

## Quant notes by GS (Target760)

A compilation from various sources (Credit goes to original posters) and my notes...

**GOLDEN RULE: learn talking to yourself. Before every question; 'yes' before every question always ask yourself, "What is being asked?"**

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Discipline:

1. No distraction. Total concentration.
2. don't mix music or any other indulgence with math. Focus 100%

### Problem Solving Summary

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1. Read the question carefully and decipher;
2. Take 5 seconds, to evaluate what is being asked (don't just launch into solving); Determine exactly what is being asked
3. Make note what is being asked. Especially in word problems!! E.g. Jim's age 3 yrs from now  $J+3$ ?
4. Assess how much effort to put in; how precise calculations need to be
5. If possible then eliminate answer choices
6. Choose fastest approach;
  - a. To solve
  - b. To pick assumed numbers and test options (AEBDC)\*
  - c. To back solve / plug-in back answer choices into the question (B or D)
7. \*Counter check; when picking nos. two answer choices may give same result. Try another
8. Re read question and choose answer

Note: Diagrams are TO SCALE in Problem solving.

If you are stressed take your eyes off the screen and re focus (mumble to yourself)

### Data Sufficiency Summary

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1. Step 1: Focus on question stem
2. Step 2: Look at each statement separately
3. Step 3: look at each statement together
4. answer decision tree: AD or BCE\*
5. \*always write and strike off options based on above logic

V Imp: Beware of 'yes' 'no' type. In such questions even if answer is "no" then still it's an answer.

Q. Commissioner R wants to schedule a 2-hour meeting on Friday for herself and three other commissioners, S, T, and U. Is there a 2-hour period on Friday that is open for all four commissioners?

1. On Friday, commissioners R and S have an open period from 10:00 a.m. to 2:00 p.m.
  2. On Friday, commissioner T has an open period from 11:00 a.m. to 1:00 p.m. and commissioner U has an open period from 8:00 a.m. to 12:00 p.m.
- OA is C. i.e. by combining both we can say that "no" 2-hour period is available.

### Note

1. DIAGRAMS are NOT TO SCALE in Data sufficiency.

2. On harder questions, if you are forced to make a guess. And if one of statements looks too difficult to comprehend then start with the easier looking statement & narrow down your options
3. In hard questions if you have figured out that whether one of statement is not sufficient, then before making guess remember that on harder question answer is more like to be C than E.
4. Do not over understand the stem. E.g. in Kaplan, (a) e.g on pg 280 (b) Question 18, on pg 302

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### Remember:

- When you see a symbol  $x$ , or  $y$ , etc, you need to make sure you understand if it is an integer, a rational number, or could it be a fraction, an irrational number, etc.
- Imp: create memory list of powers, percents, fractions, roots etc. who knows all the squares up to 20, all the cubes up to 11 and essential powers of 2, 3 and 5

Note: For tougher questions - such as overlapping sets, probability and combinations - make sure that you understand how to solve these questions and you can actually solve them in 2 minutes. If you can't - follow this approach: memorize an example from a GMAT Book. Memorize the exact words for the problem, the exact solution, solution and the final answer. Then, when you encounter these questions, write out the memorized problem and solution from memory and use that model to plug the numbers in

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### BEWARE

- In questions that ask for calculating total costs with fixed costs for first print / tkt / etc and variable for others, in final answer **do not forget to include the first pic / tkt** etc

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### Important Common percents and fractions

- $16\frac{2}{3}\% = \frac{1}{6}$
- $33\frac{1}{3}\% = \frac{1}{3}$
- $66\frac{2}{3}\% = \frac{2}{3}$
- $83\frac{1}{3}\% = \frac{5}{6}$
- $40\% = \frac{2}{5}$
- $60\% = \frac{3}{5}$
- $80\% = \frac{4}{5}$
- $12\frac{1}{2}\% = \frac{1}{8}$
- $37\frac{1}{2}\% = \frac{3}{8}$
- $62\frac{1}{2}\% = \frac{5}{8}$
- $87\frac{1}{2}\% = \frac{7}{8}$

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### ARITHMETIC & ALGEBRA

- 0 is even no.
  - 0 is neither negative, nor positive.
  - 0 & 1 are neither prime, nor composite nos
  - $N^0 = 1$
  - Division by 0 is undefined
  - $0^0$  is undefined
  - Even negative nos. is even nos. -2, -4 are even nos!!!
  - Rounding off; round up when  $\geq 5$  and round down when  $< 5$  i.e.  $3.49 = 3$  and  $3.50$  or  $3.51 = 4$
  - Whole nos = Zero + positive integers (natural nos).
-

- Natural nos = positive integers without Zero
- Integers = entire no. line
- Rational can be expressed in form of  $p/q$  and irrational cannot be expressed in  $p/q$
- Prime no. is a no divisible by 1 & only itself. i.e **have only two factors**
- Prime nos. are always positive (in GMAT negative numbers are not prime numbers)
- Square root value in GMAT problem solving is **to be taken as positive (unlike in Data sufficiency)**
- **To say a no. is evenly divisible by another no. means that latter divided former completely, without leaving a remainder and not that the latter should divide former with an 'even' divisor.**
- **$(8 \times 7.2)/8 = 7.2$  that's is to say that although 8 divides but not completely (as answer is 7.2 and not 7)**
- Prime nos: 2 3 5 7, 11 13 17 19, 23 29, 31 37, 41 43 47, 53 59, 61 67, 71 73 79, 83 89, 97 101
- 2 is only even prime no
- 2 is smallest prime no
- How to determine prime no = Find approx square root of the number. Then check if all the prime numbers below the square root are factors of the given number. If none are then the number is prime else not.  
e.g. number 91. approx sq root is 10  
Prime number below 10 are 2,3,5&7.  
91 is not divisible by 2,3 or 5. But it is divisible by 7.  
Therefore 91 is not prime.

- No. is divisible by 4 when last two digits are divisible by 4
- No. is divisible by 8 when last 3 digits are divisible by 8
- No. is divisible by 11 when diff of [sum of all alternate nos. starting from units place sum] AND [sum of all remaining nos. is divisible] by 11. eg. 46816  $(6+8+4)-(1+6) = 11$  hence divisible by 11
- A no. is divisible by 12 when its divisible by 3 and last two digits are divisible by 4
- For squares of nos with 0 or 5 in end. E.g.  $35^2 \dots$  Multiply (non-units digits) times (non-units digits + 1) i.e.  $3 \times (3+1) \dots 3 \times 4 \dots$  which gives 12  $\dots$  and then add 25 behind it (i.e.  $5 \times 5$ ). Therefore answer is 1225
- **Product of two even nos. is always divisible by 4**
- If A. B. C D. represents distinct digits in an addition problem below, what is the value of D?  

$$\begin{array}{r} AB \\ +BA \\ \hline CDC \end{array}$$

When 2 two digit nos. are added the total will always be in something 100s. i.e if the total is CDC then C would be 1 for sure ( $78+87 = 165$ ,  $98+89 = 187$  i.e. units digit is always '1') take it from here on  $\dots$

- Reciprocal of a no. between 0 and 1 (e.g.  $1/3$ ,  $2/5$ ) is greater than original no.
- Reciprocal of no. between  $-1$  and 0 is smaller than the original no.
- Square of a no. between 0 and 1 is smaller than the original no.
- Square of a no. between  $-1$  and 0 is greater than the original no.
- Multiplying a positive no. by a fraction between 0 and 1 gives a smaller no than original
- Multiplying a negative no. by a fraction between 0 and 1 gives a greater no than original

- BODMAS – O is orders or exponents
- Solve BODMAS left to right with division, multiplication together & addition, subtraction together
- % means divide by 100. But multiply when talking in terms of times. E.g 3.5 times is 350%  
e.g. 45 is what percent of 9  $> 45/9 = 5$  times or  $5 \times 100\% = 500\%$  **to make percent multiply by 100%**  
e.g. 15 is  $3/5$  percent of what  $> 15 = 3/5 \times (1/100\%) \times \text{whole} = 2500$ . **to drop percent / to find part divide by 100%**
- **Percent  $\times$  whole = Part**
- **Be careful for minor errors  $12.6\% = 63/500$  and not  $64/500$  (quick assumption error)**

- 24% of 2 = .48 and not .40 (again wrong assumption that  $24/50 = .40$ )
  - Compound interest 20% calculated **semi-annually** is 10% for 6 months.
  - Compound interest: final balance = principal  $\times (1 + \text{interest rate} / 100)^{(\text{time})(C)}$  . . . C: no. of time compounded annually i.e. principal  $\times (1 + 20 / (100 \times 2))^{\text{time} \times 2}$
- 
- Median is middle no. of n nos ordered least to greatest.
  - When n is even then median average of middle two nos.
  - Mode is highest frequency of a no. in a list
  - Range of n nos. is difference between smallest and largest no.
  - There can be more than one mode
  - Set 1{1,1,1,1}; Mean=Median=Mode=1, Range=0  
Set 2{-1,-1,1,1}; Mean=Median=0, **Mode=-1,1 (set of data can have more than one mode)**, Range = 2  
Set 3 = {-1,-1,1,1,1,2}; Mean=4/7, Median=1, Mode=1, Range=3
  - The middle term can be found at taking the average of the first and last term 'OR' In the case of if there are even no of terms e.g. ten terms, you just need to work up to the 5th and 6th term then find the middle of these two numbers.
  - A quick way to find the sum of a series where each preceding term is **incremented by the same number** would be to find the middle term and multiply it by the number of terms.  
E.g. Sum of 4,8,12,16,20 :  
Middle term: 12  
Number of terms: 5  
Sum =  $12 \times 5 = 60$
  - To find sum of consecutive nos. sum = avg of nos.  $\times$  no of terms.  
i.e. sum of integers 10 to 50 would be  $> (10+50)/2 \times (50-10+1) = 1230$
  - When you have original average and new average then; **Number added** = new sum – old sum,  
**Number deleted** = original sum – new sum
  - Standard deviation  $\Rightarrow$  ADSAS  $\Rightarrow$  Find arithmetic mean or **Average** > **Difference** between each no. and arithmetic mean > **Square** of differences > **Average** of squared differences > **Square root** of average
  - If in a series 2, 3, 7, 4, 9, 11 > average is 6 and say standard deviation is 1 then no 9 is 3 SD away.
  - Normal distribution follows the pattern: 2%, 14%, 34%, mean, 34%, 14%, 2%. Where to use:  
Princeton Review Math Bin4, Q3. if question says mean of normal distribution is 72 and we can find that 2% people are above 82. this means that 82 which is 2 standard deviations away (since 2% is two steps away from mean, 34% then 14%), thus one standard deviation is  $82-72=10/2 = 5$ . Now bottom 16% will be one standard deviation away from mean (left side,  $2\% + 14\% = 16\%$ ) therefore,  $72-5=67$ .
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- 1 Penny = 1 cent i.e. to say penny or cent mean same thing
  - 1 Nickel = 5 cents
  - 1 dime = 10 cents
  - 1 quarter = 25 cents
  - 1 half = 50 cents
  - 1 dollar = 100 cents
- 
- GCD (or HCF) of two integers a and b is the largest integer that divides them both
  - LCM of two (or more) nonzero integers is the least positive integer divisible by all of them
  - **$\text{GCD}(a,b) \times \text{LCM}(a,b) = a \times b$  e.g.  $\text{GCD}(12,15) \times (12,15) = 12 \times 15 = 180$**
  - **Remember to include '1' if you're asked to count the number of factors a number has**
  - How many positive integers x is  $130/x$  an integer?  
Solve by prime factoring; prime factors of 130 are 2,5, and 13. Just don't jump to answer as yet --  
- remember that combination of these nos. will also divide 130 without leaving remainder.  
- And also remember that 1 and the no. itself are factors too:
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So answer is 1,2,5,13,10(2x5),26(2\*13),65(5x13), 130 (2x5x13); **total 8 factors**

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- Comparing fractions; 22/19 and 11/9
    - Method 1: Cross over;  $22 \times 9 < 11 \times 19$ , therefore  $22/19 < 11/9$
    - Method 2 (if possible);  $22/19 < 22/18$  i.e. (11 x2), therefore  $22/19 < 11/9$
- 

- $Ax^2$ ; A is coefficient, x is base and 2 is the exponent / power
  - $x^m * x^n = x^{m+n}$
  - $(x^m)^n = x^{mn}$
  - $x^m/x^n = x^{m-n}$
  - $x^0=1$
  - $-ve^{n(odd)} = -ve$
  - $x^{-m} = 1/x^m$
  - $x\sqrt{m} = m^{1/x} \dots x^{2/3} = 3\sqrt{x^2}$
  - $\sqrt{xy} = \sqrt{x} \sqrt{y}$  e.g.  $2\sqrt{3} \times 3\sqrt{5} = 6\sqrt{15}$  or  $12\sqrt{15} / 2\sqrt{5} = 6\sqrt{3}$  i.e. **solve outside the sign and then inside**
  - $\sqrt{x} / y = \sqrt{x} / \sqrt{y}$
  - $\sqrt{1} = 1$ ,  $\sqrt{2} = 1.4$  (1.414) approx,  $\sqrt{3} = 1.7$  (1.732)approx.**
  - Value of  **$\pi = 22/7$  or 3** (3.142) approx
  - In GMAT  $\sqrt{\phantom{x}}$  is always +ve**
  - Pg112 Kaplan math work book. Good basic algebra workout
  - In an answer never leave root sign in the denominator. i.e.  $\sqrt{1/3}$  should be written as  $\sqrt{3}/3$**
  - $-x > 4$  then  $x < -4$  (don't forget to put – sign before 4) point to be noted:** Multiplying both sides of an inequality changes direction of the inequality eg.  $5 > 2$ ,  $-5 < -2$
  - $6 > x + 4 > 4$ ; solve in two parts: first left side  $6 > x+4 \Rightarrow 2 > x$ . Then right side  $x+4 > 4 \Rightarrow x > 0$ . Combined answer  $0 < x < 2$**
  - $x^2 - 9 < 0$  IMP: when we have '=' signs then is  $x^2 = 9$  means either  $x = 3$  or  $x = -3$ . But, if there is '>' or '<' sign then – and + are to be taken by x i.e. if  $x^2 > 9$ , then either  $-x > 3$  or  $x > 3$ . ie.  $x < -3$  or  $x > 3$  ... thus  $-3 > x > 3$**
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- If  $x/y = z/t$  then;
    - $(x+y)/y = (z+t)/t$ . Componendo
    - $x/(x+y) = z/(z+t)$
    - $(x-y)/y = (z-t)/t$ . Dividendo
    - $x/(x-y) = z/(z-y)$
    - $(x+y)/(x-y) = (z+t)/(z-t)$ . Componendo and dividendo
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- When you raise power of fraction less than 1. Fraction gets smaller i.e.
  - DST** > Distance = Speed x Time
  - To and fro in different speeds is  $2ab/(a+b)$
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- $(A \cup B) = n(A) + n(B) - n(A \cap B)$
  - $(A \cup B) = n(A - B) + n(A \cap B) + n(B - A)$ . imagine the diagram
  - $(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(C \cap A) + n(A \cap B \cap C)$
  - $U = n(A \cup B) + c(A \cup B)$
  - You can solve groups / sets problem also by making grid
- |        | Doctors | Dentist | Total |
|--------|---------|---------|-------|
| Male   | 55      | 27      | 82    |
| Female | ??      | 9       | 48    |
| Total  | 94      | 36      | 130   |
- 

- If  $a > x$ ,  $b > y$ ,  $c > z$  then,

- $a+b+c+\dots > x+y+z+\dots$
  - $abc\dots > xyz\dots$
  - $n!^2 > n \cdot n$
  - $a/b + b/c + c/d + d/a > 4$
  - $a^2b + b^2c + c^2a \geq 3abc$
  - for any integer  $n$ ,  $2 \leq (1+1/n)^n \leq 3$
  - If  $a, b, c$  are positive and not equal then
    - $(a+b+c)(ab+bc+ca) > 9abc$
    - $(b+c)(c+a)(a+b) > 8abc$
  - If  $a > b$ , then  $a^n - b^n$  is divisible by  $a-b$  *whether  $n$  is odd or even*.
  - $a^n - b^n$  is divisible by  $a + b$  *only when  $n$  is even*.
  - $a^n + b^n$  is divisible by  $a+b$  *only when  $n$  is odd*.
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- Probability (# of favourable outcomes) / (# of possible outcomes)
  - $P(\text{not } E) = 1 - P(E)$
  - $E \text{ or } F = P(E \text{ or } F) = P(E) + P(F) - P(E \text{ and } F)$
  - $E \text{ and } F = P(E \text{ and } F) = P(E)P(F)$
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#### Permutation & Combination

- The number of ways to arrange  $n$  distinct objects along a fixed circle is:  $(n - 1)!$
  - **Permutation:**  $n! / (n! - r!)$
  - **Combination:**  $n! / r!(n! - r!)$  When doing a combination question do not forget to put  $r!$  in denominator.
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- If  $x < -4$ ,  $y < -2$ , we know that  $xy > 8$ , but we don't know how  $x/y$  compare to  $(-4)/(-2)=2$  since *you can only do division when their signs are in different directions*  
 If  $x > -4$  and  $y < -2$  then  $x/y < 2$  but we don't know how  $xy$  is compared to 8 since *we can only do multiplication when their signs are the same direction*.

It is easier to do the derivation, though, if you first change the **VALUES** to positive. For example:

If  $x < -4$ ,  $y < -2$ , then  $-x > 4$ ,  $-y > 2$ ,  $xy > 8$

If  $x < -4$ ,  $y < 2$ , then  $-x > 4$ ,  $y < 2$ ,  $-x/y > 2$ ,  $x/y < -2$  i.e. use the sign of the higher no.

- 
- $x^2 > x$   
 You **Cannot** divided both sides by  $x$  and say  $x > 1$ .  
 $x^2 - x > 0$   
 $x(x-1) > 0$   
 Solution would be either both  $x$  and  $x-1$  are greater than zero, or both  $x$  and  $x-1$  are smaller than zero. So your solution is:  $x > 1$  or  $x < 0$
  - $x > 1/x$   
 Again you **Cannot** multiply both sides by  $x$  because you don't know if  $x$  is positive or negative. What you have to do is to move the right side to the left:  
 $x - 1/x > 0$   
 $(x^2 - 1)/x > 0$   
 If  $x > 0$  then  $x^2 - 1 > 0 \Rightarrow x > 1$   
 If  $x < 0$  then  $x^2 - 1 < 0 \Rightarrow x > -1$   
 Therefore your solution is  $x > 1$  or  $0 > x > -1$ .
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**Compare this to Kaplan method on pg 519, 37**

- $|x-4| < 9$   
 If  $x-4 \geq 0$ , then  $x-4 < 9$ , solve for both you get  $x > 4$ ,  $x < 13$ . So your solution is  $4 < x < 13$ .  
 If  $x-4 < 0$ , then  $-(x-4) < 9$ , ie  $x-4 > -9$ . Solve for both you get  $x < 4$ ,  $x > -5$ . So your solution for this part is -

$$5 < x < 4.$$

Combine the two solutions, you get  $-5 < x < 13$  as your final solution.

- $|x+4| > 4$   
If  $x+4 \geq 0$ , then  $x+4 > 4$ . Solve for both you get  $x \geq -4$ ,  $x > 0$ . So your solution is  $x > 0$ .  
If  $x+4 < 0$ , then  $-(x+4) > 4$ , ie.  $x+4 < -4$ . Solve for both you get  $x < -4$ ,  $x < -8$ . So your solution is  $x < -8$ .  
You final solution is  $x > 0$  or  $x < -8$ .

- $|y| > |y+1|$   
 $y^2 > (y+1)^2$   
 $y^2 > y^2 + 2y + 1$   
 $2y + 1 < 0$   
 $y < -1/2$

- If  $d$  is POSITIVE and  $|x| < d$ , then  $-d < x < d$   
If  $d$  is NEGATIVE and  $|x| < d$ , then there is no solution  
If  $d$  is POSITIVE and  $|x| > d$ , then  $x < -d$  OR  $x > d$   
If  $d$  is NEGATIVE and  $|x| > d$ , then  $x$  is all real numbers

- A square root, also called a radical or surd, of  $x$  is a number  $r$  such that  $r^2 = x$ . The function  $r = \sqrt{x}$  is therefore the inverse function of  $f(x) = x^2$  for  $x \geq 0$ . eg. if  $x < 0$ ,  $\sqrt{x^2} = -x$ , but in GMAT sq root is +ve

- If cement, gravel, and sand are to be mixed in the ratio 3:5:7 respectively, and 5 tons of cement are available, how many tons of the mixture can be made?

New ratio:  $3/3 \times 5$ ,  $5/3 \times 5$ ,  $7/3 \times 5$  Therefore total mixture =  $5 + 25/3 + 35/3 = 75/3 = 25$

- A fruit mixture is made up by 25% fruit A and 75% fruit B. Now if the amount of fruit A is doubled, what is their relative share in the new mixture?

$$A:B = 25:75$$

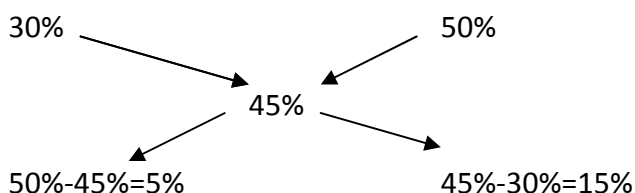
$$2A:B = 50:75 = 2:3$$

Therefore the new shares are fruit A 40%, fruit B 60%.

- A 30% solution of alcohol is mixed with 50% of solution of alcohol, to form a 10 ltr solution of 45% alcohol. How much of 30% alcohol was used?

$$.3x + .5y = 4.5 \text{ and } x+y=10 \text{ solve for variables. } x=2.5, y=7.5 \text{ ltr}$$

OR

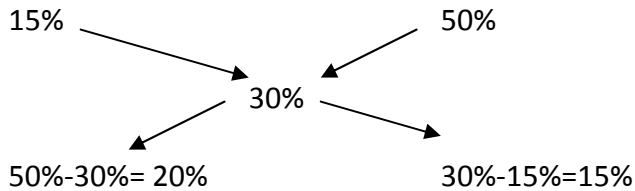


Ratio is 5%; 15% or 1:3  $\Rightarrow$  2.5 ltr : 7.5 ltr

- Mixture A is 15% alcohol and mixture B is 50% alcohol. They are mixed together to create 4 gallons of with 30% alcohol in it. How many gallons of mixture A is in final mixture?

$$15\%A + 50\%B = 1.2 \text{ and } A+B=4 \text{ solve for variables. } A = 16/7, B=12/7$$

OR



Ratio is 20% of A : 15% of B or 4:3 or  $\frac{4}{7} \times 4 = \frac{16}{7}$  of A &  $\frac{3}{7} \times 4 = \frac{12}{7}$  of B

- $\frac{1}{4}$  solution was 10% sugar by weight, was replaced by second solution resulting in solution that was 16% sugar by weight. The second solution was what percent sugar by weight.

$$(\frac{3}{4} * 10\%) + (\frac{1}{4} * x\%) = 16\% \text{ solve for } x. x=34\%$$

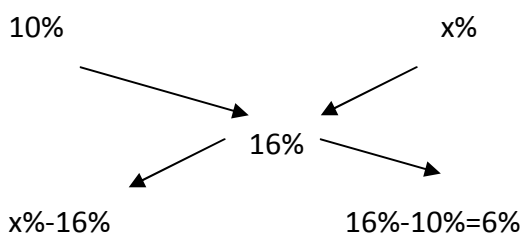
OR

Assume 100 ltr total. Thus 25ltr is replaced with new solution. Also, it's inferred that 75 ltrs has 10% sugar by weight. i.e. has 7.5 ltrs sugar.

So equation is  $7.5 \text{ ltr} + 25 * x\% \text{ ltr} = 16 \text{ ltr}$ . Solve for x.  $x = 34\%$

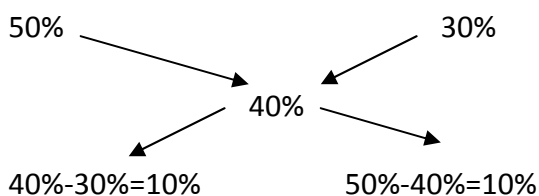
OR

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Therefore ratio is  $(x\%-16\%):6\% :: 3:1$ . Solving we get  $x\%=34\%$

- Some part of 50% solution of acid was replaced by equal amount of 30% of solution of acid. As a result, 40% solution of acid was obtained. What part of original solution was replaced?



Therefore ratio is 1:1. Thus half part of original solution was replaced.

## GEOMETRY

### Caution

- If there are 3 intersecting lines, then there are 6 angles. Q 3, Pg 152, Kaplan math workbook
- Be careful of area of photo frame questions: side of picture + 2 times frame width = outer side

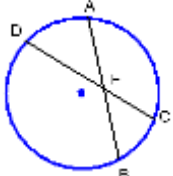


- Quadrilateral is four sided polygon. The one with parallel sides is parallelogram
- Be watchful; look at figures carefully and check what is being asked for; lest you will make simple errors: in Kaplan math workbook; pg 185 Q14, pg 178 Q 6, pg 177 Q1
- Evaluate what's the requirement of answer; like don't leave root sign in denominator
- Answer may not need pi thus multiply with 3 approx e.g. Kaplan work book pg 190 Q10
- Don't assume a shape; square for a rectangle, unless clearly stated; Kaplan math work book pg 199 Q14

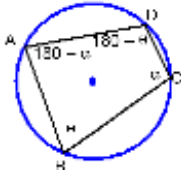
### Theorems

- Similarity: AA, SAS, SSS (A = angle, S = side)
- Ratio of the area of two similar triangles is ratio of squares of corresponding sides. i.e. if two triangles are similar and ratio of corresponding sides is 2:1 then area will be in ratio of  $2^2:1^2 \Rightarrow 4:1$
- Area of an equilateral triangle is  $\frac{\sqrt{3}}{4}a^2$
- Height of an equilateral triangle is  $\frac{\sqrt{3}}{2}a$
- In  $45^\circ 45^\circ 90^\circ$  isosceles right angle triangle the ratio of sides is  $1:1:\sqrt{2}$
- In  $30^\circ 60^\circ 90^\circ$  right angle triangle the ratio of the sides is  $1:\sqrt{3}:2$
- Difference of two sides of triangle is always less than the third side
- Sum of two sides of a triangle is always greater than the third side
- Pythagorean Triplet (3,4,5): Common right angle triangles with sides 3,4,5 - 5,12,13 - 6,8,10 - 7, 24,25
- Total of angles of a polygon is  $(n-2) \times 180^\circ$  and per angle is  $\frac{(n-2) \times 180^\circ}{n}$
- Sum of exterior angles of a regular polygon is  $360^\circ$
- A line joining mid points of two sides is parallel to third side and half its size.
- Diagonal of a square is  $\sqrt{2}a$
- Area of a triangle scalene (not isosceles, not equilateral) =  $\sqrt{S(S-a)(S-b)(S-c)}$ , where  $S = \text{perimeter}/2$
- Length of largest diagonal in a cuboid is  $\sqrt{l^2+b^2+h^2}$
- Volume of a cube is  $a^3$
- Surface area of a cube is  $6a^2$
- Area of a parallelogram is base x height
- Area of a quadrilateral is  $\frac{1}{2} \times \text{diagonal} \times (\text{sum of perpendicular on diagonals from vertex})$
- Area of rhombus is  $\frac{1}{2} d_1 d_2$
- Side of a rhombus is  $\frac{1}{2} \sqrt{d_1^2 + d_2^2}$
- Area of Trapezium is  $\frac{1}{2} (\text{side } a + \text{side } b) \times \text{height}$
- Volume of a cylinder is  $\pi r^2 h$
- Lateral surface area is  $2\pi r h$
- Total Surface area of a cylinder is  $2\pi r(r+h)$
- Area of a cone is  $\frac{1}{3} \pi r^2 h$
- Curved surface area of a cone is  $\pi r l$
- Total surface area of cone is  $\pi r(r + l)$
- Volume of a sphere is  $\frac{4}{3} \pi r^3$
- Surface area of a sphere is  $4 \pi r^2$
- Volume of a pyramid is  $\frac{1}{3} \times \text{area of base} \times \text{height}$
- Surface area of right pyramid is  $(\frac{1}{2} \times \text{perimeter of base} \times \text{slant height})$
- Volume of a right/any prism is area of base x height
- Surface area of a right/any prism is perimeter of base x height
- Volume of a rectangular prism is  $l b h$
- Surface area of rectangular prism is  $2(lb+bh+hl)$
- Angle subtended by diameter at the circumference is  $90^\circ$

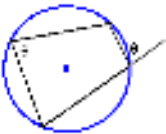
- Tangent to a circle from same point an exterior point are equal.
- Angle subtended by a chord /arc in at the centre is two times the angle subtended at the circumference
- Angle subtended by a chord / arc in same segment are equal.
- **Chord property**: If a line from centre of circle to the chord bisects the chord then it is perpendicular to chord and vice versa
- Equal chords are equidistant from the centre



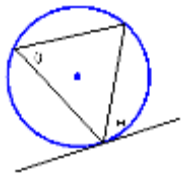
- Two chords AB and DC intersecting at E. then  $AE \times EB = DE \times EC$



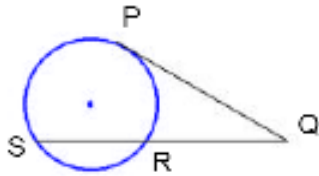
- A cyclic quadrilateral is the one with all four vertices on the circle. **Its opposite angles are supplementary**. Corollary: if opposite angles are supplementary then quadrilateral is cyclic.



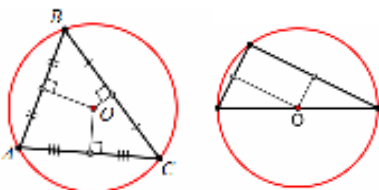
- Exterior angle of a cyclic quadrilateral is = interior opposite angle.



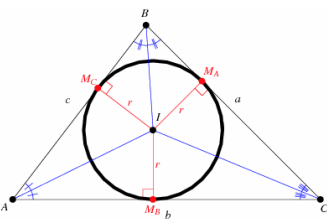
- Angle between tangent and a chord = angle in alternate segment



- $PQ^2 = QR \times QS$



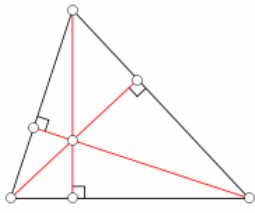
- **Circum Circle**
  - Circumcircle; formed with centre at point of intersection of 3 perpendicular side bisectors. **(for better understanding correlate this with "chord property" mentioned above)**
  - Circumcentre is equi distance from three vertices.
  - Circumcentre of right triangle is on hypotenuse



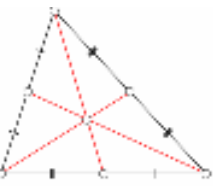
- **In circle**
  - Incentre is a point where three angle bisectors meet.
  - This point is **equi distant from 3 sides (because of radius)**

- And side are tangent to circle forming right angle with radius (for better understanding coorelate this with the property that any line touching the circle is tangent and makes 90 degree angle with radius)

Circumcircle and incircle, both are formed by bisectos; side & angles



- **Orthocetre** is a point where three altitudes meet (these altitudes not necessarily bisect the sides)



- - **Centroid** = point of intersection of all medians (line from vertex of a triangle to the mid point of the other side).
  - Centroid **divides median in ratio of 2: 1**
  - **Interesting: centroid is balance of the mass of the triangle. i.e. if you put fulcrum at this point then triangle would balance.**
  - Coordinates of centroid of a triangle with three vertices  $(x_1, y_1)$ ,  $(x_2, y_2)$ ,  $(x_3, y_3)$  is  $[(x_1 + x_2 + x_3)/ 3, (y_1 + y_2 + y_3)/ 3]$

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### Coordinate Geometry

- **Equation of a line on a plain is  $y = mx + b$ ;**
  - $b$  is the  $y$  intercept; point at which line crosses  $y$  axis
  - $m$  is the slope of the line. Slope = (diff is  $y$  coordinates) / (difference in  $x$  coordinates)
- Distance between two points =  $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- Coordinates of centroid of a triangle with three vertices  $(x_1, y_1)$ ,  $(x_2, y_2)$ ,  $(x_3, y_3)$  is  $[(x_1 + x_2 + x_3)/ 3, (y_1 + y_2 + y_3)/ 3]$

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End of Notes: GS (Target760)