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MORE STRUCTURE WORK
COMMON CORE ALGEBRA I

The more you are able to see **structure** in the various **expressions** that you deal with, the easier it will be to manipulate complex expressions. We will work with structure throughout the course. We can now look at some larger structural issues that include equivalency.

***Exercise* #1:** Consider the somewhat complex expression $x(x+4)+2(x+4)$.

(a) Write an equivalent **trinomial** expression. Test the equivalency with a value of $x=1$. Show the test.

(b) Write an equivalent expression that is in the form of a product of two binomials. Also test the equivalency with $x=1$.

Which type of equivalent expression we might need would depend on the context of what we were trying to do with the math. For now, we want to get practice with writing various expressions in an equivalent form, and being able to test that equivalency.

***Exercise* #2:** Consider the expression $(x+4)(x-5)+(x+4)(x-2)$. Write an equivalent expression that is in the form of the product of two binomials. Test the equivalency with a value of x. Show your test.

***Exercise* #3:** Which of the following is equivalent to the expression $(x-3)(2x+7)-(x-3)(x-4)$? Show the manipulations that lead to your choice.

(1) $(x-3)(x+3)$

(2) $(x-3)(x+11)$

(3) $(x-6)(x+10)$

(4) $(x-6)(x-4)$

Strangely enough, this type of manipulation, where there is a common binomial multiplying two other terms, is frequent enough that it is also a good skill to become **fluent** in. Get some additional practice in the next exercise. Be careful when subtraction is involved (see the last exercise!).

***Exercise* #4:** Rewrite each of the following expressions as an equivalent product of two binomials.

(a) $x(x+5)+7(x+5)$ (b) $3x(x-2)-4(x-2)$ (c) $-2x(x+4)+x+4$

(d) $(x-6)(x+3)+(x+9)(x+3)$ (e) $(2x+1)(x-4)-(x+6)(x-4)$

Remember, that we want to always look for **mindful manipulations** in order to help us solve our problems. Sometimes we won't know whether those manipulations will pay dividends, but as long as we know we are making manipulations that retain **equivalency** then they are worth a try.

***Exercise* #5:** The binomial $4n+1$ is equal to 7 for some value of n. What is the value of the expression shown below for the same value of n. Do not solve for n in this problem. Use mindful manipulations and look for structure to help solve this problem.

$$(3n+1)(4n+1)+(n+2)(4n+1)$$

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TRANSLATING ENGLISH TO ALGEBRA
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There will be many instances when we have to translate phrases from English into mathematical expressions. This is a skill that takes a lot of practice and time to get good at. In this lesson we will begin to build this fluency.

***Exercise* #1:** It is important to be able to recognize addition and subtraction in phrases. First, let's begin with some numerical work and then transition to expressions that contain variables.

(a) Write a calculation and a result that represents a number that is 5 greater than 3.

(b) Write a calculation and a result that represents a number that is 2 less than 9.

(c) Write a calculation and a result that represents the sum of -3 and 8.

(d) Write a calculation and a result that represents the difference of 20 and 12.

(e) If x represents a number, write an expression that represents a number 10 greater than x.

(f) If n represents a number, write an expression that represents a number that is 5 less than n.

(g) If y represents a number, write an expression that represents the sum of y and a number one greater than y.

(h) If n represents a number, write an expression that represents the difference between a number one larger than n and one smaller than n. Be careful.

We also need to be able to translate multiplication and division. Multiplication is typically easier to spot and translate. Let's get some practice.

***Exercise* #2:** Translate each verbal statement into an expression and evaluate the expression if it is numerical.

(a) Write an expression for a number that is five times greater than 2.

(b) If n represents a number, then write an expression for a number that is twice n.

(c) Write an expression for the quotient (or ratio) of 12 and 3.

(d) If x represents a number, write an expression for the ratio of x to 5.

Now we want to be able to put operations together to create more complex expressions. These can be tricky. It is always important to read them carefully, think about your order of operations, and check with a real number.

Exercise #3: Translate each of the following statements into an algebraic expression.

(a) If x represents a number, then write an expression for a number that is three more than twice the value of x.

(b) If n represents a number, then write an expression for two less than one fourth of n.

(c) If s represents Sally's age and her father is 4 years less than five times her age, then write an expression for her father's age in terms of the variable s.

(d) If x represents a number, then write an expression for three times the sum of x and 10.

(e) If n represents a number, then write an expression for 7 less than four times the difference of n and 5.

(f) If x represents a number, then write an expression for the ratio of 3 less than x to 2 more than x.

(g) If x represents a number, then write an expression for the sum of twice x with twice a number one larger than x.

(h) If n represents a number, then write an expression for the quotient of twice n with three less than n.

(i) If y represents a number, then write an expression for three-quarter of the difference of y and 8.

(k) If x represents a number, then write an expression for one half the sum of x and 4.

Exercise #4: Neat patterns can occur repeatedly when you play around with numbers. A fairly easy one occurs when you add a number to one less and one more than the number. Do this for a few numbers, x, and record the results. Then, prove a general pattern by writing an expression for the sum of a number with a number one less and a number one more than it.

CALCULATIONS:

x	sum

ALGEBRAIC EXPRESSION:

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TRANSLATING ENGLISH TO ALGEBRA
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FLUENCY

1. Translate each of the following statements into an algebraic expression.

(a) If x represents a number, then write an expression for a number that is three more than the number.

(b) If x represents a number, then write an expression for a number that is eight less than twice the value of x.

(c) If x represents a number, then write an expression for a number that is three more than one third the value of x.

(d) If n represents a number, then write an expression for two less than one fourth of n.

(e) If g represents Gregs's age and his daughter is 4 years less than one half his age, then write an expression for his daughter's age in terms of the variable g.

(f) If y represents a number, then write an expression for negative two times the sum of y and 7.

(g) If n represents a number, then write an expression for three times the difference of the number and six increased by four times the number.

(h) If k represents a number, then write an expression for the ratio of 3 less than k to 2 more than k.

(i) If x represents a number, then write an expression for the difference of three times the number increased by 3 and twice that number.

(j) If h represents a number, then write an expression for the quotient of twice h and 10 more than h.

(l) If x represents a number, then write an expression for one half the sum of x and 7.

(k) If x represents a number, then write an expression for 7 more then one half the number.

9. The product of a number and twelve

10. twenty times a number increased by thirteen

11. the quotient of twice a number and negative nine

12. three less than four times a number

13. eight increased by twice a number

14. The quotient of six less than twice a number and four

15. The product of twice a number and negative three

16. Three less than the quotient of a number and six