Name: Key Date: ____

COMMON ALGEBRAIC EXPRESSIONS
COMMON CORE ALGEBRA II

In Algebra II we will spend a lot of time evaluating and simplifying algebraic expressions. Just to be clear:

> **ALGEBRAIC EXPRESSION**
>
> **Algebraic expressions** are just combinations of constants and variables using the typical operations of addition, subtraction, multiplication, and division along with exponents and roots (square roots, cube roots, etcetera).

It is important to be able to evaluate algebraic expressions for values of the variables contained in them.

***Exercise* #1:** Consider the algebraic expression $4x^2+1$.

PEMDAS

(a) Describe the operations occurring within this expression and the order in which they occur.

1 the number is squared
2 multiply by 4
3 add 1

(b) Evaluate this expression for the replacement value $x=-3$. Show each step in your calculation. Do not use a calculator.

$4(-3)^2+1$
$4(9)+1$
$36+1$
$\boxed{37}$

***Exercise* #2:** Consider the more complex algebraic expression (known as a rational expression) $\dfrac{4x+3}{x^3-7}$.

(a) Without using your calculator, find the value of this expression when $x=3$. Reduce your answer to simplest terms. Show your steps.

$\dfrac{4(3)+3}{(3)^3+7} \Rightarrow \dfrac{12+3}{27+7} \Rightarrow \boxed{\dfrac{15}{34}}$

(b) If a student entered the following expression into their calculator, it would give them the incorrect answer. Why?

4(3)+3/3^3−7

In a rational expression, the parenthesis in the numerator and denominator are understood. It should look like (4(3)+3)/(3^3−7).

Expressions can contain more complex operators, such as the square and cube roots as well as the absolute value. We will need each of these over the span of this course, so some practice with all of them is warranted.

***Exercise* #3:** Is the absolute value expression $|x-8|+2$ equivalent to $|x|+10$? How can you check this?

Set them equal to each other

$|x-8|+2=|x|+10$
$\quad\;\;-2 \qquad\quad -2$
$|x-8|=|x|-8$

These are not equivalent because the left side will always be positive, but the right will be negative when $|x|<8$.

Exercise #4: Consider the algebraic expression $\sqrt{25-x^2}$, which contains a square root.

(a) Evaluate this expression for $x=-3$.

$\Rightarrow \sqrt{25-(3)^2}$

$\Rightarrow \sqrt{25-9}$

$\Rightarrow \sqrt{16} \Rightarrow \boxed{4}$

(b) Why can you *not* evaluate the expression for $x=13$?

$\Rightarrow \sqrt{25-(13)^2}$

$\Rightarrow \sqrt{25-169}$

$\Rightarrow \sqrt{-144}$

You cannot take the square root of a negative number... yet :)

(c) Max thinks that the square root operation distributes over the subtraction. In other words, he believes the following equation is an identity:

$$\sqrt{25-x^2}=5-x$$

Show that this is **not** an **identity**.

We can test this by plugging in a number (proof by contradiction).

When $x=1$... $\sqrt{25-(1)^2} = 5-1$

$\Rightarrow \sqrt{25-1} = 4 \Rightarrow \sqrt{24} \neq 4$ ✓

Algebraic expressions can become quite complicated, but if you consider **order of operations** and work generally from **inside to outside** then you can evaluate any expression for replacement values.

Exercise #5: Consider the rather complicated expression $\sqrt{\dfrac{|x-8|}{5x^2+4}}$.

(a) What operation comes last in this expression?

taking the square root

(b) Evaluate the expression for $x=2$. Simplify it completely.

$\sqrt{\dfrac{|2-8|}{5(2)^2+4}} \Rightarrow \sqrt{\dfrac{|-6|}{5(4)+4}}$

$\Rightarrow \sqrt{\dfrac{6}{20+4}} \Rightarrow \sqrt{\dfrac{6}{24}} \Rightarrow \sqrt{\dfrac{1}{4}} = \boxed{\dfrac{1}{2}}$

Exercise #6: Which of the following is the value of $\dfrac{\left|\sqrt{4x+9}-x^2\right|}{3}$ when $x=10$?

(1) 31

(2) 24

(3) 18

(4) 84

$\dfrac{\left|\sqrt{4(10)+9}-(10)^2\right|}{3} \Rightarrow \dfrac{\left|\sqrt{40+9}-100\right|}{3}$

$\Rightarrow \dfrac{|\sqrt{49}-100|}{3} \Rightarrow \dfrac{|7-100|}{3} \Rightarrow \dfrac{|-93|}{3} = \dfrac{93}{3} = \boxed{31}$

(1) 31