• Math 141 Exam Review •

CHAPTER 1: Intro. to Problem Solving (see Page 4 in text)

Problem solving strategies

- guess and test
- draw a diagram
- make a list
- look for a pattern
- inductive/deductive reasoning
- solve an equation
- use a variable
- work backwards

CHAPTER 2: Sets, Whole Numbers & Numeration Systems

Sets

- subsets (⊆) → contained
- union of sets (∪) → all elements in either set ["sets combined"]
- intersection of sets (∩) → all elements common to both sets ["overlap"]
- complement of sets ($\bar{X}$) → all elements in the universal set, that are NOT in selected set

Numeration Systems

- Tally Numeration system → 𝍸 III = 8
- Egyptian Numeration system → ??? ∩∩ IIII = 324
  - I (1) ∩ (10) ? (100) Δ (1000) ...etc
- Babylonian Numeration system → ▽<<▽▽▽ = 83
  - ▽ = 1 < = 10
- Mayan Numeration system → ⊙ (0) • (1) — (5)

Example: ••• over two bars (13(20)), •• over one bar (7(1)): 13(20) + 7(1) = 267

Bases

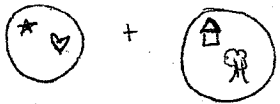
- Know other bases/conversions → Hindu-Arabic
  - example: Base 5 → Base 10
    - $1203_5 = \_\_\__{10}$ $(1)(5^3) + (2)(5^2) + 0(5^1) + 3(5^0) = 178$ ten
  - example: Base 10 → Base 5 ★
    - $117_{10} = \_\_\__5$
      - a.) Divide 117 by highest power of 5. $(5^2) = 117/25 = 4$ R17
      - b.) Divide previous R (17) by next highest power of 5. (5^1) $17/5 = 3$ R2
      - c.) $117_{10} = 432_5$

Functions & Sequences

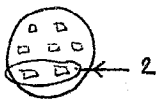
- Function: relation that matches each element of 1st set to an element in the 2nd set so that no element is assigned to different elements
  - example: F = (1,2) (2,4) (3,6) (4,8) (5,10)
- Arithmetic vs. Geometric sequences
  - (1, 3, 5, 7, 9, 11...) +2 +2 +2 — add same #
  - vs. (1, 2, 4, 8, 16...) — multiply by same #
    - ↳ example: "Find 10th term in this sequence"
    - ↳ $1(r)^{n-1} = 1(2)^9$

CHAPTER 3: Whole Numbers, Operations, & Properties

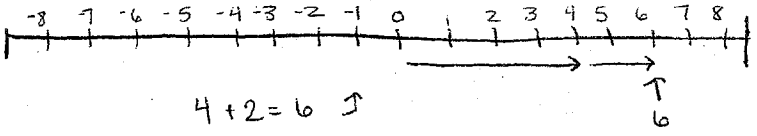
- Set Model Addition

example #1:  $2 + 2 = 4$

example #2: $(5+2) = 7$ ↓



- Measurement Model (number line)



Addition

Properties of Addition of whole numbers

a.) closure → "closed for addition"; if you add two whole numbers the sum is always a whole number.

b.) commutative → $(5+3) = (3+5)$ / order doesn't matter

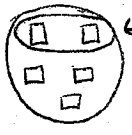
c.) associative → $(a+b)+c = a+(b+c)$ Grouping

d.) (additive identity) → $a + 0 = a$

Subtraction

- Set Model Subtraction

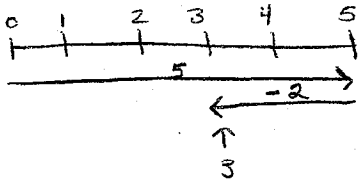
$5 - 2 = 3$



take away 2 leaves 3

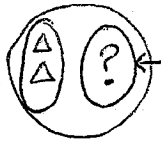
- Take-Away Approach

$5 - 2 = 3$



- Missing Addend Approach

$5 - 2 = \underline{?}$



$2 + \underline{?} = 5$

mult. & division

* know methods of multiplication & division
  example: cartesian product, repeated addition, etc.
* know multiplicative rules (factors)
* know properties (distributive, commutative, associative, identity)

commutative $5 \times 3 = 3 \times 5$ (order)

Associative $(2 \times 4) \times 7 = 2 \times (4 \times 7)$ (grouping)

identity for mult. $6 \times 1 = 6$

distributive $7(2+4) = 7(2) + 7(4)$

CHAPTER 4: Whole # Computation (Mental, Written & Electronic)

Mental Math

a. Mental math
- → use properties to rearrange numbers in able to calculate mentally
- → compatible numbers: $452 \div 91 = 450 \div 90 = 5$
- → compensation method: $486 + 297 = (486 - 3) + (297 + 3)$
  $483 + 300 = 783$

b. Estimation
- → Front End (range); (1 & 2 column); (Front-End w/ Adjustment)

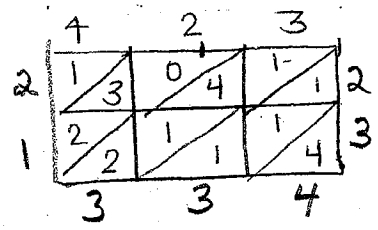
(7,000) 7815 (8000)
(1,000) + 1739 (2000)
(8,000) —— (10,000)

- take 'low' of range & see how much more you need to go
  ex: 8,000 + (1500) = ~9500

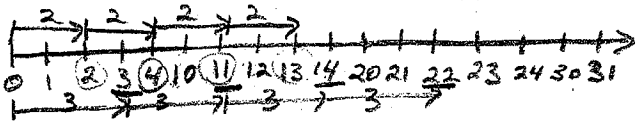
- → Rounding (compatible numbers)

Algorithms

423 × 23 — Answer in Base 5 using the lattice method
Also do using standard method



$(4 \times 2) = 13$ $(4 \times 3) = 22$
$(2 \times 2) = 4$ $(2 \times 3) = 11$
$(3 \times 2) = 11$ $(3 \times 3) = 14$
$= 21{,}334$



$$\begin{array}{r} {\scriptstyle 1\ 1} \\ 423 \\ \times\ 23 \\ \hline 2324 \\ 1401 \\ \hline 21{,}334 \end{array}$$

CHAPTER 5: Number Theory

- prime vs. composite
  (1, and itself) (more factors)

*KNOW GCF & LCM
(use venn-diagrams)

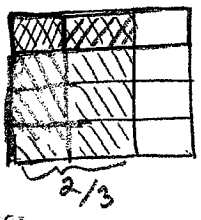
Divisibility Tests

2: ends in an even number (0, 2, 4, 6, 8)
3: sum of digits divisible by 3
4: last 2 digits divisible by 4
5: ends in 0 or 5
6: divisible by 2 & 3
8: last 3 digits divisible by 8
7: double ones digit & subtract ~~from other digits~~
9: sum of digits divisible by 9
10: ends in 0
11: difference of alternating digits divisible by 11
Subtract sums from alternate digits
this difference is divisible by 11

CHAPTER 6 Fractions

- know how to order fractions (cross multiply, common denominator, convert to a decimal and compare) and find a fraction b/w 2 fractions
- know how to add & subtract (common denominator)
- know how to estimate / calculate mentally)
- rectangular diagram (example) to illustrate multiplication of fractions

$\frac{1}{4}$ of $\frac{2}{3}$ =



$\frac{1}{4} \times \frac{2}{3} = \boxed{\frac{2}{12}}$

CHAPTER 7 Decimals

- know how to write decimals as fractions
- finding percentages; example: 148% of 59

Estimate ~150% of 60
→ 100% of 60 = 60
+→ 50% of 60 = 30
~90

- calculate mentally
(subtraction: add numbers to both to compensate)
(addition: add (1), subtract (1) to compensate)
- terminating decimals

$\frac{4}{56} = \frac{1}{14}$ not terminating; 14's factors = 7 & 2

$\frac{21}{56} = \frac{3}{8}$ terminating; 8's factor's = 2^3 (only 2)

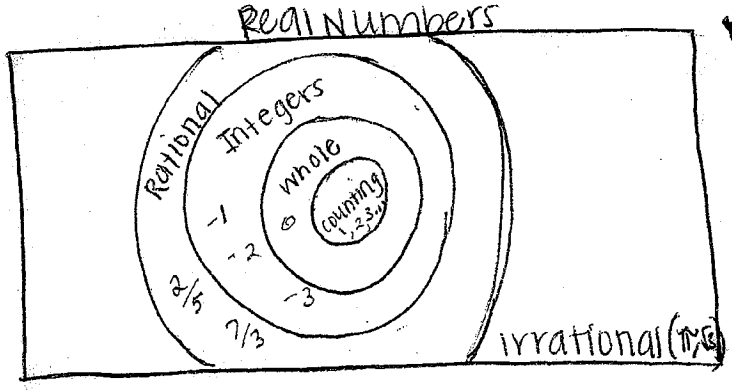
$\frac{6}{40} = \frac{3}{20}$, terminating; 20's factors = 2·2·5 (only 2 and 5)

- ratio's and proportions within word problems

CHAPTER 8 Integers

CHAPTER 9: Rational, irrational and real numbers.

- know properties (closure, associative, commutative, identity, add. inverse, distributive, mult. inverse (reciprocal)



Real Numbers: all
Irrational: π, $\sqrt{3}$
Rational: $\frac{2}{3}$, -2, 0
Integers: -2, 2, 0
whole: 0, 1, 2, 3...
counting 1, 2, 3...