

10. $6x^2 - 7x - 10$

11. $3x^2 - 10x + 8$

12. $3y^2 - 16y - 12$

13. $5x^2 + 2x - 3$

14. $3x^2 + 7x + 2$

15. $7x^2 - 10x + 3$

16. $3x^2 + 8x + 5$

17. $2x^2 + 9x + 4$

18. $5x^2 - 7x + 2$

19. $5x^2 - 22x + 8$

20. $4x^2 + 17x - 15$

21. $5x^2 - 33x - 14$

22. $3x^2 - 2x - 8$

23. $3y^2 + 7y - 6$

24. $2x^2 + 13x - 24$

$6x^2 + 13x + 6$	=		
$12x^2 – 5x – 3$	=		
$2x^2 – 21x + 49$	=		
$4x^2 + 11x + 6$	=		
$6x^2 – x – 40$	=		
$12x^2 + 17x – 7$	=		
$6x^2 – 17x + 12$	=		
$3x^2 + 29x + 40$	=		
$4x^2 + 20x - 11$	=		
$4x^2 – 19x – 5$	=		
$x^2 – 2x – 15$	=		
$3x^2 – 10x + 3$	=		

Factoring $x^2 + bx + c$ with 2 variables

1.) $x^2 - 6xy + 8y^2$

2.) $x^2 - 3xy - 40y^2$

3.) $x^2 + 8xy + 15y^2$

4.) $p^2 - 10pq + 16q^2$

5.) $h^2 + 18hj + 17j^2$

6.) $m^2 - 3mn - 54n^2$

7.) $d^2 + 17dg - 60g^2$

8.) $x^2 - 14xy + 49y^2$

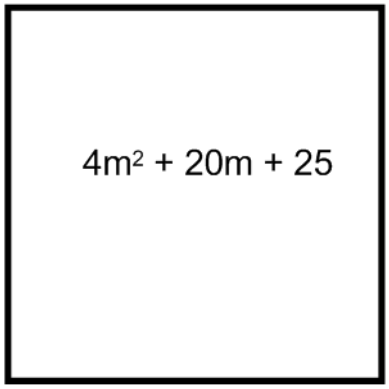
CHALLENGE:

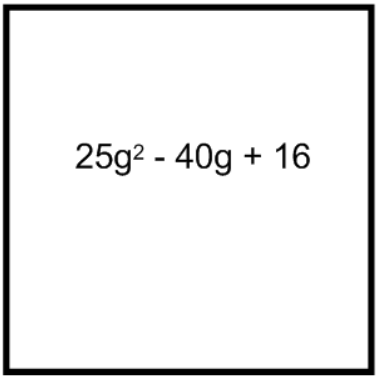
9.) $x^{12} + 12x^6 + 35$

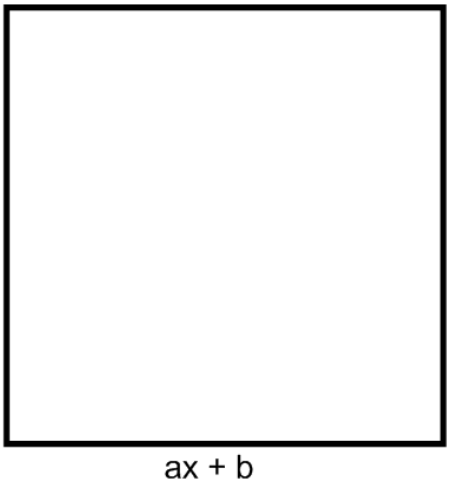
10.) $t^8 + 5t^4 - 24$

Factoring Special Cases

The given expression represents the area of the square. Find the side length of each square.

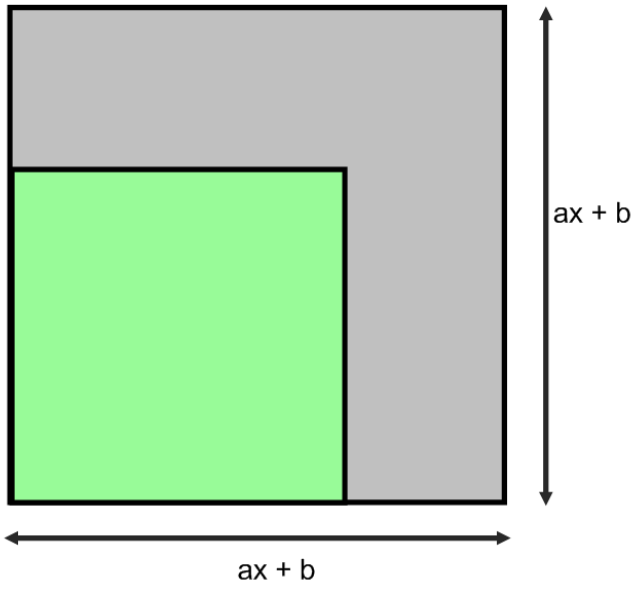






The area of the square shown below is $4x^2 + 28x + 49$. What is the sum of *a* and *b*?

The diagram shows two regions. The area of the smaller region (shaped like a square) is $4x^2 + 16x + 16$. The area of the larger region (shaped like an L) is $5x^2 + 14x + 9$. What is the value of *b*?



Factoring Special Cases

Factor each completely.

1) $16n^2 - 9$

2) $4m^2 - 25$

3) $16b^2 - 40b + 25$

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

5) $9x^2 - 1$

6) $n^2 - 25$

7) $n^4 - 100$

8) $a^4 - 9$

9) $k^4 - 36$

10) $n^4 - 49$

Factoring Special Cases

11) $98n^2 - 200$

12) $3 + 6b + 3b^2$

13) $400 - 36v^2$

14) $100x^2 + 180x + 81$

15) $10n^2 + 100n + 250$

16) $49n^2 - 56n + 16$

17) $49x^2 - 100$

18) $1 - r^2$

19) $10p^3 - 1960p$

20) $343b^2 - 7b^4$

21) $81v^4 - 900v^2$

22) $200m^4 + 80m^3 + 8m^2$

Factoring by Grouping

1. Follow the steps to the right in order to factor by grouping

$2n^3 + 5n + 4n^2 + 10$

_____ group terms
_____ factor out GCF from each group
_____ rewrite as a pair of binomial factors

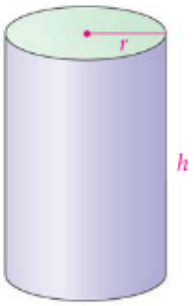
2. Rewrite the four term polynomial above in standard form and factor by grouping.

3. What do you notice about the pair of binomial factors from numbers 1 & 2? Does order matter when factoring by grouping?

4. Factor by grouping $x^2p + x^2q^5 + yp + yq^5$

5. Factor by grouping $30m^5 + 24m^3n - 35m^2n^2 - 28n^3$

6. The polynomial $2\pi x^3 + 12\pi x^2 + 18\pi x$ represents the volume of a cylinder



a) Factor $2\pi x^3 + 12\pi x^2 + 18\pi x$

b) Based on your answer to part (a), write an expression for a possible radius of the cylinder.

Factoring Trinomials by Grouping

(i) $x^2 - 11x - 42$ (ii) $x^2 - 12x - 45$ (iii) $x^2 - 7x - 30$

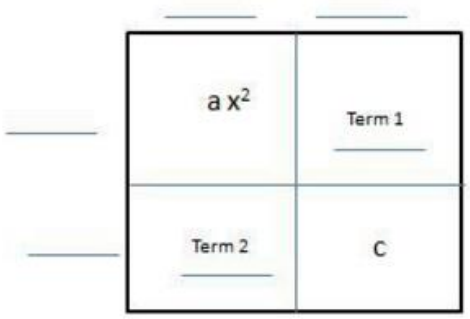
(iv) $x^2 - 5x - 24$ (v) $3x^2 + 10x + 8$ (vi) $3x^2 + 14x + 8$

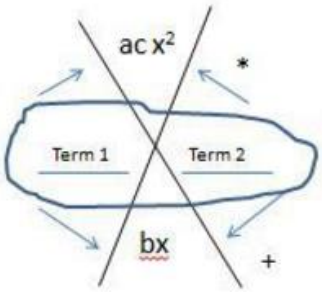
(vii) $2x^2 + x - 45$ (viii) $6x^2 + 11x - 10$ (ix) $3x^2 - 10x + 8$

(x) $2x^2 - 17x - 30$

Factoring with an organizer

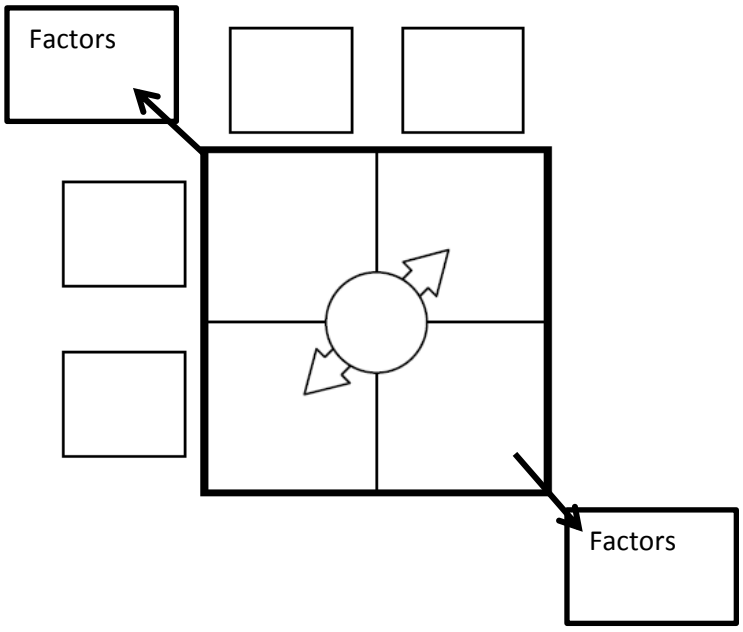
$a x^2 + bx + c$



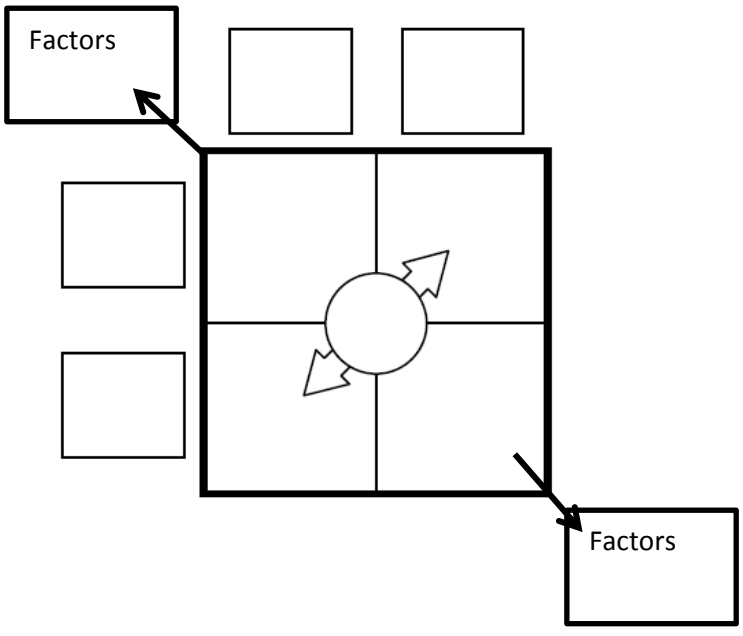


1. Put **a x²** in top left box corner.
2. Put **c** in bottom right box corner.
3. Multiply terms and put in top of X.
4. Put **bx** at bottom of x.
5. THE BIG QUESTION: What two terms **multiply** to ac x² and **add** to bx?
6. Put the two terms in the empty box spaces. IT DOESN'T MATTER WHERE.
7. Pick a row (usually the top) and find the GCF of the two terms (in this case, a x² and Term 1.)
8. Then either work backwards or find the GCF for each outside spot.

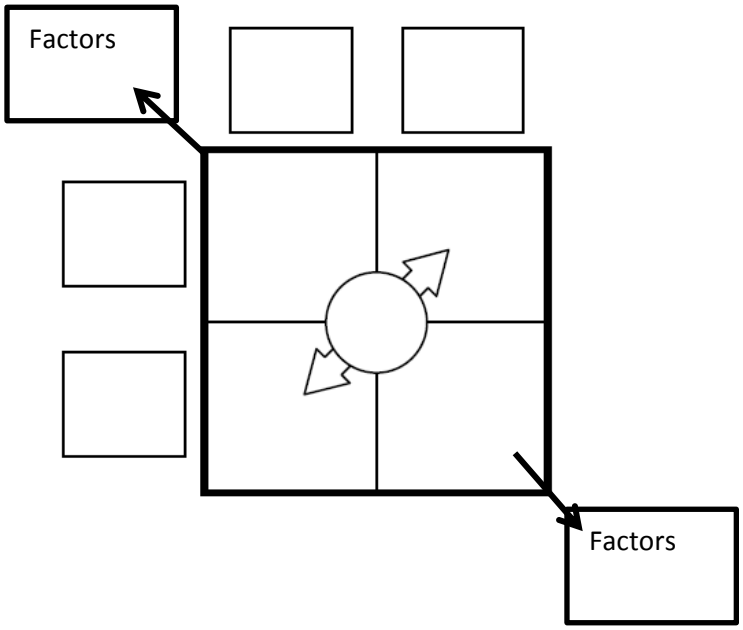
FACTOR: $6x^2 + 65x + 50$



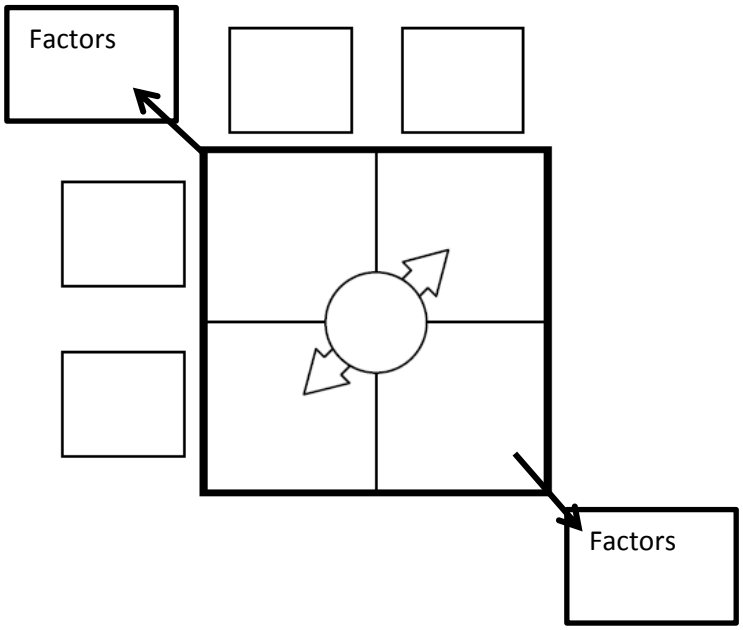
FACTOR: $x^2 + 14x + 48$



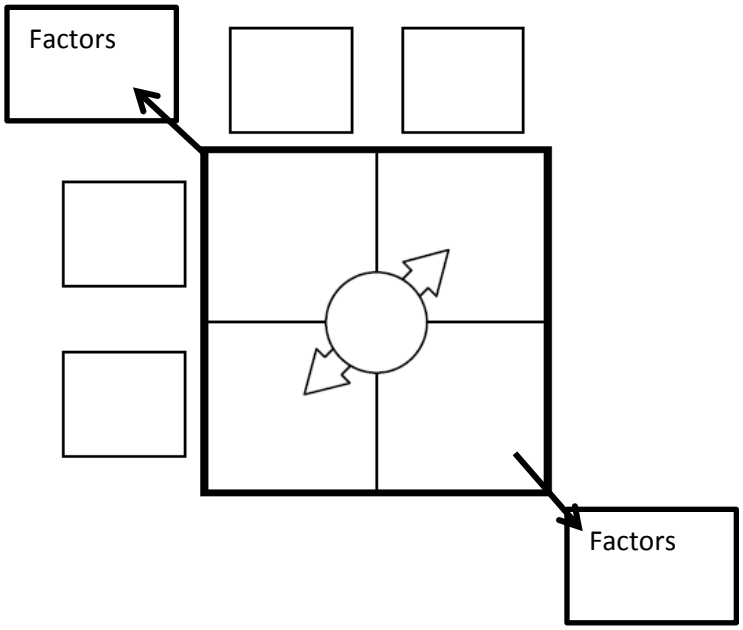
FACTOR: $3w^2 - 6w - 24$



FACTOR: $k^2 - 17k + 60$



FACTOR: $25x^2 + 90x + 81$



FACTOR: $h^2 - 22h + 121$