

Lesson 2 – Operations with Numbers

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Fast Five

- ▶ In which sets do the following numbers belong: (asked in the textbook as: Classify each number in as many ways as possible)
- ▶ (i) -12.88
- ▶ (ii) $1,789,000$
- ▶ (iii) $0.1212212221222.....$
- ▶ (iv) $0.33333333.....$
- ▶ (v) 56
- ▶ (vi) $4.\overline{77}$

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BIG PICTURE

- ▶ **RECALL FROM LESSON #1**
- ▶ Define mathematics → What IS Mathematics?

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BIG PICTURE

- ▶ What IS Mathematics?
- ▶ (WEBSTERS) the **science of numbers and their operations**, interrelations, combinations, generalizations, and abstractions and of space configurations and their structure, measurement, transformations, and generalizations
- ▶ (OXFORDS) the abstract **science of number**, quantity, and space, either as abstract concepts (pure mathematics), or as applied to other disciplines such as physics and engineering (applied mathematics)

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Lesson Objectives

- ▶ Since Math is about numbers, you will classify numbers according to the number sets
- ▶ Since Math is about numbers, you will identify and use properties of real numbers (closure, commutative, associative, identity, inverse, and distributive properties)
- ▶ Evaluate expressions by using the order of operations

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(A) Properties of Numbers

- ▶ Within each of the respective number sets, there are a variety of properties that are true
- ▶ We constantly use these properties when we work with numbers (in the context of equations & graphing), even though we aren't always aware of the properties
- ▶ We will focus here on the properties of REAL numbers

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(A) Properties of Real Numbers

- ▶ For all real numbers $a, b,$ and c

	Addition	Multiplication
Closure	$a + b$ is a real number	ab is a real number
Communicative	$a + b = b + a$	$ab = ba$
Associative	$(a + b) + c = a + (b + c)$	$(ab)c = a(bc)$
Identity	There is a number (0) , such that $a + 0 = a$ and $0 + a = a$	There is a number (1) such that $(1)a = a$ and $a(1) = a$
Inverse	For every real number a , there is a real number $-a$ such that $a + (-a) = 0$	For every real number a , there is a real number $1/a$ such that $a(1/a) = 1$
distributive	For all real numbers, a, b, c : $a(b + c) = ab + ac$	

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(B) Properties of Numbers - Examples

- ▶ Ex: State the property that justifies the following statements:
 - ▶ (i) $6 + (-3) = (-3) + 6$
 - ▶ (ii) $2(4 - 5) = (4 - 5)2$
 - ▶ (iii) $(-10)(-7) = (-7)(-10)$
 - ▶ (iv) $-2 + (x - 5) = (-2 + x) - 5$
 - ▶ (v) $x(w + y) = xw + xy$
 - ▶ (vi) $(m - n) + [-(m - n)] = 0$
 - ▶ (vii) $(-2)(1/-2) = 1$
 - ▶ (viii) $c = 1c$
 - ▶ (ix) $\frac{1}{2}(-3) + \pi$ is a real number
 - ▶ (x) if $7 + x = 7 + y$, then $x = y$

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(B) Properties of Numbers - Examples

- ▶ (a) Simplify $2(3x)$ and justify each step
- ▶ (b) Simplify $4x + 7y - 6x$ and justify each step
- ▶ (c) Simplify $(2 - x)(x + 4)$ and justify each step
- ▶ State the property that justifies the solution to:
 - ▶ (d) $x + 5 = 7$
 - ▶ (e) $2x - 3 = 11$

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(C) Investigation

- ▶ Given the following expression,

$$3 + 1 - 2 \bullet 4 - 3^2 + 2$$

- ▶ Add grouping symbols so that the expression has the values of:
 - ▶ (i) -8
 - ▶ (ii) 4
 - ▶ (iii) -11
 - ▶ (iv) -3

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(D) Please Excuse My Dear Aunt Sally

- ▶ Within the real number set, an expression is evaluated according to the following standard set of rules:
 - ▶ (i) Parenthesis (or brackets) are evaluated/simplified first
 - ▶ (ii) Exponents are performed next
 - ▶ (iii) multiplication & division in order from left to right
 - ▶ (iv) addition & subtraction in order from left to right

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(D) Order of Operations - Examples

- ▶ Evaluate

$$(i) \frac{6(11+3^2)}{8}$$

$$(ii) \frac{2^2(12+8)}{5+3} + 6 - 2^{-2}$$

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Links for Extra Help

- ▶ [From PurpleMath](#)
- ▶ Video Links:
- ▶ http://www.teachertube.com/viewVideo.php?title=Properties_of_Real_Numbers&video_id=115513



(E) Homework

- ▶ Textbook, Sec2.1, p90
- ▶ p.90 #13-31 odds, 39-65 odds, 72



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