Nature of Math
Test 2

Study Guide

About the Test

- 34 Questions
- 20% of Semester Grade
- Calculator Okay
- 75 minutes
- Sample Questions in Appendix

Suggestions

- Look through sample questions
- Get enough sleep
- Visit Math Lab
- Study with friends

Topics

- Averages & Weighted Averages
- Counting Combinations
- Algebra: Multiplying / Combining Like Terms
- Different Bases
  - Whole Number base conversions
  - ~~Decimal / Fraction conversions~~ (Not on test)
  - Mayan Numbers – Normal & Solar Numbers
  - Unknown Bases / Finding Numbers
- Using Exponents

Averages

- Ordinary Average
  - Add the numbers
  - Divide by the number of numbers

$$\frac{85+90+93}{3} = 89.3$$

Averages

- Weighted Average
  - Multiply each number by its weight
  - Add
  - Divide by the total weight

Calculate your GPA if you get:
a B in a 4-unit class
an A in a 2-unit class
a B in a 3-unit class
a C in a 3-unit class

B+ A+ B+ C

$$\frac{(4)3+(2)4+(3)3+(3)2}{12}$$

$$\frac{12+8+9+6}{12} = \frac{35}{12} = 2.92$$

Averages

- Average Speed
  - Determine distance for each part
  - Total Distance / Total Time

Find your average speed if you ride your bike
20 mph for 30 minutes (10 miles) then 15 mph for an hour (15 miles)

$$\text{avg. speed} = \frac{\text{total miles}}{\text{total hours}} = \frac{10+15}{1.5} = \frac{25}{1.5} = 16.67 \text{ mph} = 16\tfrac{2}{3} \text{ mph}$$

Counting Combinations

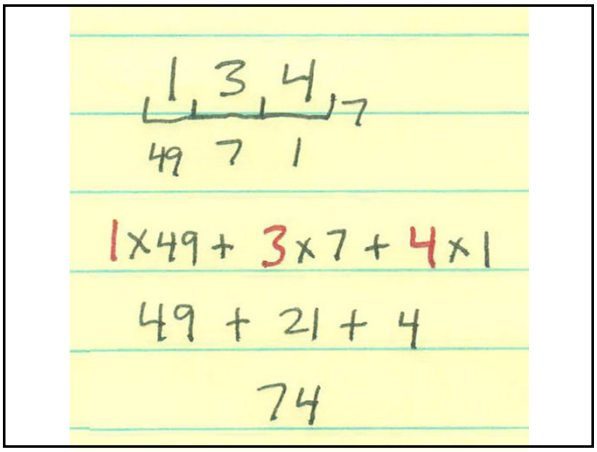
- "Basic Counting Principle"
- Count ways things can be done
- Multiply

If you can order three different soups and four different pastas for a dinner combo, how many total choices do you have?

$3 \times 4 = 12$

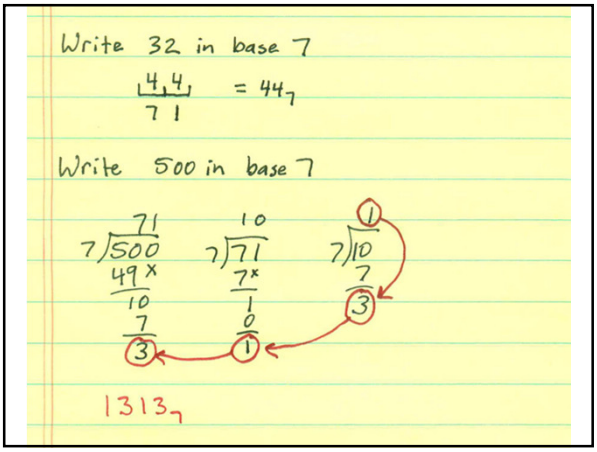
Bases – Whole Numbers

- Converting from Base 7 to Base 10
  - Determine Place values for each place
  - Add up the digits



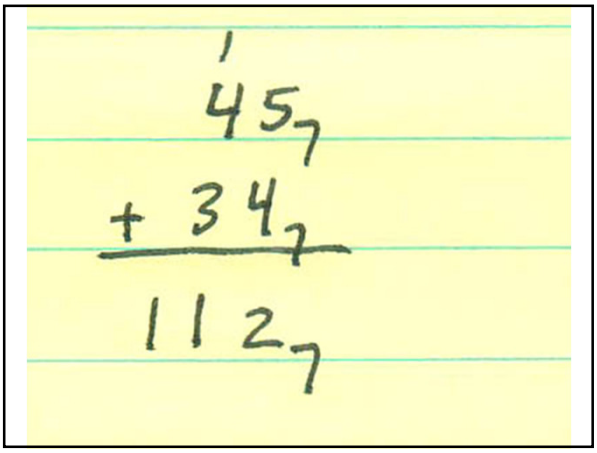
Bases – Whole Numbers

- Converting to a different Base
  - Determine place values then guess
  - Repeated long division



Bases – Arithmetic

- Addition
- Multiplication



Bases – Unknown

- Number written in unknown base
- Unknown number (Chinese Remainder Theorem)

54 is written as 42_x where x is an unknown base – find the base

42_x

x 1

$4x + 2 \cdot 1 = 54$

$4x = 54 - 2$

$4x = 52$

$x = 13$

Bases – Unknown

- Number written in unknown base
- Unknown number (Chinese Remainder Theorem)

A number which in base 5 ends in 3 and in base 7 ends in 4 is: ____

3, 8, 13, 18, 23, 28, 33, 38, 43

4, 11, 18, 25, 32

18

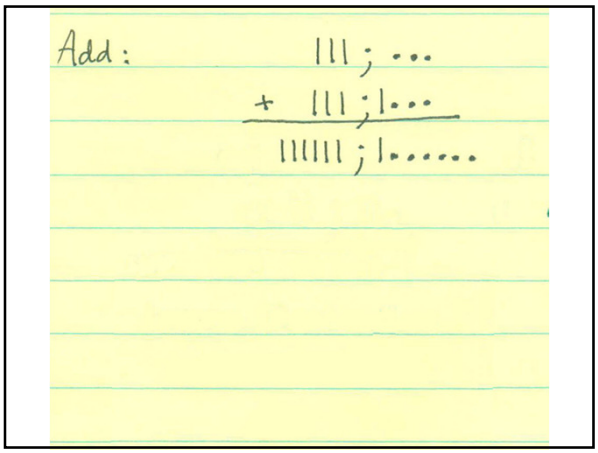
$33_5 = 24_7$

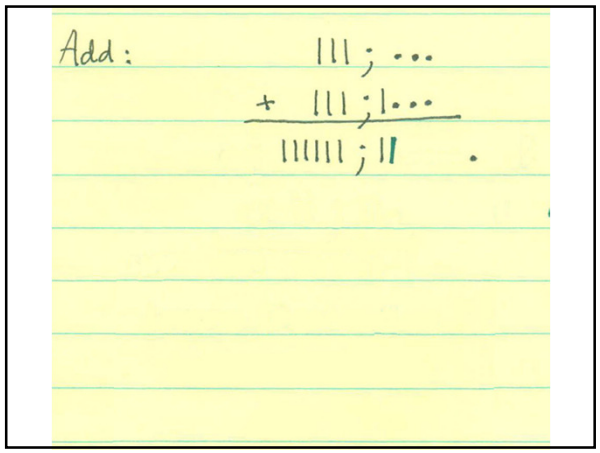
Mayan Numbers

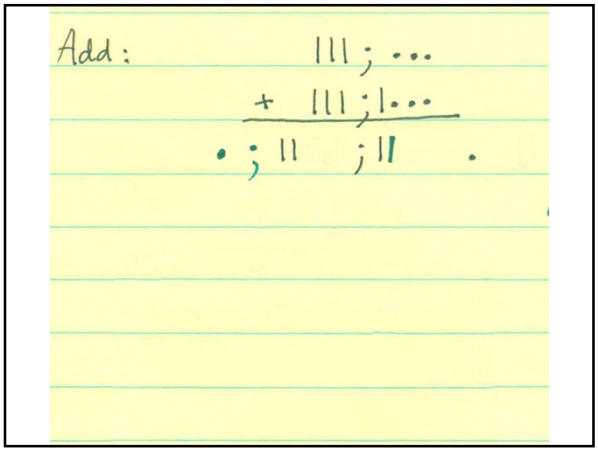
- Base 20
- Digits written as: 5 = | and 1 = .
- "Common" Mayan: 400 / 20 / 1
- "Solar" Mayan: 360 / 20 / 1

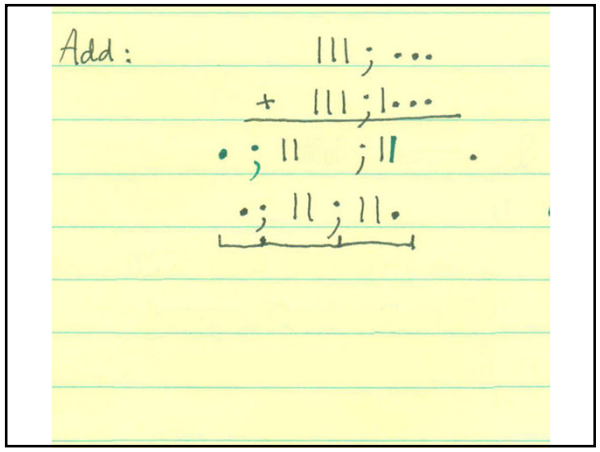
Add:

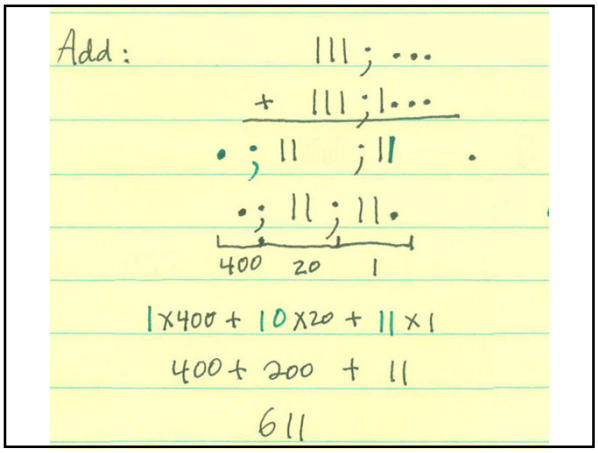
				...
+				...











Exponents

Rules For Exponents

1. $a^m \cdot a^n = a^{m+n}$ (m+n is the total number of a's)
2. $\frac{a^m}{a^n} = a^{m-n}$ (cancel n of the m a's)
3. $(a^m)^n = a^{m \cdot n}$ (n groups of m a's each)
4. $(a \cdot b)^m = a^m \cdot b^m$ (regroup the a's and b's)

Exponents

1. Zero as an exponent

$a^0 = 1$

since $1 = \left(\frac{a^n}{a^n}\right) = a^{n-n} = a^0$.

Examples: $7^0 = 1$ $256^0 = 1$

2. Negative whole numbers as exponents

$a^{-n} = \frac{1}{a^n}$

since $a^n \cdot a^{-n} = a^{n-n} = a^0 = 1$.

Examples $3^{-2} = \frac{1}{3^2} = \frac{1}{9}$ $4^{-1} = \frac{1}{4}$ $2^{-3} = \frac{1}{2^3} = \frac{1}{8}$

$x^7 \cdot x^{10}$ $3^{-2} =$

$(x^7)^{10}$

$\frac{x^{20}}{x^5}$ $16^{0.5} =$

$4^0 =$ $9^{1.5} =$

$x^7 \cdot x^{10} = x^{17}$ $3^{-2} = \frac{1}{3^2} = \frac{1}{9}$

$(x^7)^{10} = x^{7 \cdot 10} = x^{70}$

$\frac{x^{20}}{x^5} = x^{15}$ $16^{0.5} = \sqrt{16} = 4$

$4^0 = 1$ $9^{1.5} = 9^1 \cdot 9^{0.5} = 9 \cdot \sqrt{9} = 9 \cdot 3 = 27$

Exponents – Larger Exponents

- Addition 8+10
- Multiplication 8x10
- Exponents 8^{10}
- Arrow Notation $8\uparrow\uparrow 10$
- Arrow Notation $8\uparrow\uparrow\uparrow 10$

(This list goes from smaller to larger)