Decimal Number System – Introduction

Since early childhood in our education system we have been using decimal number system (base 10)...10 fingers, 10 toes...

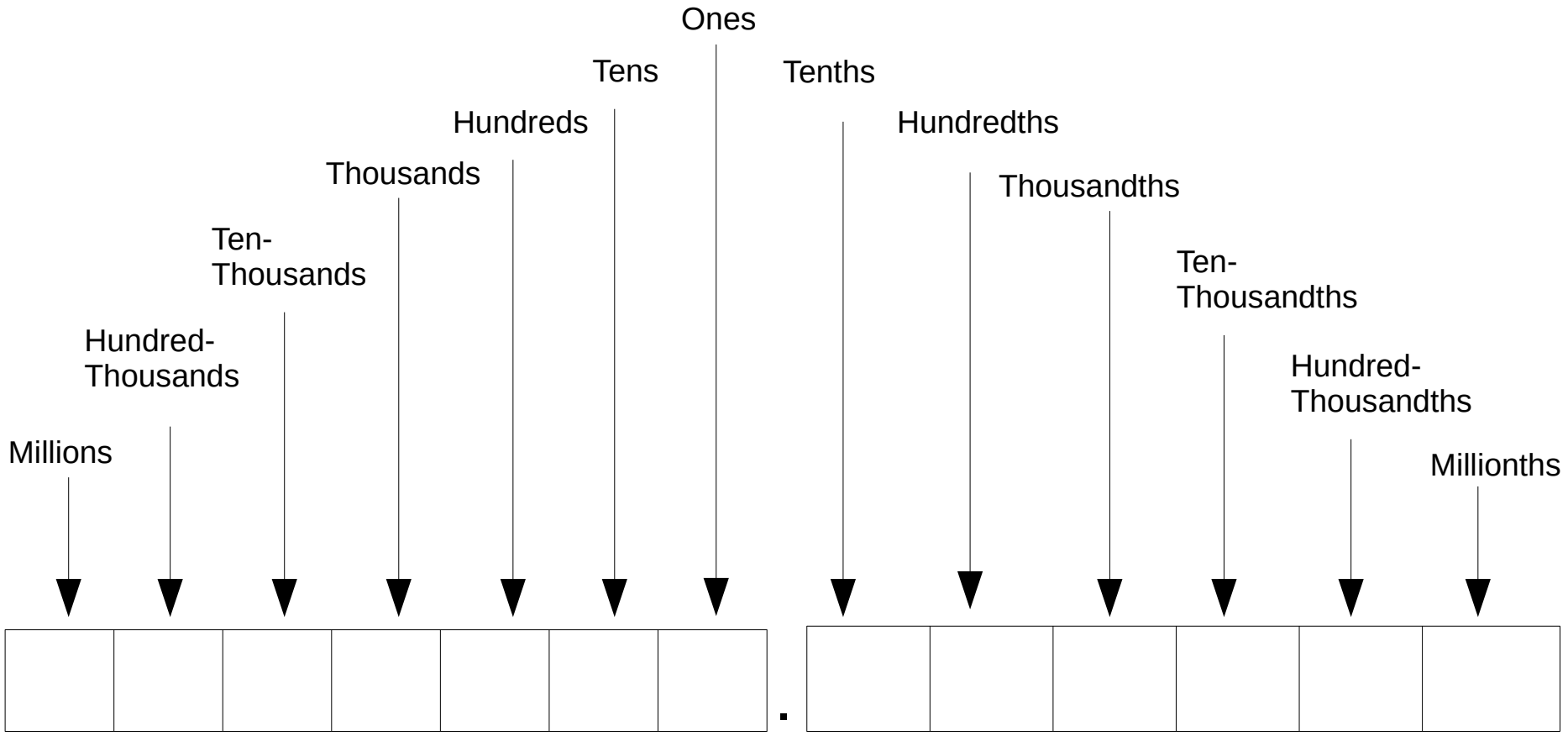
Other cultures used number systems based on spaces between the fingers (base 8) or all 10 fingers and toes (base 20)...

First unit is review of the concepts and operations in base 10

- Add, subtract, multiply, divide, powers
- Conversion between fractions and decimals
- Rounding

Decimal Numbers – Base 10 Number System

Decimal number system (aka place value system) is a base 10 number system
0 is the least value digit and 9 is greatest value digit
Counting above 9, produces a carry from the ones place to the tens place...



Mathematical Operators

Mathematics is a language of its own. Understanding the symbols is essential in becoming an effective math communicator.

Name	**Symbol**	**Example**
Decimal point	.	3.7
Addition	+	3+2
Positive sign	+	+3
Subtraction	-	3-2
Negative sign	-	-3
Multiplication	× or *	3×2 or 3*2
Division	÷ or /	3÷2 or 3/2
Equal	=	3*2=6
Absolute Value	| |	|-7| = +7 |+7| = +7
Power function	$( )^2$	$(3)^2 = 3x3 = 9$
Square root	$\sqrt{}$	$\sqrt{4}=2$

Fractions

In a decimal fraction, the denominator is 10 or a multiple of 10 (100, 1000...)

$$\frac{7}{10}$$

numerator

denominator

The fraction is read as “seven tenths”

143 thousandths

17 ten-thousandths

Converting from Decimal Fractions to Decimal Numbers and Vice versa

In converting from a fraction to a decimal, first determine the value of the denominator. Place the right most digit in that position. Then the rest of the digits is placed before it.

$$\frac{12}{100}=0.12$$

$$\frac{23}{10000}=0.0023$$

In converting from a decimal to a fraction, the position of the right most number will determine the value of the denominator.

$$0.00495=\frac{495}{100000}$$

$$0.0007=\frac{7}{10000}$$

Percent and Percentage

Dividing by powers of 100 results in specific term, percent (%). Found in areas such as statistics, science, commerce...Originally started in ancient Rome but quickly became standard in commerce since then.

$$\frac{46}{100} = 0.46 = 46\%$$

$$\frac{276}{100} = 2.76 = 276\%$$

Converting from decimal to % is as follows

23% = 0.23

134% = 1.34

Whole Numbers and Fractions

Mixed numbers refer to quantities that have a whole number part and a fraction part

The word “and” is used to bridge the whole number part and the fraction part

$432\frac{658}{1000}$ Four hundred thirty-two and six hundred fifty-eight thousandths

$57.0425 = 57\frac{425}{10000}$

Rounding Whole and Non-whole Numbers

Rounding refers to the technique used to simplify whole numbers. Accuracy is lost as a result of rounding

1. Determine which place value number is to be rounded
2. Look at the number in the previous place value (to the right)
3. If the number in the previous place value is between 0 – 4, then keep as is
4. If the number in the previous place value is between 5 – 9, then round up

Round 72348 to nearest ten = 72350

Round 72348 to nearest hundred = 72300

Round 72348 to nearest thousand = 72000

Round 72348 to nearest ten-thousand = 70000

Same algorithm can be used for non-whole numbers

Round 12.736 to nearest hundredth = 12.740

Significant Digits

Significant digits (significant figures) are digits in a number that are known to be accurate

Most significant digit (MSD) is the left most nonzero digit

Least significant digit (LSD) is the right most digit

- All non-zero digits are significant (1-9)

- Zeros in between non-zero digits are significant (2004) 4 sig. figs.

- Leading zeros are never significant (00524) 3 sig. figs.

- For non-whole numbers, leading zeros are important in that it indicates place value, but not significant (0.000763) 3 or 7 sig. figs.

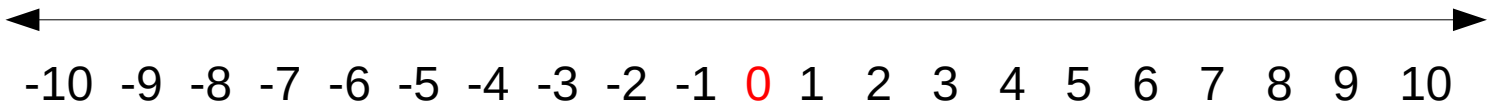
- For non-whole numbers, trailing zeros are significant since it indicates accuracy to a certain place value...53.000 5 sig. figs.

Signed Numbers

Numbers in mathematics can be either positive or negative

Relations between numbers can be described using the "less than" (<) or "greater than" (>) symbols

4 > -3 (4 is greater than -3) or -3 < 4 (-3 is less than 4)



Addition and Subtraction

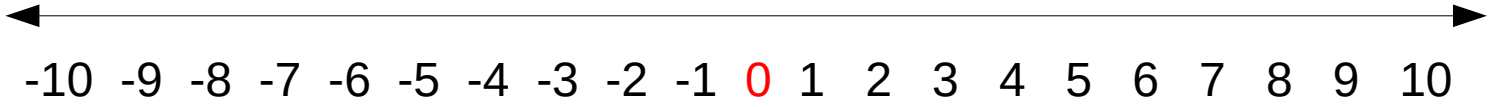
For adding numbers with the same sign, add the numbers and affix the sign to the answer

(+7) + (+3) = +10 or (-3) + (-4) = -7

Adding numbers with different signs, subtract the smaller from the larger and affix the sign of the larger number to the answer

(-6) + (+2) = -4 or (-2) + (+5) = +3

$$\begin{array}{rl} 8 & \text{(minuend)} \\ -\ 4 & \text{(subtrahend)} \\ \hline 4 & \text{(difference)} \end{array}$$



Multiplication and Division

Specific names can be used to identify parts of multiplication and division operations

6	*	7	=	42
multiplicand		multiplier		product

15	/	3	=	5
dividend		divisor		quotient

When multiplying or dividing signed numbers, follow the rules

(+) * (+) = (+)
(+) * (-) = (-)
(-) * (-) = (+)

(+) / (+) = (+)
(+) / (-) = (-)
(-) / (-) = (+)

Mathematical Terms, Expressions, Factors

As with multi-stage problem solving, mathematical expressions use many types of operations

Terms – quantities separated by – and/or +
Factors – quantities separated by * and/or /
Expressions – quantities denoted by one or more terms and/or factors

3 – 6*3 + 2

What is the answer for these expressions?

8 / 2 (2+2)

Mathematical Order of Operations

1. Operations inside Brackets [ ], braces { } parentheses ( ) or Absolute values | | - highest priority

2. Exponents, Roots and Radicals

3. Division and Multiplication (from left to right)

4. Addition and Subtraction (from left to right) – lowest priority

-3 – [2 + 4 * (-6+3)]
-3 – [2 + 4 * (-3)]
-3 – [2 + (-12)]
-3 – [-10]
-3 +10
7

When confronted with nested terms, always start with the inner most brackets first and work your way outwards

Review Questions

Review question set 1