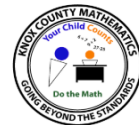




# Algebra 1



## KCS at Home

### Algebra 1 Summer Packet

#### Activity Set 1

##### A. Quadratic Functions

Objective: The student will be able to:

- Graph quadratics embedded in a real-world situation.
- Factor a quadratic function to reveal the zeros of the function.
- Determine the minimum and maximum of a quadratic by completing the square.
- Know and apply the quadratic formula.

#### Activity Set 2

##### B. Linear Functions and Equations

Objective: The student will be able to:

- Calculate and write the equation for the slope of a line.
- Rewrite an equation in standard form to slope intercept form
- Model and compare linear functions using multiple representations.
- Represent and solve systems of linear functions
- Solve multi-step equations using properties of equality and number properties.

#### Activity Set 3

##### C. Exponent Laws and Exponential Functions

Objective: The student will be able to:

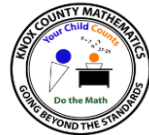
- Use properties of exponents to rewrite exponential expressions.
- Evaluate powers that have zeros or negative exponents.
- Write the explicit formula for geometric sequences in function form.
- Create an exponential function given a graph.
- Represent exponential growth and decay functions.

#### Activity Set 4

##### D. Polynomials Expressions

Objective: The student will be able to:

- Simply polynomials by adding and subtracting.
- Multiply monomials and polynomials using models and strategies.
- Use arithmetic operations to simply expressions.
- Identify the greatest common factor of the terms of a polynomial expression.
- Factor polynomials using strategies such as grouping or difference of squares.



## Activity Set 4

### A. Polynomial Expressions

#### I. Adding and Subtracting Polynomials

- You can add or subtract terms that are considered “alike”, or terms that have the same variable with the same exponent.
- Every term inside the parentheses is multiplied by the term outside of the parentheses.

$$-8h^2 + 10h^3 - 12h^2 - 15h^3$$

$$\underline{-8h^2 + 10h^3} - \underline{12h^2 - 15h^3}$$

$$\boxed{-20h^2 - 5h^3}$$

$$5x - 7y + 10x + 3y$$

$$\underline{5x - 7y} + \underline{10x + 3y}$$

$$\boxed{15x - 4y}$$

$$Ex2: 4x^2(5x^3 + 6x)$$

$$4x^2 \cdot 5x^3 + 4x^2 \cdot 6x$$

$$4x^2 \cdot 5x^3 + 4x^2 \cdot 6x$$

$$\boxed{20x^5 + 24x^3}$$

$$Ex1: 3(9x - 4)$$

$$3 \cdot 9x - 3 \cdot 4$$

$$\boxed{27x - 12}$$

#### REAL WORLD SCENARIO:

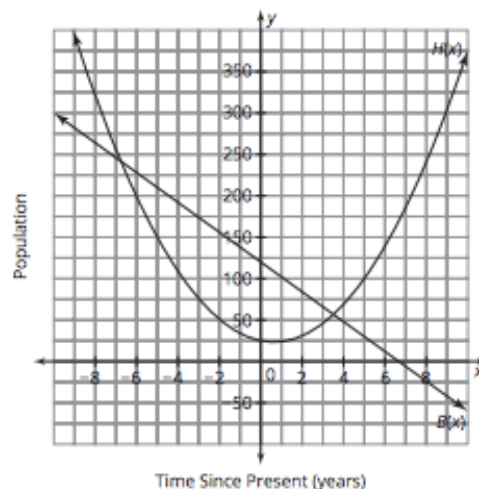
You are playing a new virtual reality game called “Species.” You are an environmental scientist who is responsible for tracking two species of endangered parrots, the orange-bellied parrot and the yellow-headed parrot. Suppose the orange-bellied parrots’ population can be modeled by the function  $B(x)$ , where  $x$  represents the number of years since the current year. Suppose that the population of the yellow-headed parrot can be modeled by the function  $H(x)$ .

- You can write a function  $T(x)$ , in terms of  $x$  to calculate the total number of parrots at any time.

$$B(x) = -18x + 120$$

$$H(x) = 4x^2 - 5x + 25$$

The two polynomial functions are shown on the coordinate plane.



#### Worked Example

$$T(x) = B(x) + H(x)$$

$$T(x) = (-18x + 120) + (4x^2 - 5x + 25)$$

$$T(x) = 4x^2 + (-18x + (-5x)) + (120 + 25)$$

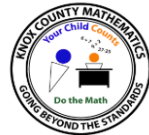
$$T(x) = 4x^2 - 23x + 145$$

Write  $T(x)$  in terms of two known functions.

Substitute the functions in terms of  $x$ .

Use the Commutative Property to reorder and the Associative Property to group like terms.

Combine like terms.



## II. Multiply Polynomials using a Model

- You can multiply polynomials using an area model.
- $(3x - 2)(12x + 7)$
- Combine like terms
- $36x^2 - 3x - 14$
- See KCS Video for more details.

.	$3x$	$-2$
$12x$	$36x^2$	$-24x$
$7$	$21x$	$-14$

## III. Identify the Greatest Common Factor of a Polynomial Expressions

- Numerical GCF: Greatest common factor of all numerical coefficients and constant.
- Variable GCF: The lowest exponent of a particular variable.
- 

a.  $3x^2 + 6x + 12$       GCF = 3  
 $= 3(x^2 + 2x + 4)$

b.  $4a^2b - 8ab^2 + 6ab$       GCF =  $2ab$   
 $= 2ab(2a - 4b + 3)$

- Factoring  $Ax^2 + Bx + C$  when the leading coefficient is 1.
- Factor using a table or area model. (See KCS Video)

$x^2 + 5x + 6$       **Product of 6**  
 $= (x + 2)(x + 3)$ 

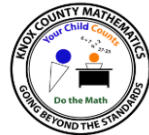
1	6	-1	-6
2	3	-2	-3

  
↑  
sum of 5

b.  $x^2 - 3x - 10$       **Product of -10**  
 $= (x + 2)(x - 5)$ 

-1	10	1	-10
-2	5	2	-5

  
↑  
sum of -3



#### IV. Factor by Grouping

- Factoring  $Ax^2 + Bx + C$  when the leading coefficient is not 1  $a \neq 1$ .

**Example 1:** Factor  $6x^2 + 11x + 4$  First, we look for GCF. But there is no GCF!

$6x^2 + 11x + 4$

Multiply  $a$  and  $c$ . → **Product of 24**

1	24	-1	-24
2	12	-2	-12
3	8	-3	-8
4	6	-4	-6

sum of 11 → Split the  $bx$  term into two separate terms.

$= 6x^2 + 3x + 8x + 4$   
 $= (6x^2 + 3x) + (8x + 4)$       Group by brackets  
 $= 3x(2x + 1) + 4(2x + 1)$       Take out GCF for each bracket.  
 $= (3x + 4)(2x + 1)$       Factor by Common Bracket!

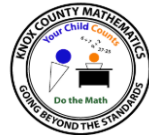
#### V. Factor by using Difference of Squares

**Example 1:** Completely factor the followings.

a.  $x^2 - 25 = (x - 5)(x + 5)$

b.  $x^2 + 9 =$  (NOT Factorable – Sum of Squares)

c.  $3x^2 - 300 = 3(x^2 - 100) = 3(x - 10)(x + 10)$



## PRACTICE

1. Simply the expressions.

A.  $3x^2 - 2x + 14) - (6x^2 + 3x - 9)$

B.  $3x(2x - 4)$

2.

Given  $A(x) = x^3 - 5x + 4$ ,  $B(x) = 2x^2 + 5x - 6$ , and  $C(x) = -x^2 + 3$ , determine each function.

Write your answer in general form.

a.  $D(x) = B(x) + C(x)$

b.  $E(x) = A(x) + B(x)$

c.  $F(x) = A(x) - C(x)$

d.  $G(x) = C(x) - B(x)$

e.  $H(x) = A(x) + B(x) - C(x)$

f.  $J(x) = B(x) - A(x) + C(x)$

3.

Two students determine the product of the 3 binomials using two different methods. Student 1 uses a multiplication table, and Student 2 uses the distributive Property. Their work is shown below. Determine which student multiplied correctly and identify the mistake the other student made. Explain how you determined your answer.

**Student 1**

•	$x$	$3$	$2x$	$1$
$x$	$x^2$	$3x$	$2x^2$	$x$
$-4$	$-4x$	$-12$	$-8x$	$-4$

The product is  $3x^2 - 8x - 16$ .

**Student 2**

$$(x + 3)(2x + 1)(x - 4) = (2x^2 + 7x + 3)(x - 4)$$

$$= 2x^3 - x^2 - 25x - 12$$

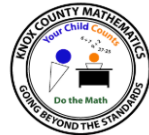
The product is  $2x^3 - x^2 - 25x - 12$ .

4. What is the greatest common factor of the polynomial  $24x^3 - 16x^2 - 68x$ ?

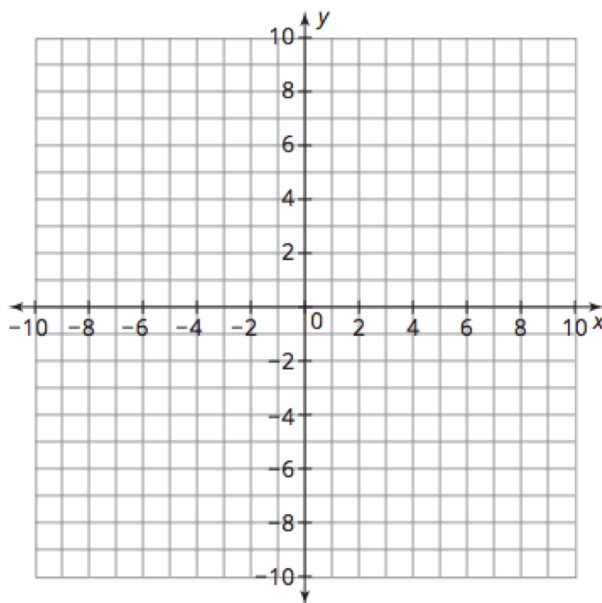
5. Correctly factor the polynomial  $3x^4 - 9x^3 - 30x$ .

6. A. Factor the trinomial  $x^2 + 10x + 16$  using the model.

•		
	$x^2$	
		$16$



- B. Graph the function.
- C. Identify the roots
- D. Identify the vertex



7. Determine the roots of each equation by completing the square.

A.  $x^2 - 6x + 4 = 0$

B.  $x^2 - 12x + 6 = 0$

8. Factor each binomial completely.

A.  $x^2 - 25$

B.  $x^2 - 64$

C.  $4a^2 - 49$

## Answer Key Activity Set 4

1. A.  $-3x^2 - 5x + 23$

2.

a.  $D(x) = x^2 + 5x - 3$

b.  $E(x) = x^3 + 2x^2 - 2$

c.  $F(x) = x^3 + x^2 - 5x + 1$

d.  $G(x) = -3x^2 - 5x + 9$

e.  $H(x) = x^3 + 3x^2 - 5$

f.  $J(x) = -x^3 + x^2 + 10x - 7$

4.  $4x$

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

6. A.

Determine the factor pairs of the constant term. The factors of 16 are (1)(16), (2)(8), and (4)(4). Experiment with factors of the constant term to determine the pair whose sum is the coefficient of the middle term, 10.

	$x$	8
$x$	$x^2$	$8x$
2	$2x$	16

The sum of  $2x$  and  $8x$  is  $10x$ .

So,  $x^2 + 10x + 16 = (x + 2)(x + 8)$ .

7.

a.  $x = 3 \pm \sqrt{5}$

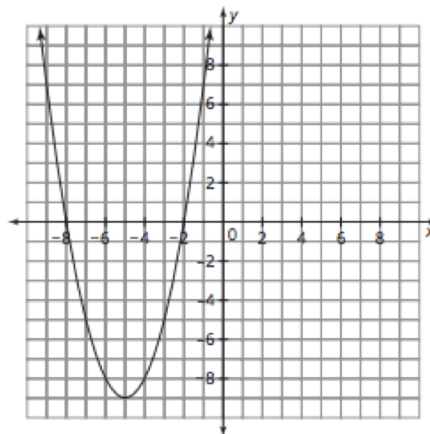
b.  $x = 6 \pm \sqrt{30}$

B.  $6x^2 - 12x$

3.

Student 2 determined the correct product. Student 1 incorrectly multiplied the expression  $(x - 4)$  by the sum of the expressions  $(x + 3)$  and  $(2x + 1)$ . Student 2 determined the product of the first two linear factors,  $(x + 3)$  and  $(2x + 1)$ , and then multiplied that expression by  $(x - 4)$ .

6.B. roots:  $(-2, 0)$  and  $(-8, 0)$  Vertex:  $(-5, 9)$



8.A.  $(x + 5)(x - 5)$

8.B.  $(x + 8)(x - 8)$

8.C.  $(2a + 7)(2a - 7)$