OPERATIONS WITH SIGNED NUMBERS
N-GEN MATH® 8

We begin this year with algebra. As we start our work, it is important to remind ourselves how operations (such as addition, subtraction, multiplication, and division) behave with signed numbers (positive and negative). In this lesson we will review the “rules” of signed numbers and some properties of these operations.

Exercise #1: It is important to be able to add simple and relatively small signed numbers without a calculator by thinking about how positive and negative numbers “cancel” each other in addition. Find each of the following sums.

(a) $-8 + 14$  
(b) $-20 + 15$  
(c) $-6 + -10$

In Exercise #1 (a) and (b) we should see a connection between adding signed numbers and the operation of subtraction. In fact, we can always convert any subtraction problem into one involving addition.

Exercise #2: Convert each of the following subtraction problems into an equivalent addition problem and then evaluate the sum.

(a) $10 - 3$  
(b) $9 - 20$  
(c) $6 - (-2)$

It is important to be able to rewrite subtraction as addition because addition has the properties of being commutative and associative. In addition, the order of the numbers in the addition doesn’t matter (commutative) and which order we add them in doesn’t matter (associative). We can take advantage of this when there are many numbers involved in our sum/difference.

Exercise #3: For each of the following expressions do the following: (1) rewrite using only sums, (2) group the positive together and the negatives together, (3) find the sum of the positives and the sum of the negatives, and (4) find the overall sum.

(a) $7 - 10 + 2 - 5 + -3 + 11$  
(b) $-8 + 9 - 2 - (-5) + 3 - 10$
Last year you also worked with multiplication and division of negatives. Here we will just review the basic rules that govern multiplying and dividing signed numbers.

**Exercise #4:** For each of the following, fill in the blank with the word positive or negative and then state the result of the calculation.

(a) a positive \times a negative = _________________  
   ex: 8 \times -5 = __________

(b) a negative \times a positive = _________________  
   ex: \(-\frac{1}{2}\) \times 20 = __________

(c) a negative \times a negative = _________________  
   ex: -4 \times -7 = __________

(d) a positive \div a negative = _________________  
   ex: 48 \div -4 = __________

(e) a negative \div a positive = _________________  
   ex: -72 \div 9 = __________

(f) a negative \div a negative = _________________  
   ex: -36 \div -9 = __________

Recall that in **order of operations**, multiplication and division occur before addition and subtraction.

**Exercise #5:** Find the results of each of the following expressions.

(a) \((-3)(7) + (-5)(-2)\)  
   (b) 8 - 2(-7)  
   (c) \((-5)^2 + 3(-5) - 8\)

Because of the connection between division and fractions, it is important to be able to simplify fractions that contain negatives in their numerators and/or denominators.

**Exercise #6:** Simplify each fraction. If the result is an integer, state it without a denominator.

(a) \(-\frac{3}{6}\)  
   (b) \(-\frac{24}{-3}\)  
   (c) \(-\frac{20}{-16}\)  
   (d) \(-\frac{9}{-27}\)
OPERATIONS WITH SIGNED NUMBERS
N-GEN MATH® 8 HOMEWORK

FLUENCY

It is important to do as many of these problems as possible without your calculator. These ideas will be important for later work in algebra.

1. Which of the following calculations would produce a negative result?

   (1) \(-5 + 12\)  
   (2) \(30 ÷ -10\)  
   (3) \(-9 \cdot -5\)  
   (4) \(-5 - (-20)\)

2. Find each of the following sums.

   (a) \(-30 + 18\)  
   (b) \(-11 + -9\)  
   (c) \(22 + -12\)  
   (d) \(-17 + 17\)

3. For each of the following differences, do the following: (1) change the difference into a sum and (2) evaluate the sum.

   (a) \(10 - 7\)  
   (b) \(9 - 17\)  
   (c) \(-5 - 8\)  
   (d) \(14 - (-3)\)

4. Find the result of each expression below. Rewrite as addition, combine positives and negatives separately, and then find the final value.

   (a) \(15 - 5 + -3 + 7 - 11\)  
   (b) \(-8 + 15 - 2 - (-6) - 11\)  
   (c) \(25 + 7 - 20 + -16 + 3\)
5. The result of each product or quotient below is an integer (not fractional). Find the result of each. Products and quotients are shown in multiple ways.

(a) \(-8 \cdot -10\)  
(b) \(7(-5)\)  
(c) \(-40 \div -8\)  
(d) \(48 \div -6\)

(e) \((-9)^2\)  
(f) \((-5)(12)\)  
(g) \(-\frac{45}{5}\)  
(h) \(-\frac{49}{-7}\)

6. Write each of the following fractions in simplest form. If the result is an integer, state it without the use of a denominator.

(a) \(-\frac{8}{24}\)  
(b) \(-\frac{15}{-20}\)  
(c) \(-\frac{18}{-2}\)  
(d) \(-\frac{-5}{-20}\)

7. Which fraction below is not equal to \(-\frac{1}{2}\)?

(1) \(-\frac{11}{-22}\)  
(2) \(-\frac{5}{10}\)  
(3) \(-\frac{-6}{-12}\)  
(4) \(-\frac{7}{14}\)

8. Find the results of each of the following calculations. State your answers in simplest form. Show intermediate steps.

(a) \(4(-5) + 7(2)\)  
(b) \(2(5 - 9) - (-3 - 8)\)  
(c) \((-7)^2 + 10(-5)\)