

$$\sin = \frac{\text{opp}}{\text{hyp}}$$

$$\cos = \frac{\text{adj}}{\text{hyp}}$$

$$\tan = \frac{\text{opp}}{\text{adj}}$$

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This is a new powerpoint. If you find any errors please let me know at [mccoach3@aol.com](mailto:mccoach3@aol.com)

**NUMBER SENSE AT A FLIP**

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## Number Sense

Number Sense is memorization and practice. The secret to getting good at number sense is to learn how to recognize and then do the rules accurately. Then learn how to do them quickly. Every practice should be under a time limit.

## The First Step

The first step in learning number sense should be to memorize the **PERFECT SQUARES** from  $1^2 = 1$  to  $40^2 = 1600$  and the **PERFECT CUBES** from  $1^3 = 1$  to  $25^3 = 15625$ . These squares and cubes should be learned in both directions. i.e.  $17^2 = 289$  and the  $\sqrt{289}$  is 17.

The Rainbow Method

**2x2 Foil (LIOF)**  
Work Backwards

$$23 \times 12$$

Used when you forget a rule about 2x2 multiplication

1. The last number is the units digit of the product of the unit's digits
2. Multiply the outside, multiply the inside
3. Add the outside and the inside together plus any carry and write down the units digit
4. Multiply the first digits together and add and carry. Write down the number

$$\begin{array}{r} \underline{2(1)} \quad \underline{2(2)+3(1)} \quad \underline{3(2)} \\ 2 \qquad \qquad 7 \qquad \qquad 6 \end{array}$$

$$276$$

### Squaring Numbers Ending In 5

$$75^2$$

1. First two digits = the ten's digit times one more than the ten's digit.
2. Last two digits are always 25

$$\begin{array}{r} \underline{7(7+1)} \quad \underline{25} \\ = \underline{56} \quad \underline{25} \end{array}$$

### Consecutive Decades

$$35 \times 45$$

1. First two digits = the small ten's digit times one more than the large ten's digit.
2. Last two digits are always 75

$$\begin{array}{r} \underline{3(4+1)} \quad \underline{75} \\ = \underline{15} \quad \underline{75} \end{array}$$

### Ending in 5...Ten's Digits Both Even

$$45 \times 85$$

1. First two digits = the product of the ten's digits plus  $\frac{1}{2}$  the sum of the ten's digits.
2. Last two digits are always 25

$$\begin{array}{r} \underline{4(8) + \frac{1}{2}(4+8)} \quad \underline{25} \\ = \underline{38} \quad \underline{25} \end{array}$$

### Ending in 5...Ten's Digits Both Odd

$$35 \times 75$$

1. First two digits = the product of the ten's digits plus  $\frac{1}{2}$  the sum of the ten's digits.
2. Last two digits are always 25

$$\begin{array}{r} \underline{3(7) + \frac{1}{2}(3+7)} \quad \underline{25} \\ = \underline{26} \quad \underline{25} \end{array}$$

### Ending in 5...Ten's Digits Odd&Even

$$35 \times 85$$

1. First two digits = the product of the ten's digits plus  $\frac{1}{2}$  the sum of the ten's digits. Always drop the remainder.
2. Last two digits are always 75

$$\begin{array}{r} \underline{3(8) + \frac{1}{2}(3+8)} \quad \underline{75} \\ = \underline{29} \quad \underline{75} \end{array}$$

(1/8 rule)

### Multiplying By 12 $\frac{1}{2}$

$$32 \times 12 \frac{1}{2}$$

1. Divide the non-12  $\frac{1}{2}$  number by 8.
2. Add two zeroes.

$$\begin{array}{r} \frac{32}{8} = 4+00 \\ = \underline{4} \quad \underline{00} \end{array}$$

(1/6 rule)

**Multiplying By 16 2/3**

$$42 \times 16 \frac{2}{3}$$

1. Divide the non-16 2/3 number by 6.
2. Add two zeroes.

$$\frac{42}{6} = 7+00$$

$$= \underline{7} \underline{00}$$

(1/3 rule)

**Multiplying By 33 1/3**

$$24 \times 33 \frac{1}{3}$$

1. Divide the non-33 1/3 number by 3.
2. Add two zeroes.

$$\frac{24}{3} = 8+00$$

$$= \underline{8} \underline{00}$$

(1/4 rule)

**Multiplying By 25**

$$32 \times 25$$

1. Divide the non-25 number by 4.
2. Add two zeroes.

$$\frac{32}{4} = 8+00$$

$$= \underline{8} \underline{00}$$

(1/2 rule)

**Multiplying By 50**

$$32 \times 50$$

1. Divide the non-50 number by 2.
2. Add two zeroes.

$$\frac{32}{2} = 16+00$$

$$= \underline{16} \underline{00}$$

(3/4 rule)

**Multiplying By 75**

$$32 \times 75$$

1. Divide the non-75 number by 4.
2. Multiply by 3.
3. Add two zeroes.

$$\frac{32}{4} = 8 \times 3 = 24+00$$

$$= \underline{24} \underline{00}$$

(1/8 rule)

**Multiplying By 125**

$$32 \times 125$$

1. Divide the non-125 number by 8.
2. Add three zeroes.

$$\frac{32}{8} = 4+000$$

$$= \underline{4} \underline{000}$$

**Multiplying When Tens Digits Are Equal And The Unit Digits Add To 10**

$$32 \times 38$$

1. First two digits are the tens digit times one more than the tens digit
2. Last two digits are the product of the units digits.

$$\begin{array}{r} \underline{3(3+1)} \quad \underline{2(8)} \\ = \underline{12} \quad \underline{16} \end{array}$$

**Multiplying When Tens Digits Add To 10 And The Units Digits Are Equal**

$$67 \times 47$$

1. First two digits are the product of the tens digit plus the units digit
2. Last two digits are the product of the units digits.

$$\begin{array}{r} \underline{6(4)+7} \quad \underline{7(7)} \\ = \underline{31} \quad \underline{49} \end{array}$$

**Multiplying Two Numbers in the 90's**

$$97 \times 94$$

1. Find out how far each number is from 100
2. The 1<sup>st</sup> two numbers equal the sum of the differences subtracted from 100
3. The last two numbers equal the product of the differences

$$\begin{array}{r} \underline{100-(3+6)} \quad \underline{3(6)} \\ = \underline{91} \quad \underline{18} \end{array}$$

**Multiplying Two Numbers Near 100**

$$109 \times 106$$

1. First Number is always 1
2. The middle two numbers = the sum on the units digits
3. The last two digits = the product of the units digits

$$\begin{array}{r} \underline{1} \quad \underline{9+6} \quad \underline{9(6)} \\ = \underline{1} \quad \underline{15} \quad \underline{54} \end{array}$$

**Multiplying Two Numbers With 1<sup>st</sup> Numbers = And A 0 In The Middle**

$$402 \times 405$$

1. The 1<sup>st</sup> two numbers = the product of the hundreds digits
2. The middle two numbers = the sum of the units x the hundreds digit
3. The last two digits = the product of the units digits

$$\begin{array}{r} \underline{4(4)} \quad \underline{4(2+5)} \quad \underline{2(5)} \\ = \underline{16} \quad \underline{28} \quad \underline{10} \end{array}$$

10101 Rule

**Multiplying By 3367**

$$18 \times 3367$$

1. Divide the non-3367 # by 3
2. Multiply by 10101

$$\begin{array}{r} \underline{18/3 = 6} \times 10101 = \\ = \underline{60606} \end{array}$$

121 Pattern

### Multiplying A 2-Digit # By 11

$$92 \times 11$$

(ALWAYS WORK FROM RIGHT TO LEFT)

1. Last digit is the units digit
2. The middle digit is the sum of the tens and the units digits
3. The first digit is the tens digit + any carry

$$\begin{array}{r} 9+1 \quad 9+2 \quad 2 \\ = \underline{10} \quad \underline{1} \quad \underline{2} \end{array}$$

1221 Pattern

### Multiplying A 3-Digit # By 11

$$192 \times 11$$

(ALWAYS WORK FROM RIGHT TO LEFT)

1. Last digit is the units digit
2. The next digit is the sum of the tens and the units digits
3. The next digit is the sum of the tens and the hundreds digit + carry
4. The first digit is the hundreds digit + any carry

$$\begin{array}{r} 1+1 \quad 1+9+1 \quad 9+2 \quad 2 \\ = \underline{2} \quad \underline{1} \quad \underline{1} \quad \underline{2} \end{array}$$

12321 Pattern

### Multiplying A 3-Digit # By 111

$$192 \times 111$$

(ALWAYS WORK FROM RIGHT TO LEFT)

1. Last digit is the units digit
2. The next digit is the sum of the tens and the units digits
3. The next digit is the sum of the units, tens and the hundreds digit + carry
4. The next digit is the sum of the tens and hundreds digits + carry
5. The next digit is the hundreds digit + carry

$$\begin{array}{r} 1+1 \quad 1+9+1 \quad 1+9+2+1 \quad 9+2 \quad 2 \\ = \underline{2} \quad \underline{1} \quad \underline{3} \quad \underline{1} \quad \underline{2} \end{array}$$

1221 Pattern

### Multiplying A 2-Digit # By 111

$$41 \times 111$$

(ALWAYS WORK FROM RIGHT TO LEFT)

1. Last digit is the units digit
2. The next digit is the sum of the tens and the units digits
3. The next digit is the sum of the tens and the units digits + carry
4. The next digit is the tens digit + carry

$$\begin{array}{r} 4 \quad 4+1 \quad 4+1 \quad 1 \\ = \underline{4} \quad \underline{5} \quad \underline{5} \quad \underline{1} \end{array}$$

### Multiplying A 2-Digit # By 101

$$93 \times 101$$

1. The first two digits are the 2-digit number x1
2. The last two digits are the 2-digit number x1

$$\begin{array}{r} 93(1) \quad 93(1) \\ = \underline{93} \quad \underline{93} \end{array}$$

### Multiplying A 3-Digit # By 101

$$934 \times 101$$

1. The last two digits are the last two digits of the 3-digit number
2. The first three numbers are the 3-digit number plus the hundreds digit

$$\begin{array}{r} 934+9 \quad 34 \\ = \underline{943} \quad \underline{34} \end{array}$$

### Multiplying A 2-Digit # By 1001

$$87 \times 1001$$

1. The first 2 digits are the 2-digit number x 1
2. The middle digit is always 0
3. The last two digits are the 2-digit number x 1

$$\begin{array}{r} \underline{87(1)} \quad \underline{0} \quad \underline{87(1)} \\ = \underline{87} \quad \underline{0} \quad \underline{87} \end{array}$$

### Halving And Doubling

$$52 \times 13$$

1. Take half of one number
2. Double the other number
3. Multiply together

$$\begin{array}{r} \underline{52/2} \quad \underline{13(2)} \\ = 26(26) = \underline{676} \end{array}$$

### One Number in the Hundreds And One Number In The 90's

$$95 \times 108$$

1. Find how far each number is from 100
2. The last two numbers are the product of the differences subtracted from 100
3. The first numbers = the small number difference from 100 increased by 1 and subtracted from the larger number

$$\begin{array}{r} \underline{108-(5+1)} \quad \underline{100-(5 \times 8)} \\ = \underline{102} \quad \underline{60} \end{array}$$

### Fraction Foil (Type 1)

$$8 \frac{1}{2} \times 6 \frac{1}{4}$$

1. Multiply the fractions together
2. Multiply the outside two number
3. Multiply the inside two numbers
4. Add the results and then add to the product of the whole numbers

$$\begin{array}{r} \underline{(8)(6)+1/2(6)+1/4(8)} \quad \underline{(1/2 \times 1/4)} \\ = \underline{53} \quad \underline{1/8} \end{array}$$

### Fraction Foil (Type 2)

$$7 \frac{1}{2} \times 5 \frac{1}{2}$$

1. Multiply the fractions together
2. Add the whole numbers and divide by the denominator
3. Multiply the whole numbers and add to previous step

$$\begin{array}{r} \underline{(7 \times 5)+6} \quad \underline{(1/2 \times 1/2)} \\ = \underline{41} \quad \underline{1/4} \end{array}$$

### Fraction Foil (Type 3)

$$7 \frac{1}{4} \times 7 \frac{3}{4}$$

1. Multiply the fractions together
2. Multiply the whole number by one more than the whole number

$$\begin{array}{r} \underline{(7)(7+1)} \quad \underline{(1/4 \times 3/4)} \\ = \underline{56} \quad \underline{3/16} \end{array}$$

### Adding Reciprocals

$$\overleftarrow{7/8 + 8/7}$$

1. Keep the denominator
2. The numerator is the difference of the two numbers squared
3. The whole number is always two plus any carry from the fraction.

$$\begin{array}{r} \underline{2} \quad \underline{(8-7)^2} \\ \quad \quad \underline{7 \times 8} \\ = \underline{2} \quad \underline{1/56} \end{array}$$

### Percent Missing the Of

36 is 9% of     

1. Divide the first number by the percent number
2. Add 2 zeros or move the decimal two places to the right

$$\begin{array}{r} \underline{36/9} \quad \underline{00} \\ = \underline{400} \end{array}$$

### Base N to Base 10

$$42_6 = \underline{\quad\quad} 10$$

1. Multiply the left digit times the base
2. Add the number in the units column

$$\begin{array}{r} \underline{4(6)+2} \\ = \underline{26}_{10} \end{array}$$

### Multiplying in Bases

$$4 \times 53_6 = \underline{\quad\quad}_6$$

1. Multiply the units digit by the multiplier
2. If number cannot be written in base n subtract base n until the digit can be written
3. Continue until you have the answer

$$\begin{array}{r} = 4 \times 3 = 12 \text{ subtract } 12 \text{ Write } 0 \\ = 4 \times 5 = 20 + 2 = 22 \text{ subtract } 18 \text{ Write } 4 \\ \quad \quad \quad = \text{Write } 3 \\ = \underline{340}_6 \end{array}$$

### N/40 to a % or Decimal

$$\overleftarrow{21/40} \quad \underline{\quad\quad} \text{ decimal}$$

1. Mentally take off the zero
2. Divide the numerator by the denominator and write down the digit
3. Put the remainder over the 4 and write the decimal without the decimal point
4. Put the decimal point in front of the numbers

$$= \frac{5}{21/4} \frac{25}{1/4}$$

### Remainder When Dividing By 9

$$867/9 = \underline{\quad\quad} \text{ remainder}$$

1. Add the digits until you get a single digit
2. Write the remainder

$$\begin{array}{r} \underline{8+6+7=21=2+1=3} \\ = \underline{3} \end{array}$$

421 Method

### Base 8 to Base 2

$$732_8 = \underline{\quad\quad\quad}_2$$

1. Mentally put 421 over each number
2. Figure out how each base number can be written with a 4, 2 and 1
3. Write the three digit number down

$$\begin{array}{ccc} \begin{array}{c} 421 \\ \underline{7} \end{array} & \begin{array}{c} 421 \\ \underline{3} \end{array} & \begin{array}{c} 421 \\ \underline{2} \end{array} \\ 111 & 011 & 010 \end{array}$$

421 Method

### Base 2 to Base 8 Of

$$111011010_2 = \underline{\quad\quad}_8$$

1. Separate the number into groups of 3 from the right.
2. Mentally put 421 over each group
3. Add the digits together and write the sum

$$\begin{array}{ccc} \begin{array}{c} 421 \\ \underline{111} \end{array} & \begin{array}{c} 421 \\ \underline{011} \end{array} & \begin{array}{c} 421 \\ \underline{010} \end{array} \\ 7 & 3 & 2 \end{array}$$

### Cubic Feet to Cubic Yards

$$3\text{ft} \times 6\text{ft} \times 12\text{ft} = \underline{\quad\quad}\text{yds}^3$$

1. Try to eliminate three 3s by division
2. Multiply out the remaining numbers
3. Place them over any remaining 3s

$$\begin{array}{ccc} \frac{3}{3} & \frac{6}{3} & \frac{12}{3} \\ 1 \times 2 \times 4 = 8 & \text{Cubic yards} & \end{array}$$

### Cubic Feet to Cubic Yards

$$44 \text{ ft/sec} = \underline{\quad\quad} \text{ mph}$$

1. Use 15 mph = 22 ft/sec
2. Find the correct multiple
3. Multiply the other number

$$\begin{array}{l} 22 \times 2 = 44 \\ \underline{15 \times 2 = 30} \text{ mph} \\ \text{Cubic yards} \end{array}$$

### Subset Problems

$$\{F, R, O, N, T\} = \underline{\quad\quad\quad} \text{SUBSETS}$$

1. Subsets =  $2^n$
2. Improper subsets always = 1
3. Proper subsets =  $2^n - 1$
4. Power sets = subsets

$$\underline{2^5 = 32} \text{ subsets}$$

### Repeating Decimals to Fractions

$$\overline{.18} = \underline{\quad\quad} \text{fraction}$$

1. The numerator is the number
2. Read the number backwards. If a number has a line over it then there is a 9 in the denominator
3. Write the fraction and reduce

$$\frac{18}{99} = \frac{2}{11}$$



### Repeating Decimals to Fractions

$$.1\overline{8} = \underline{\hspace{2cm}} \text{ fraction}$$

1. The numerator is the number minus the part that does not repeat
2. For the denominator read the number backwards. If it has a line over it, it is a 9. if not it is a 0.

$$\frac{18-1}{90} = \frac{17}{90}$$

### Gallons ↔ Cubic Inches

$$2 \text{ gallons} = \underline{\hspace{2cm}} \text{ in}^3$$

(Factors of 231 are 3, 7, 11)

1. Use the fact: 1 gal = 231 in<sup>3</sup>
2. Find the multiple or the factor and adjust the other number. (This is a direct variation)

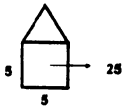
$$\underline{2(231) = 462 \text{ in}^3}$$

### Finding Pentagonal Numbers

$$5^{\text{th}} \text{ Pentagonal \#} = \underline{\hspace{2cm}}$$

1. Use the house method)
2. Find the square #, find the triangular #, then add them together

$$1+2+3+4 = 10$$



$$\underline{25+10=35}$$

### Finding Triangular Numbers

$$6^{\text{th}} \text{ Triangular \#} = \underline{\hspace{2cm}}$$

1. Use the  $n(n+1)/2$  method
2. Take the number of the term that you are looking for and multiply it by one more than that term.
3. Divide by 2 (Divide before multiplying)

$$\underline{6(6+1)=42}$$

$$\underline{42/2=21}$$

### Pi To An Odd Power

$$\pi^{13} = \underline{\hspace{2cm}} \text{ approximation}$$

1. Pi to the 1<sup>st</sup> = 3 (approx) Write a 3
2. Add a zero for each odd power of Pi after the first

$$\underline{3000000}$$

### Pi To An Even Power

$$\pi^{12} = \underline{\hspace{2cm}} \text{ approximation}$$

1. Pi to the 2<sup>nd</sup> = 95 (approx) Write a 95
2. Add a zero for each even power of Pi after the 4<sup>th</sup>

$$\underline{950000}$$

### The "More" Problem

$$17/15 \times 17$$

1. The answer has to be more than the whole number.
2. The denominator remains the same.
3. The numerator is the difference in the two numbers squared.
4. The whole number is the original whole number plus the difference

$$\begin{array}{r} 17+2 \quad \frac{(17-15)^2}{15} \\ \hline =19 \quad \frac{4}{15} \end{array}$$

### The "Less" Problem

$$15/17 \times 15$$

1. The answer has to be less than the whole number.
2. The denominator remains the same.
3. The numerator is the difference in the two numbers squared.
4. The whole number is the original whole number minus the difference

$$\begin{array}{r} 15-2 \quad \frac{(17-15)^2}{17} \\ \hline =13 \quad \frac{4}{15} \end{array}$$

### Multiplying Two Numbers Near 1000

$$994 \times 998$$

1. Find out how far each number is from 1000
2. The 1<sup>st</sup> two numbers equal the sum of the differences subtracted from 1000
3. The last two numbers equal the product of the differences written as a 3-digit number

$$\begin{array}{r} 1000-(6+2) \quad 6(2) \\ \hline =992 \quad 012 \end{array}$$

Two Things Helping

### The (Reciprocal) Work Problem

$$1/6 + 1/5 = 1/X$$

1. Use the formula  $ab/a+b$ .
2. The numerator is the product of the two numbers.
3. The denominator is the sum of the two numbers.
4. Reduce if necessary

$$\begin{array}{r} =\frac{6(5)}{6+5} \\ \hline =\frac{30}{11} \end{array}$$

Two Things working Against Each Other

### The (Reciprocal) Work Problem

$$1/6 - 1/8 = 1/X$$

1. Use the formula  $ab/b-a$ .
2. The numerator is the product of the two numbers.
3. The denominator is the difference of the two numbers from right to left.
4. Reduce if necessary

$$\begin{array}{r} =\frac{6(8)}{8-6} \\ \hline =\frac{24}{2} \\ \hline =12 \end{array}$$

### The Inverse Variation % Problem

$$30\% \text{ of } 12 = 20\% \text{ of } \underline{\hspace{2cm}}$$

1. Compare the similar terms as a reduced ratio
2. Multiply the other term by the reduced ratio.
3. Write the answer

$$\begin{array}{r} \frac{30}{20} = \frac{3}{2} \\ \frac{3}{2}(12) = 18 \\ \hline =18 \end{array}$$

### Sum of Consecutive Integers

$$1+2+3+\dots+20$$

1. Use formula  $n(n+1)/2$
2. Divide even number by 2
3. Multiply by the other number

$$(20)(21)/2$$

$$10(21) = 210$$

### Sum of Consecutive Even Integers

$$2+4+6+\dots+20$$

1. Use formula  $n(n+2)/4$
2. Divide the multiple of 4 by 4
3. Multiply by the other number

$$(20)(22)/4$$

$$5(22) = 110$$

### Sum of Consecutive Odd Integers

$$1+3+5+\dots+19$$

1. Use formula  $((n+1)/2)^2$
2. Add the last number and the first number
3. Divide by 2
4. Square the result

$$(19+1)/2 =$$

$$10^2 = 100$$

### Finding Hexagonal Numbers

Find the 5<sup>th</sup>

Hexagonal Number

1. Use formula  $2n^2 - n$
2. Square the number and multiply by 2
3. Subtract the number wanted from the previous answer

$$2(5)^2 = 50$$

$$50 - 5 =$$

$$45$$

### Cube Properties

Find the Surface Area of a Cube  
Given the Space Diagonal of 12

1. Use formula  $\text{Area} = 2D^2$
2. Square the diagonal
3. Multiply the product by 2

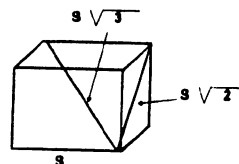
$$2(12)(12)$$

$$2(144) =$$

$$288$$

### Cube Properties

Find S, Then Use It To Find  
Volume or Surface Area



Finding Slope From An Equation

$$3X+2Y=10$$

1. Solve the equation for Y
2. The number in front of X is the Slope

$$3X+2Y=10$$

$$Y = \frac{-3X + 5}{2}$$

$$\text{Slope} = -3/2$$

Hidden Pythagorean Theorem  
Find The Distance Between These Points

$$(6,2) \text{ and } (9,6)$$

1. Find the distance between the X's
2. Find the distance between the Y's
3. Look for a Pythagorean triple
4. If not there, use the Pythagorean Theorem

3	4	5
5	12	13
7	24	25
8	15	17

$$9-6=3 \quad 6-2=4$$

$$\underline{3} \quad \underline{4}$$

$$\underline{5}$$

The distance is 5

Common Pythagorean triples

Finding Diagonals  
Find The Number Of  
Diagonals In An Octagon

1. Use the formula  $n(n-3)/2$
2. N is the number of vertices in the polygon

$$\frac{8(8-3)}{2} = 20$$

Finding the total number of factors

$$24 = \underline{\hspace{2cm}}$$

1. Put the number into prime factorization
2. Add 1 to each exponent
3. Multiply the numbers together

$$3^1 \times 2^3 =$$

$$1+1=2 \quad 3+1=4$$

$$2 \times 4 = 8$$

Estimating a 4-digit square root

$$\sqrt{7549} = \underline{\hspace{2cm}}$$

1. The answer is between  $80^2$  and  $90^2$
2. Find  $85^2$
3. The answer is between 85 and 90
4. Guess any number in that range

$$80^2=6400$$

$$85^2=7225 \longrightarrow 87$$

$$90^2=8100$$

Estimating a 5-digit square root

$$\sqrt{37485} = \underline{\hspace{2cm}}$$

1. Use only the first three numbers
2. Find perfect squares on either side
3. Add a zero to each number
4. Guess any number in that range

$$19^2=361$$

$$190-200 \longrightarrow 195$$

$$20^2=400$$

C ↔ F

$$55C = \underline{\hspace{2cm}} F$$

1. Use the formula  $F = 9/5 C + 32$
2. Plug in the F number
3. Solve for the answer

$$\begin{aligned} &9/5(55) + 32 \\ &99 + 32 \\ &= 131 \end{aligned}$$

C ↔ F

$$50F = \underline{\hspace{2cm}} C$$

1. Use the formula  $C = 5/9 (F-32)$
2. Plug in the C number
3. Solve for the answer

$$\begin{aligned} &5/9(50-32) \\ &5/9(18) \\ &= 10 \end{aligned}$$

Finding The Product of the Roots

$$4X^2 + 5X + 6$$

a
b
c

1. Use the formula  $c/a$
2. Substitute in the coefficients
3. Find answer

$$6 / 4 = 3/2$$

Finding The Sum of the Roots

$$4X^2 + 5X + 6$$

a
b
c

1. Use the formula  $-b/a$
2. Substitute in the coefficients
3. Find answer

$$-5 / 4$$

Estimation  
999999 Rule

$$142857 \times 26 =$$

1. Divide 26 by 7 to get the first digit
2. Take the remainder and add a zero
3. Divide by 7 again to get the next number
4. Find the number in 142857 and copy in a circle

$$\begin{aligned} &26/7 = 3r6 \\ &6+0=60/7=8 \\ &3\ 857142 \end{aligned}$$

Area of a Square Given the Diagonal

Find the area of a square  
with a diagonal of 12

1. Use the formula  $\text{Area} = 1/2 D_1 D_2$
2. Since both diagonals are equal
3.  $\text{Area} = 1/2 12 \times 12$
4. Find answer

$$\begin{aligned} &1/2 D_1 D_2 \\ &1/2 \times 12 \times 12 \\ &72 \end{aligned}$$

Estimation of a 3 x 3 Multiplication

$$346 \times 291 =$$

1. Take off the last digit for each number
2. Round to multiply easier
3. Add two zeroes
4. Write answer

$$\begin{array}{r} 35 \times 30 \\ 1050 + 00 \\ \hline 105000 \end{array}$$

Dividing by 11 and finding the remainder

$$7258 / 11 = \underline{\hspace{2cm}}$$

Remainder

1. Start with the units digit and add up every other number
2. Do the same with the other numbers
3. Subtract the two numbers
4. If the answer is a negative or a number greater than 11 add or subtract 11 until you get a number from 0-10

$$\begin{array}{r} 8+2=10 \quad 7+5=12 \\ 10-12=-2 \quad -2+11=9 \end{array}$$

Multiply By Rounding

$$2994 \times 6 =$$

1. Round 2994 up to 3000
2. Think  $3000 \times 6$
3. Write 179, then find the last two numbers by multiplying what you added by 6 and subtracting it from 100.

$$\begin{array}{r} 3000(6)=179 \\ 6(6)=36 \quad 100-36=\overline{64} \\ \hline =17964 \end{array}$$

The Sum of Squares  
(factor of 2)

$$12^2 + 24^2 =$$

1. Since 12 goes into 24 twice...
2. Square 12 and multiply by 10
3. Divide by 2

$$\begin{array}{r} 12^2=144 \\ 144 \times 10= \\ \hline =1440 \end{array}$$

The Sum of Squares  
(factor of 3)

$$12^2 + 36^2 =$$

1. Since 12 goes into 24 three times...
2. Square 12 and multiply by 10

$$\begin{array}{r} 12^2=144 \\ 144 \times 10= \\ \hline =1440 \\ \hline =720 \end{array}$$

The Difference of Squares  
(Sum x the Difference)

$$32^2 - 30^2 =$$

1. Find the sum of the bases
2. Find the difference of the bases
3. Multiply them together

$$\begin{array}{r} 32+30=62 \\ 32-30=2 \\ \hline 62 \times 2 =124 \end{array}$$

**Addition by Rounding**  
(Sum x the Difference)

$$2989 + 456 =$$

1. Round 2989 to 3000
2. Subtract the same amount to 456,  $456 - 11 = 445$
3. Add them together

$$\begin{aligned} 2989 + 11 &= 3000 \\ 456 - 11 &= 445 \\ 3000 + 445 &= 3445 \end{aligned}$$

**123...x9 + A Constant**  
(1111...Problem)

$$123 \times 9 + 4$$

1. The answer should be all 1s. There should be 1 more 1 than the length of the 123... pattern.
2. You must check the last number. Multiply the last number in the 123... pattern and add the constant.

$$\begin{array}{r} 3 \times 9 + 4 = 31 \\ \underline{1111} \end{array}$$

**Supplement and Complement**

**Find The Difference Of The Supplement And The Complement Of An Angle Of 40.**

1. The answer is always 90

$$= 90$$

**Supplement and Complement**

**Find The Sum Of The Supplement And The Complement Of An Angle Of 40.**

1. Use the formula  $270 - \text{twice the angle}$
2. Multiply the angle by 2
3. Subtract from 270

$$\begin{aligned} 270 - 80 &= \\ &= 190 \end{aligned}$$

**Larger or Smaller**

$$\begin{array}{c} 55 \swarrow \quad \searrow 52 \\ \frac{5}{4} + \frac{13}{11} \end{array}$$

1. Find the cross products
2. The larger fraction is below the larger number
3. The smaller number is below the smaller number

$$\begin{aligned} \text{Larger} &= 5/4 \\ \text{Smaller} &= 13/11 \end{aligned}$$

**Two Step Equations**  
(Christmas Present Problem)

$$\frac{A}{3} - 1 = 11$$

1. Start with the answer and undo the operations using reverse order of operations

$$\begin{aligned} 11 + 1 &= 12 \\ 12 \times 3 &= 36 \end{aligned}$$

The geometric mean is the multiplicative average  $a, b = \sqrt{a \cdot b}$  = geometric average

if  $a = 9$   $b = 4$   
geometric mean =  $\sqrt{36} = 6$

**Relatively Prime**  
(No common Factors Problem)  
\* One is relatively prime to all numbers

**How Many #s less than 20 are relatively prime to 20?**

- Put the number into prime factorization
- Subtract 1 from each exponent and multiply out all parts separately
- Subtract 1 from each base
- Multiply all parts together

$2^2 \times 5^1 = 2^1 \times 5^0 = 2 \times 1$   
 $2 \times 1 \times 1 \times 4 = 8$

**Product of LCM and GCF**

**Find the Product of the GCF and the LCM of 6 and 15**

- Multiply the two numbers together

$6 \times 15 = 90$

Answer ratio  
 $\frac{4}{6} = \frac{2}{3}$   
 $\frac{6}{9} = \frac{2}{3}$

**Estimation**

**15 x 17 x 19**

- Take the number in the middle and cube it

$17^3 = 4913$

**Sequences-Finding the Pattern**

**7, 2, 5, 8, 3, 14**  
Find the next number in this pattern

- If the pattern is not obvious try looking at every other number. There may be two patterns put together

7, 2, 5, 8, 3, 14  
1

**Sequences-Finding the Pattern**

**1, 4, 5, 9, 14, 23**  
Find the next number in this pattern

- If nothing else works look for a Fibonacci Sequence where the next term is the sum of the previous two

1, 4, 5, 9, 14, 23  
 $14 + 23 = 37$

**Degrees ↔ Radians**

$90^\circ =$  \_\_\_\_\_  
Radians

- If you want radians use  $\pi X / 180$
- If you want degrees use  $180 X / \pi$

$90(\pi) / 180 = \pi / 2$

Logarithm def. - When  $b$  is raised to the power of  $y$  is  $x$ .  
 $b^y = x$  then  $\log_b(x) = y$ .  
 $2^4 = \log_2(16) = 4$