# **Operations with Whole Numbers Discussion Guide (for use during or after reading)**

1. In math, what is a function? What are inputs and outputs? (Functions, p. 10-13)
   1. In math, a function is a relationship between two groups of numbers, called the input and the output. Each input has exactly one output. Functions are dictated by function rules and include a second number as well as at least one operation. For example, a function rule may state “subtract 2,” meaning we would need to subtract 2 from the input to find the output.
2. Consider the example on page 11. Use your own words to explain how the function rule “add 12” matches the function table shown. (Functions, p. 10-11)
   1. We can tell that this function table represents the function rule of “add 12” because each input corresponds to an output that is 12 greater. For example, we can apply the rule of “add 12” to each input: 5 + 12 = 17, 12 + 12 = 24, and 17 + 12 = 29. Because this rule applies to multiple entries in the function table, it is reasonable to assume that this rule represents the function.
3. Describe how to compare two expressions such as “fifteen more than 8” and “triple 7.” (Comparing Quantities, p. 14-15)
   1. In order to compare two expressions, we must first find the value of each expression separately. For example, “fifteen more than 8” can be thought of as 15 + 8, or 23. “Triple 7” can be thought of as 3 x 7, or 21. Now that we have simplified the expressions, we can compare their values. Because 23 > 21, we can say “fifteen more than 8 is greater than triple 7.”
4. What is estimation? Why is it useful in the real world as well as in mathematics? (Estimation, p. 16-19)
   1. An estimate is an approximate answer based on reasonableness and, often, rounding. To estimate is to choose a number that is close to the real answer. Estimation can be helpful when working with general rather than specific amounts. For example, companies estimate how much profit they may make in a year. In addition, estimation can be helpful when solving math problems. For instance, a mathematician may estimate a solution and then compare their actual solution to it to determine whether their answer is reasonable.
5. How are estimation and rounding related? (Estimation, p. 16-19)
   1. Both estimation and rounding can be used to find approximate amounts and answers. When estimating a solution to a problem, it can be helpful to first round the digits you are working with to create a simpler problem that is easier to solve. For example, in order to estimate the product of 11 and 29, we could round both factors to 10 and 30, a problem that is easier to solve mentally. Because 10 x 30 = 300, we can estimate the product of 11 and 29 to be close to 300. (The actual product of 11 and 29 is 319, which is relatively close to the estimate.)
6. What are bases and exponents? Explain how to find the value of 24. (Exponents, p. 20-21)
   1. Bases and exponents work together to represent repeated multiplication. A base is the bottom number, and an exponent is written in small superscript. In this example, the base is 2 and the exponent is 4. To find the value of 24, we can rewrite it as 2 x 2 x 2 x 2. We can solve this to get a final solution of 16. 24 = 16.
7. Consider the examples on pages 22 and 23. What patterns do you notice here? How will this help you multiply larger numbers? (Strategies for Multiplying, p. 22-23)
   1. Students’ responses may vary, however, they should notice a pattern in the number of zeros found within the factors as well as the product. Students should explain that this will help them multiply larger numbers with zeros because they can quickly solve the related multiplication problem before mentally adjusting the place value and number of zeros required for a reasonable answer.
8. What are powers of ten? Why do you think scientists use powers of ten to describe things such as the distance to major space features as highlighted on page 27? (Powers of 10, p. 26-27)
   1. Powers of ten refer to any exponent with 10 as a base. The exponent tells the number of zeros to include in the standard form. For example, 104 means 10 x 10 x 10 x 10, or a 1 followed by 4 zeros, or 10,000.
   2. Students’ inferences about scientists’ use of power of ten may vary. Make sure to discuss the idea of efficiency with numbers and whether it would be reasonable to write out all the zeros to represent those distances. In addition, discuss why thinking about the context (the distance to major space features) helped us understand just how large powers of ten can be.
9. What is mental math? Why is it important to develop mental math thinking skills? (Mental Math, p. 28-31)
   1. Mental math is math you can do in your head, often without the aid of pencils, paper, or calculators. It is important to be able to do mental math, especially with the four main operations, because we use numbers frequently in our everyday lives. In addition, knowing how to think about numbers mentally supports our number sense and flexible thinking skills that will benefit us as we encounter more complex math.
10. What is reasonableness in the area of mathematics? Why is it important for mathematicians to consider reasonableness when solving problems? (Reasonableness, p. 32-35)
    1. Reasonableness refers to the idea that our mathematical answers make sense and are reasonable. It is important to consider reasonableness because if our answers are not reasonable, then we know we must try the problem again or approach it in a new way. Reasonableness not only includes considering the context of the problem at hand, but also whether the answer makes mathematical and logical sense. For example, although we may not have the product of 13 and 7 memorized, we can say that 10,000 is not a reasonable product. In addition, we can extend our thinking to say that a reasonable product would be about 84 because 12 x 7 is 84 and 13 x 7 must be slightly more than that.