Algebra 1 Unit 1 worksheet: Closure

Name _____ Date _____ Period _____

1. Each answer below comes from two natural numbers. Work it out, then name the smallest of these sets that contains it: the natural numbers, the whole numbers, the integers, the rational numbers.

(a) $3 - 7$ (b) $7 \div 3$ (c) $3 - 3$ (d) 7×3

2. Hannah writes: "$7 - 3 = 4$ but $3 - 7 = -4$. The answers are different, so the integers are not closed under subtraction."

What is wrong with her reasoning? Are the integers closed under subtraction?

3. Let G be the set of integers greater than 10: 11, 12, 13, …

(a) Is G closed under addition? Explain.

(b) Ryan works out $30 - 12 = 18$, $50 - 25 = 25$ and $41 - 11 = 30$. Every answer is in G, so he says G is closed under subtraction. Is he right? Explain.

4. Let D be the set of natural numbers whose last digit is 6: 6, 16, 26, 36, … Each member can be written as $10m + 6$ with m a whole number.

(a) Is D closed under addition?

(b) Is D closed under multiplication?

For each, give a counterexample or an argument with letters that covers every pair.

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5. Let $x = \sqrt{5}$, an irrational number. Write each number in simplest form and say whether it is rational or irrational.

(a) x^2 (b) x^3 (c) x^4 (d) $x^3 - x$

Then say what part (a) shows about the irrational numbers under multiplication.

6. Give an example of each, or explain why there is none.

(a) Two irrational numbers whose product is 6.

(b) Two irrational numbers whose sum is 6.

(c) Two irrational numbers whose product is rational but whose sum is irrational.

7. (a) Show that if x is irrational, then $\dfrac{1}{x}$ is irrational. (Note that $x \neq 0$, since 0 is rational.)

(b) Use part (a) to decide whether $\dfrac{1}{\pi - 3}$ is rational or irrational.

8. Decide whether the negative rational numbers (the rational numbers less than 0) are closed under each operation: addition, subtraction, multiplication, and division by a nonzero member. For each, give a reason that covers every pair or a counterexample.

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