

## Lesson 2.1 – Operations with Numbers

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## Lesson Objectives

- ▶ Classify numbers according to the number sets
- ▶ 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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## Fast Five

- ▶ Follow this internet link and work through the following quiz: [Number Sets Quiz from Maths Online](#)

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## (A) Number Sets

- ▶ Recall that we have several major number sets with which we shall work this year:
  - ▶ N = Natural Numbers
  - ▶ W = Whole Numbers
  - ▶ Z = Integers
  - ▶ Rational and Irrational Numbers
  - ▶ R = Real Numbers

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## (B) Working With Number Sets

- ▶ 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) 0.12122122212222.....
- ▶ (iv) 0.33333333.....
- ▶ (v) 56
- ▶ (vi)  $4.\overline{77}$

▶ 5

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## (C) 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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## (C) 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 $a(1/a) = 1$

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## (C) Properties of Numbers

- ▶ And then we have the familiar distributive property:
- ▶ For all real numbers,  $a$ ,  $b$ ,  $c$ :
- ▶  $a(b + c) = ab + ac$

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### (C) Properties of Numbers

- ▶ 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  $x = y$

▶ 9

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### 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

▶ 10

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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

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

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

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## Links for Extra Help

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- ▶ [From PurpleMath](#)



## (E) Homework

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



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