CSAT

FORMULA

CHAPTER 1: DIVISIBILITY RULES

- ✓ 2 – Last digit is 0, 2, 4, 6 or 8
- ✓ 3 – Sum is divisible by 3
- ✓ 4 – Last two digits are divisible by 4
- ✓ 5 – Last digit is 0 or 5
- ✓ 6 – Number is divisible by 2 and 3
- ✓ 7 – Using rule of Triplet, if alternating sum is divisible by 7
- ✓ 8 - Last three digits are divisible by 8
- ✓ 9 – Sum is divisible by 9
- ✓ 10 – Unit digit is 0
- ✓ 11 – Difference of sum odd digits and sum of even digits is 0 or divisible by 11
- ✓ 12 – Number divisible by 3 and 4
- ✓ 13 - Using rule of Triplet, if alternating sum is divisible by 13

Q. How many 3-digit natural numbers (without repetition of digits) are there such that each digit is odd and the number is divisible by 5? (2022)

(a) 8 (b) 12 (c) 16 (d) 24

Ans. (b)

Solution: A three-digit number having all digits different and is divisible by 5 hence the last digit is 0 or 5. It is an odd number thus the last digit will be 5. The number of ways we can fill the first two digits from amongst 4 distinct digits =first digit in 4 ways × second digit in 3 ways = Total 12 ways. Hence, the correct answer is (b).

CHAPTER 2: PROGRESSION

Arithmetic Progression

Arithmetic Mean = ______________________

$= \frac{x1+x2+\cdots\ldots+xn}{\quad}$

T_n = a + (n-1) d

S_n = _ [2a + (n-1) d] =_(a + l)

- If numbers are consecutive numbers starting from 1 with difference = 1,

Then a = 1 and d = 1

S_n = _ [2 (1) + (n-1) (1)] = $\frac{(\ +\ )}{\quad}$

Where a = First term, d = Common difference, T_n = n^{th} term, S_n = Sum of n terms

- While solving three unknown terms in an Arithmetic Progression whose sum or product is given should be assumed as a-d, a, a+d.
- While solving four terms in an Arithmetic Progression whose sum or product is given, it should be assumed as a-3d, a-d, a+d, a+3d.

Geometric Progression

Geometric Mean = $\sqrt[n]{x1 * x2 * x3 * \ldots\ldots xn}$ **$T_n = ar^{n-1}$** **$S_n = \frac{a\,(r^{\ \ }-1)}{r-1}$ if r > 1** **$S_n = \frac{a\,(1-r^{\ \ })}{1-r}$ if r < 1** **$S_{Infinity} = \frac{\ \ }{1-r}$** Where a = First term, r = Common ratio	**T_n = n^{th} term, S_n = Sum of n terms** **$S_{Infinity}$ = Sum of infinite terms with decreasing common ratio r** While solving three unknown Term in a G.P whose sum or product is given should be assumed as (–), a, ar.

Harmonic Progression

Harmonic Mean = $\frac{\ \ }{\frac{}{x}+\frac{}{x}+\frac{}{x}+\cdots+\frac{}{xn}}$ **T_n = _+ (n-1) d**	A ≥ G ≥ H **A * H = G^2**, i.e. A, G, H are in GP. If A, G and H are respectively the arithmetic, geometric and harmonic means, then

Q. A biology class at high school predicted that a local population of animals will double in size every 12 years. The population at the beginning of the year 2021 was estimated to be 50 animals. If P represents the population after n years, then which one of the following equations represents the model of the class for the population? (2021)

(a) P = 12 + 50n (b) P = 50 + 12n (c) $P = 50\ (2)^{12n}$ (d) $P = 50\ (2)^{n/12}$

Ans. (c)

Solution: The population is doubling every 12 years. So, this is a case of Geometric Progression.

So, r = 2 and Initial population = 50 Being a case of GP, the population should be in the form of ar^{n-1} or $50(2)^t$

Thus, option A and B are eliminated since they are not represented in this particular manner.

From C and D (putting a value of n =12 for doubling of population), option C gives the correct answer.

CHAPTER 3: ALGEBRAIC FORMULAS

➢ **(a + b)2 = a2 + b2 + 2ab** ➢ **(a – b)2 = a2 + b2 – 2ab** ➢ **a2 – b2 = (a + b) (a – b)** ➢ **(a + b + c)2 = a2 + b2 + c2 + 2ab + 2bc + 2ca**	➢ **(a + b)3 = a3 + 3a2 b + 3ab2 + b3** ➢ **(a−b) 3 = a 3− 3a2b + 3ab2 − b3** ➢ **a3 + b3 = (a + b) (a 2− ab + b2)** ➢ **a3−b3 = (a−b) (a2 + ab + b2)**

Q. How many pairs of natural numbers are there such that the difference of whose squares is 63? (2020)

(a) 3 (b) 4 (c) 5 (d) 2

Ans. (a)

Solution: Let the required natural numbers be a and b as per statement, $a^2 - b^2 = 63$

Using formula $a^2 - b^2 = (a + b)\ (a - b)$

(a + b) (a – b) = 63 -> 63 = 9*7

Or 63 = 21*3 Or 63 = 63*1

.

There will be a total of three possible cases in which product of two numbers is 63

Case 1: (a + b) = 9 and (a – b) = 7 Then a = 8 and b = 1

Case 2: (a + b) = 21 and (a – b) = 3

Then a = 12 and b = 9

Case 3: (a + b) = 63 and (a –b) = 1 -> Then a = 32 and b = 31

Total three such pair will be there.

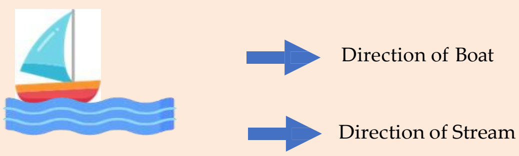
CHAPTER 4: TIME, SPEED AND DISTANCE

✓ **Speed** = $\frac{Distance}{\ \ }$ ✓ **Average Speed** = $\frac{Total\ distance\ travelled}{\ \ }$ ✓ Relative Speed: $Time = \frac{Sum\ of\ lengths}{\ \ }$	✓ **Time** = $\frac{+}{S1 \pm S2}$ **Note**: Speeds to be added if two objects are travelling towards each other and subtracted if going away from each other.

Problems on Trains: **Time** = $\frac{\ \ }{Relative\ Speed} = \frac{+}{S1 \pm S2}$

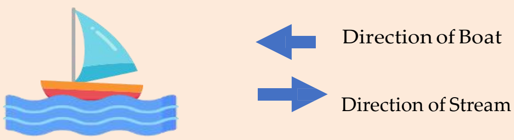
Problems on Boats:

Speed Downstream =
[Speed of boat in still water + Speed of Stream]



As both are in **same direction**, speeds will be **added**.

Speed Upstream =
[Speed of boat in still water - Speed of Stream]



As both are in **opposite direction**, speeds will be **subtracted**.

✓ Speed of the boat in still water = $\frac{1}{2}$(Downstream speed + Upstream speed)

✓ An object covers equal distance at speed S1 and other equal distance at speed S2 then his average speed for the distance is $\frac{2(S1)(S2)}{+}$

✓ Conversion from Km/h to m/s -> Multiply by 5/18

Q. X and Y run a 3 km race along a circular course of length 300m. Their speeds are in the ratio 3:2. If they start together in the same direction, how many times would the first one pass the other (the start-off is not counted as passing)? (2022)

(a) 2 (b) 3 (c) 4 (d) 5

Ans. (b)

Solution: Formula: Speed = ______

As per the question, Speed of X and Y are in ratio 3:2, the faster runner i.e., X will cross the slower one i.e., Y after covering extra 300 m. Assume that their speeds are 3 m/sec and 2 m/sec. So, their relative speed = 3 – 2 = 1 m/sec.

So, the time taken by the X to cross Y = Distance/Relative Speed = 300/1 = 300 seconds. Thus, X will cross Y every 300 seconds. Now, the time taken for the X to complete the race = Total Distance/Speed = 3000/3 = 1000 seconds.

Therefore, the X will cross Y three times during the entire race i.e., after 300 seconds, 600 seconds, and 900 seconds.

CHAPTER 5: SIMPLE AND COMPOUND INTEREST

- **Amount = Principal + Interest**
- **Simple Interest =** $\frac{Principal*Rate*Time}{}$
- **Compound Interest = P * (1+** $\frac{R}{}$**)**^{T} **– P**

Where P = Principal, R = Rate and T = Time

- **Doubling of money** –

Rule of 72 i.e., Rate * Time = 72 (approx.)

- **Tripling of money** –

Rule of 114 i.e., Rate *Time = 114 (approx.)

- **Quadrupling of money** –

Rule of 144 i.e., Rate*Time = 144 (approx.)

Q. A person bought a refrigerator worth Rs. 22800 with 12.5% interest compounded yearly. At the end of first year, he paid Rs. 8650 and at the end of second year Rs. 9125. How much will he have to pay at the end of third year to clear the debt? (2018)

(a) Rs. 9990 (b) Rs. 10000 (c) Rs. 10590 (d) Rs. 11250

Ans. (d)

Solution:

Using the Formula , Simple Interest = $\frac{Principal*Rate*Time}{100}$

1st year's Interest = 22800 x $\frac{12.5}{100}$= 2850

Amount at the end of I Year = 22800 + 2850 = 25650.

Payment made for first year = 25650 - 8650 = 17000

Interest on 17,000: 17000 x $\frac{12.5}{100}$ = 2125

Total Amount after Second year:

17000 + 2125 = 19125

Payment made at the end of second year: 9125.

Amount Remaining: 19125-9125= 10000.

Interest at the end of third year:

10000 + 10000 x $\frac{12.5}{100}$= 1250

Total amount to be paid: 10000 + 1250 = 11250. Hence, the correct answer is (d).

CHAPTER 6: PROFIT AND LOSS

- **Profit = Selling Price – Cost Price**
- **Loss = Cost Price – Selling Price**
- **Profit % =** $\frac{Profit}{}$ *** 100**
- **Loss % =** $\frac{Loss}{}$ *** 100**
- **Discount = Marked Price – Selling Price**
- **Discount % =** $\frac{Discount}{}$ *** 100**
- **Successive Discount formula**

= (x + y - __)%

Where x and y refer to successive discounts offered

Q. A person bought a car and sold it for Rs. 3,00,000. If he incurred a loss of 20%, then how much did he spend to buy the car? (2020)

(a) Rs. 3,60,000 (b) Rs. 3,65,000 (c) Rs. 3,70,000 (d) Rs. 3,75,000

Ans. (d)

Solution:

Loss % = $\frac{Loss}{}$ x 100 Loss % = $\frac{Cost\ Price - Selling\ Price}{}$ x 100

Substituting values as given in question: 20% = 1 - $\frac{3,00,000}{}$ x 100

Solving the equation, we get CP = 3,75,000. Hence, the correct answer is (d).

CHAPTER 7: AVERAGES

- **Average =** $\frac{Sum\ of\ observations}{}$
- **Weighted Average =** $\frac{w1x1+w2x2+\cdots\ldots wnxn}{x1+x2+\cdots\ldots+xn}$

- If the value of each unit in a set is increased or decreased by some value x, then the average of the set also increases or decreases respectively by x.

Q. The average weight of A, B, C is 40 kg, the average weight of B, D, E is 42 kg and the weight of F is equal to that of B. What is the average weight of A, B, C, D, E and F? (2022)
(a) 40.5 kg (b) 40.8 kg (c) 41 kg (d) Cannot be determined as data is inadequate

Ans. (c)

Solution: As per the question,
(A + B + C)/3 = 40 Or (A + B + C) = 120 -> (B + D + E)/3 = 42 Or (B + D + E) = 126
F = B From the above information: -> A + B + C + B + D + E = 120 + 126 Or A + B + C + D + E + B = 246
Or A + B + C + D + E + F = 246 (as F = B) -> So, average weight of A + B + C + D + E + F = 246/6 = 41 kg

CHAPTER 8: PERCENTAGE

- **Percentage Change =** $\frac{Final\,Value - Initial\,Value}{\quad}$ *** 100**

- For Successive change of x% and y%
Total change in percentage = (x + y + ——) %

Q. The increase in the price of a certain item was 25%. Then the price decreased by 20% and then again increased by 10%. What is the resultant increase in the price? (2022)
(a) 5% (b) 10% (c) 12.5% (d) 15%

Ans. (b)

Solution: Let the initial price be Rs. 100. After 25% rise, the new price = 100 + 25% of 100 = Rs. 125
After 20% fall, the new price = 125 – 20% of 125 = Rs. 100
After 10% rise, the new price = 100 + 10% of 100 = Rs. 110
So, resultant percentage increase in price = 10%. Hence, the correct answer is (b).

Fraction	%
½	50%
1/3	33.33%
¼	25%
1/5	20%
1/6	16.66%

1/7	14.28%
1/8	12.5%
1/9	11.11%
1/10	10%
1/11	9.09%
1/12	8.33%

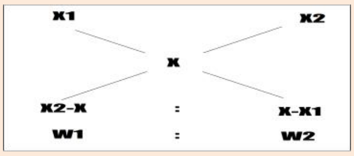
1/13	7.69%
1/14	7.14%
1/15	6.66%
1/20	5%
1/24	4.16%
1/25	4%

1/30	3.33%
1/40	2.5%
1/50	2%
1/100	1%

CHAPTER 9: ALLIGATION

- **Rule of Allegation:**

$$\frac{w1}{w2} = \frac{x2-x}{x-x1}$$



Q. There is a milk sample with 50% water in it. If 1/3rd of this milk is added to equal amount of pure milk, then water in the new mixture will fall down to: (2017)
(a) 25% (b) 30% (c) 35% (d) 40%

Ans. (a)

Solution: Original 18 liters (9 milk + 9 water), i.e., 18 x $\frac{1}{3}$ = 6 (3 + 3)
Pure milk 18 liters (18 milk + 0 water) + 3 milk +3 water. => New mixture = 24 liter (21 milk + 3 water) = 25%.

CHAPTER 10: LCM AND HCF

- **HCF of fraction =** $\frac{HCF\ of\ Numerator}{\quad}$
- **LCM of fraction =** $\frac{LCM\ of\ Numerator}{\quad}$
- **LCM * HCF = Product of two numbers**

- The least number which when divided by a, b and c leaves a remainder R in each case. Required number = **(LCM of a, b, c) + R**
- The greatest number which divides a, b and c to leave the remainder R is = **HCF of (a – R), (b – R) and (c – R)**
- The greatest number which divides x, y, z to leave remainders a, b, c is = **HCF of (x – a), (y – b) and (z – c)**

Q. What is the greatest length x such that 3_m and 8_m are integral multiples of x? (2020)

(a) $1\frac{1}{2}$m (b) $1\frac{1}{3}$m (c) $1\frac{1}{4}$m (d) $1\frac{3}{4}$m

Ans. (d)

Solution: $3\frac{1}{2} = \frac{7}{2}$ and $8\frac{3}{4} = \frac{35}{4}$ -> x = H.C.F. of (7/2) and (35/4) = $\frac{...}{...}$ $\frac{7}{2}$ $\frac{35}{4}$ = $\frac{7}{4}$ --> Hence, = 7/4 m or $1\frac{3}{4}$ m

CHAPTER 11: PERMUTATION AND COMBINATION & FACTORIALS

- **n! = 1 * 2 * 3 * 4 * ……. n**
- **n! = n * (n - 1)!** **0! = 1,** **1! = 1**
- **Permutation** $^nP_r = \frac{n!}{(n-r)!}$
- **Combination** $^nC_r = \frac{n!}{r!(n-r)!}$
- $^nC_r = {}^nC_{n-r}$
- $^nC_0 + {}^nC_1 + {}^nC_2 + ... + {}^nC_n = 2^n$

- Total number of Handshakes possible among total n people = $^nC_2$
- Total number of Triangles that can be formed by joining sides of polygon of n sides = $^nC_3$
- Total number of diagonals of a polygon of n sides = $\frac{n*(n-3)}{}$
- Total number of circular permutations if clockwise and anti-clockwise are taken as different= **(n-1)!**

Q. In a tournament of Chess having 150 entrants, a player is eliminated whenever he loses a match. It is given that no match results in a tie/draw. How many matches are played in the entire tournament?

(a) 151 (b) 150 (c) 149 (d) 148

Ans. (c)

Solution: The tournament starts with 150 players.

After the first round (in which 75 matches are held): 75 players are eliminated, and 75 remain.
After the second round (in which 37 matches are held): 37 players are eliminated, and 38 remain.
After the third round (in which 19 matches are held): 19 players are eliminated, and 19 remain.
After the fourth round (in which 9 matches are held): 9 players are eliminated, and 10 remain.
After the fifth round (in which 5 matches are held): 5 players are eliminated, and 5 remain.
After the sixth round (in which 2 matches are held): 2 players are eliminated, and 3 remain.
After the seventh round (in which 1 match is held): 1 player is eliminated, and 2 remain.
After the eighth round (in which 1 match is held): 1 player is eliminated, and 1 remains.
So, total number of matches = 75 + 37 + 19 + 9 + 5 + 2 + 1 + 1 = 149.

CHAPTER 12: PROBABILITY

- **Random Experiment – An experiment whose result cannot be predicted e.g., Dice, coin etc**
- **Probability of an event always lies between 0 and 1.**
- **P (Not A) = 1 – P(A)**
- **Probability of an event**
  = ______________________

- **Odds in favour of event**
  = ______________________
- **Odds against an event**
  = ______________________

Q. A bag contains 15 red balls and 20 black balls. Each ball is numbered either 1 or 2 or 3. 20% of the red balls are numbered 1 and 40% of them are numbered 3. Similarly, among the black balls, 45% are numbered 2 and 30% are numbered 3. A boy picks a ball at random. He wins if the ball is red and numbered 3 or if it is black and numbered 1 or 2. What are the chances of his winning? (2018)

(a) 1/ 2 (b) 4/7 (c) 5/9 (d) 12/13

Ans. (b)

Solution: Total red balls = 15 and Total black balls = 20

Red Ball

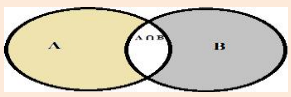
Probability of picking a random ball is Red = 15/ 35
Probability of picking Red and Number 3 = 15/35*40/100 ……. Eq 1
(As 40% red balls are Number 3)

Black Ball

Probability of picking a random ball is Black= 20/35
Black and Number 1 = 20/35*25/100…………………Eq 2
(As Black Number 1 balls = 100% - Black Number 2 balls – Black Number 3 balls = 100% - 45% - 30% = 25%)
Black and Number 2 = 20/35*45/100……………………. Eq 3
(As 45% black balls are Number 2)
Total probability = Eq 1 + Eq 2 + Eq 3 = 4/7 Hence, the correct answer is (b).

CHAPTER 13: VENN DIAGRAM

- **n(A ∪ B) = n(a) + n (B) – n(A ∩ B)**
- **n(A ∪ B ∪ C) = n(a) + n(B) + n(c) – n(A ∩ B) – n(B ∩ C) – n(A ∩ C) + n(A ∩ B ∩ C)**



Q. In a group of 120 persons, 80 are Indians and the rest are foreigners. Furthermore, 70 persons in the group can speak English. The number of Indians who can speak English is: (2021)

(a) 20 (b) 30 (c) 30 or less (d) 30 or more

Ans. (d)

Solution: Out of 120 persons, 80 are Indians and 40 are foreigners.

Out of 120 persons, 70 can speak English, and the rest cannot.

The maximum possible number of Indians who can speak English is 70, i.e., if all the English-speaking people are Indians.
The minimum possible number of Indians who can speak English is 30, i.e., if all the foreigners speak English.
So, English-speaking Indians will fall in the range of **30 to 70**. Hence, the correct answer is (d).

CHAPTER 14: IMPORTANT SERIES SUM

- **Sum of first n Natural numbers =** $\frac{n(n+1)}{\ }$
- **Sum of first n odd numbers =** n^2
- **Sum of first n Even numbers = n (n+1)**
- **Sum of squares of first n Natural numbers =** $\frac{(\ +\ )(\ \ +\ )}{\ }$
- **Sum of cubes of first n Natural numbers =** $[\frac{n(n+1)}{\ }]^2$

Q. What is the value of X in the sequence 20, 10, 10, 15, 30, 75, X? (2022)

(a) 105 (b) 120 (c) 150 (d) 225

Ans. (d)

Solution: The given series is: 20, 10, 10, 15, 30, 75, X?

The terms are decreasing in the initial half, and then they start increasing. The speed at which they increase at the latter half suggests that multiplication may be involved.

The pattern is as follows:

20 × 0.5 = 10 10 × 1 = 10
10 × 1.5 = 15 15 × 2 = 30
30 × 2.5 = 75 75 × 3 = 225 Hence, the correct answer is (d).

CHAPTER 15: RATIOS AND PROPORTIONS

If $\frac{\ }{\ } = \frac{\ }{\ }$ then,

- ✓ **As per Invertendo law,** $\frac{b}{\ } = \frac{d}{\ }$
- ✓ **As per Alternendo law,** $\frac{a}{\ } = \frac{b}{\ }$
- ✓ **As per Componendo law,** $\frac{a+b}{\ } = \frac{c+d}{\ }$
- ✓ **As per Dividendo law,** $\frac{a-b}{\ } = \frac{c-d}{\ }$
- ✓ **As per Componendo and Dividendo,** $\frac{a+b}{a-b} = \frac{c+d}{c-d}$

- **For a proper fraction** $\frac{a}{\ }$

  i.e., a <b, then for a positive quantity c, then

  ✓ $\frac{a+c}{b+c} > \frac{a}{b}$ **and** $\frac{a-c}{b-c} < \frac{a}{b}$

- **For improper fraction** $\frac{a}{\ }$

  i.e., a >b, then for a positive quantity c, then

  ✓ $\frac{a+c}{b+c} < \frac{a}{b}$ **and** $\frac{a-c}{b-c} > \frac{a}{b}$

CHAPTER 16: SURDS AND INDICES

- $x^0 = 1$
- $x^a * x^b = x^{a+b}$
- $\frac{x}{\ } = x^{a-b}$
- $x^{-a} = \frac{1}{\ }$
- $^a\sqrt{x} = (x)^{\overline{a}}$
- $(x)^{\overline{b}} = {}^b\sqrt{x^a}$
- $(x^a)^b = x^{ab}$
- $x^a y^a = (xy)^a$
- $\sqrt{a} * \sqrt{b} = \sqrt{ab}$

CHAPTER 17: CALENDAR

- **Normal Year – 365 days or 52 weeks and 1 day**
- **Leap Year – 366 days or 52 weeks and 2 days**
- **Century Leap Year – If century year is divisible by 400. e.g., 2000 is leap year, but 1900 is not.**
- **Leap Years in 400-year time period - 97**
- **Leap Years in 100-year time period – 24 or 25 depending on whether 100-year end is in century leap year or not**

Q. Which date of June 2099 among the following is Sunday? (2022)

(a) 4 (b) 5 (c) 6 (d) 7

Ans. (d)

Solution: It can be inferred that 1st January, 2001 was a Monday.

(Just like 1st January, 1601, or 1st January, 1201, i.e. every 400 years).

In 100 years from 1st January, 2001 to 31st December, 2100, there will be 24 leap years (as 2100 is not a leap year).

So, the number of odd days from 1st January, 2001 to 31st December, 2100 = (24 × 2) + 76 = 48 + 76 = 124 = 5 odd days.

(every leap year has 2 odd days, and every non-leap year has 1 odd day)

So, the day on 1st January, 2101 must be Monday + 5 = Saturday.

So, the day on 1st January, 2100 must be Saturday – 1 = Friday (there is 1 odd day in any non-leap year) So, the day on 1st January, 2099 must be Friday – 1 = Thursday (there is 1 odd day in any non-leap year)

The number of odd days in the year 2099 are: January – 3; February – 0; March – 3; April – 2; May – 3;

So, the number of odd days from 1st January, 2099 to 31st May, 2099 = 3 + 0 + 3 + 2 + 3 = 11 = 4 So, the day on 1st June, 2099 must be Thursday + 4 = Monday. So, the first Sunday in the month of June, 2099 will fall on 7.

CHAPTER 18: CLOCK

- **Degrees covered by Minute hand in 1 min = 6°**
- **Degrees covered by Second hand in 1 second = 6°**
- **Degrees covered by Hour hand in 1 min = ½°**
- **Angle between Hour and Minute Hand at a particular time =** $\frac{60*Hour-11*Minute}{\quad}$

Q. A man started from home at 14:30 hours and drove to the village, arriving there when the village clock indicated 15:15 hours. After staying for 25 minutes, he drove back by a different route of length 1.25 times the first route at a rate twice as fast, reaching home at 16:00 hours. As compared to the clock at home, the village clock is (2022)

(a) 10 minutes slow (b) 5 minutes slow (c) 10 minutes fast (d) 5 minutes fast

Ans. (d)

Solution: Total time taken by the man to come back home = 16 – 14.5 = 1.5 hours = 90 minutes
Out of which he stayed in the village for 25 minutes.
So, his total travelling time = 90 – 25 = 65 minutes
The return route was 1.25 times the initial route. So, time taken must have increased by 25% too. So, if the initial time was 100 units, now it must be 125 units. But it is also given that while returning he drove twice as fast. So, time taken must have been halved. So, time taken while returning back = 125/2 = 62.5 units
So, 100 + 62.5 = 65 minutes or 162.5 units = 65 minutes
So, 100 units = (65/162.5) × 100 = 40 minutes -> So, the man took 40 minutes to reach the village.
So, the actual time at that moment = 14:30 + 40 minutes = 15:10 hours It's pretty evident that the village clock is 15:15 – 15:10 = 5 minutes fast. Hence, the correct answer is (d).

CHAPTER 19: TIME AND WORK

- **Days required to complete work =** $\frac{1}{\quad}$
- **Efficiency α** ______

- If M1 persons can do W1 work in D1 days working T1 hours each day with E1 efficiency and M2 persons can do W2 work in D2 days working T2 hours each day with E2 efficiency,

  then, ______ = ______

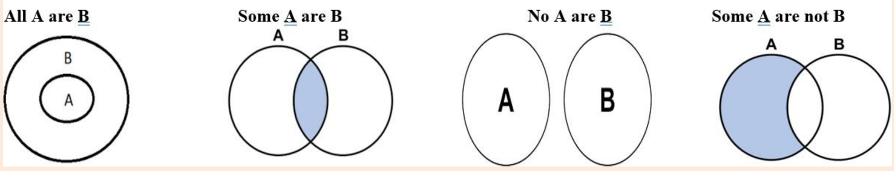
Q. 24 men and 12 women can do a piece of work in 30 days. In how many days can 12 men and 24 women do the same piece of work? (2022)

(a) 30 days (b) more than 30 days
(c) Less than 30 days or more than 30 days (d) Data is inadequate to draw any conclusion

Ans. (d)

Solution: Since the comparative efficiencies of men and women are not known, we cannot determine the time taken by 12 men and 24 women to complete the given work. Hence, the data is inadequate to draw any conclusion.

CHAPTER 20: SYLLOGISM



Q. Two Statements followed by four Conclusions are given below. You have to take the Statements to be true even if they seem to be at variance from the commonly known facts. Read all the Conclusions and then decide which of the given Conclusions logically follows follow from the Statements, disregarding the commonly known facts:

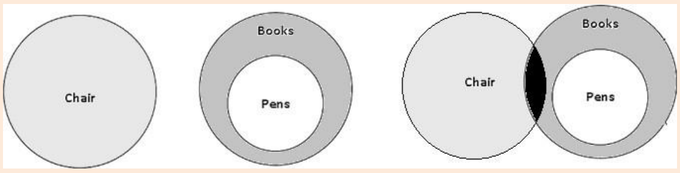
Statement-1: All pens are books. **Statement-2:** No chair is a pen.
Conclusion-I: All chairs are books. **Conclusion-II:** Some chairs are pens.
Conclusion-III: All books are chairs. **Conclusion-IV:** No chair is a book.

Which one of the following is correct? (2022)

(a) Only Conclusion-1 (b) Only Conclusion-11
(c) Both Conclusion-III and Conclusion-IV (d) None of the Conclusion follows

Ans. (d)

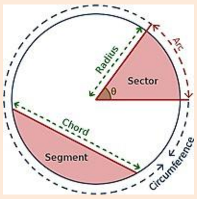
Solution: We can draw the following possible Venn diagrams based on the given two statements:



Hence, the correct answer is (d).

CHAPTER 21: MENSURATION

Circle



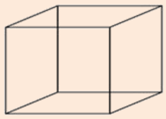
Radius = r= $\frac{}{2}$

Circumference = 2 * π * r

Area = π * r^2

Area of Arc= $\frac{\theta}{360}$ * π * r^2

Cube



All sides are of length a

Volume of cube = a^3

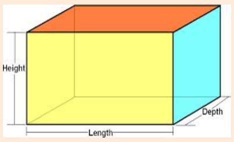
Length of Diagonal = $\sqrt{3}$ a

Lateral surface area = Perimeter of Base * Height = $4a^2$

Total surface area = Lateral Surface Area + 2 Base Area = $6a^2$

Open area =Lateral Surface Area + Base Area = $5a^2$

Cuboid



Base of Cuboid is a rectangle.

Length =l, Breadth = b, Height =h,

Volume = l*b*h

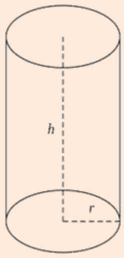
Length of Diagonal = $\sqrt{l^2 + b^2 + h^2}$

Lateral Surface Area = 2(l+b) *h

Open area = 2(l+b) *h + l*b

Total Surface Area = 2(l + b) *h + l*b = 2(lb + bh + lh).

Cylinder



Volume = π * r^2 * h

Curved Surface Area = 2 * π * r * h

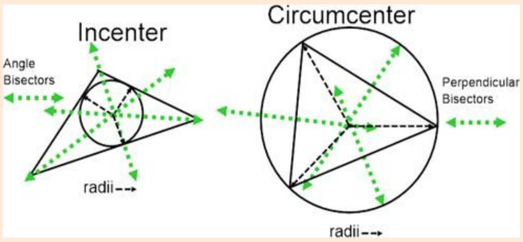
Total Surface Area

= Curved Surface Area + 2 Base Area

= 2 * π * r * h + 2 * π * r^2 = 2 * π * r (h + r)

CHAPTER 22: GEOMETRY

- ✓ Inradius of triangle = $\frac{Area}{Semi-Perimeter}$
- ✓ Circumradius = $\frac{a*b*c}{4*Area}$, where a, b and c are three sides of triangle
- ✓ In a right-angle triangle, circumradius is equal to half of Hypocentre.
- ✓ Area of Triangle= $\frac{1}{2}$ * base * height
- ✓ Area of Triangle = $\frac{1}{2}$ab sinQ where Q is angle between a and b
- ✓ Are of equilateral triangle = $\sqrt{\frac{3a^2}{4}}$, where a is side of triangle



Triangle and its properties:

- ✓ Sum of three angles of triangle = 180°
- ✓ Sum of two sides is always greater than third side.
- ✓ Difference of two sides is always less than third side.
- ✓ Sum of interior angles = 180°
- ✓ Exterior angle is always equal to sum of two opposite angles.
- ✓ Sum of exterior angles = 360°
- ✓ Perimeter of triangle = Sum of sides
- ✓ Semi - perimeter, s = $\frac{1}{2}$ of perimeter
- ✓ Area of triangle using Heron's Formula = $\sqrt{(s)(s-a)(s-b)(s-c)}$

Important Pythagorean Triplets:

Numbers that follow $P^2 + B^2 = H^2$

3,4,5

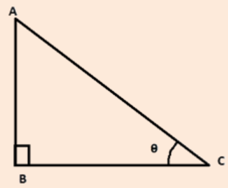
6, 8, 10

7, 24, 25

5, 12, 13

9, 40, 41

20, 21, 29



Quadrilateral

Total number of sides =4

Sum of interior angles = 360°

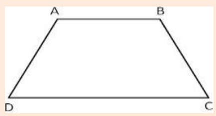
5 major types of Quadrilaterals:

1. Trapezium 2. Parallelogram

3.Rectangle 4. Square

5.Rhombus

I. Trapezium



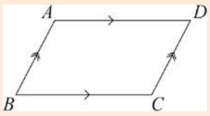
Two sides are parallel and other two sides are non-parallel.

Perimeter = a + b + c + d

Area = ½* sum of parallel sides * distance between parallel sides

=½ * (a+b) * h

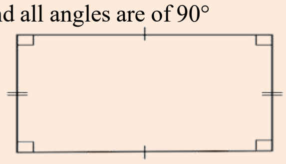
II. Parallelogram



Opposite sides are equal and parallel.
Opposite angles are equal.
Perimeter= 2(a+b)
Area = ½ * product of diagonals* sinQ,
Here Q is angle between the diagonals.
(D1)2 + (D2)2 = 2 (a2+ b2)
Where D1 = Diagonal 1 and D2 = Diagonal 2
a = length of one side
b = length of other unequal side

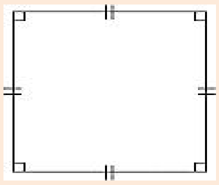
III. Rectangle

Opposite sides are equal, parallel and all angles are of 90°
Perimeter = 2(l+b)
Area = l*b



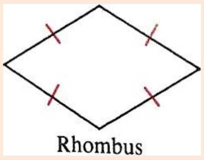
Diagonal = $\sqrt{l^2 + b^2}$
Diagonals are equal.
Where l= Length and b = Breadth of rectangle

IV. Square



All sides are equal.
All angles are of 90°
Perimeter = 4a
Diagonal = $\sqrt{2}$ a
Area = a^2

V. Rhombus



All sides are equal.
Opposite angles are equal.
Perimeter = 4a
Area = ½ * product of diagonals
(As angles intersect at 90°, so sin Q =1)
Here Q is angle between the diagonals.

CHAPTER 23: SQUARES & CUBES

Number	Square
1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81
10	100

Number	Square
11	121
12	144
13	169
14	196
15	225
16	256
17	289
18	324
19	361
20	400

Number	Square
21	441
22	484
23	529
24	576
25	625
26	676
27	729
28	784
29	841
30	900

Number	Cube
1	1
2	8
3	27
4	64
5	125
6	216
7	343
8	512
9	729
10	1000

CHAPTER 24: CODING DECODING

1	2	3	4	5	6	7	8	9	10	11	12	13
A	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**
Z	**Y**	**X**	**W**	**V**	**U**	**T**	**S**	**R**	**Q**	**P**	**O**	**N**
26	25	24	23	22	21	20	19	18	17	16	15	14

Trick to remember codes:

Remember word -> "EJOTY"

where, E = 5 J = 10 O = 15 T = 20 Y = 25

CHAPTER 25: QUADRATIC EQUATIONS

For Quadratic equation of second order => $ax^2 + bx + c = 0$,
where a, b, and c are coefficients of real numbers and $a \neq 0$

Roots => $\frac{-b\pm\sqrt{b^2-4ac}}{}$

Sum of the roots = -b/a

Product of the roots = c/a

The discriminant (D) of the quadratic equation $ax^2 + bx + c = 0$ is: D = b2 – 4ac

The roots are:

1. Real and Unequal: If D > 0
2. Real and Equal: If D = 0
3. Imaginary: If D < 0

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