IPM-AT Indore 2021
Quantitative Ability

Short Answer (SA)

IPM AT INDORE 2021 (QA)

SA-9 THE NO. OF POSITIVE INTEGERS THAT DIVIDE 1890 × 170 × 130 AND ARE NOT DIVISIBLE BY 45.

SOLN. FIRST FIND TOTAL NO. OF FACTORS OF 1890 × 170 × 130

$\Rightarrow N = 1890 \times 170 \times 130$

$= 2^3 \times 3^3 \times 5^3 \times 7 \times 13 \times 17$

It's total no. of factors $= (3+1)(3+1)(3+1)(1+1)(1+1)(1+1)$

$= 4 \times 4 \times 4 \times 2 \times 2 \times 2$

$= 512.$

Now, finding its factors which are divisible by 45 or which are multiples of 45.

Writing N as $3^2 \times 5 \times \underbrace{(2^3 \times 3 \times 5^2 \times 7 \times 13 \times 17)}$

$45 \times \underbrace{(2^3 \times 3 \times 5^2 \times 7 \times 13 \times 17)}$,

finding the factors of this part of N.

$(3+1)(1+1)(2+1)(1+1)(1+1)(1+1)$

$4 \times 2 \times 3 \times 2 \times 2 \times 2$

$= 192$

So. Ans. $512 - 192$

$= 320.$

$\boxed{\text{Ans. } 320.}$

Note: All these Q's are memory based, shared by our students soon after the IPM AT 2021 exam. Language or data used in these Qs can be in variation with the language or data used in actual IPM AT Indore 2021 exam.

IPMAT INDORE 2021 QA

SA-02 IF A FUNCTION $f(a) = \max\{a, 0\}$, then the smallest INTEGER VALUE OF X FOR WHICH THE EQUATION $f(x-3) + 2f(x+1) = 8$ holds true is:

SOLN. ITS CLEAR THAT $\Rightarrow$ IF A is $-$ve VALUE THE VALUE OF FUNCTION $= 0$

$\Rightarrow$ IF A is $+$ve VALUE THE VALUE OF FUNCTION $=$ A.

SO CHECKING FOR.

$x = 0 \quad f(-3) + 2f(1) = 0 + 2\times1 = 2 \neq 8.$

$x = 1 \quad f(-2) + 2f(2) = 0 + 2\times2 = 4 \neq 8$

$x = 2 \quad f(-1) + 2f(3) = 0 + 2\times3 = 6 \neq 8$

$x = 3 \quad f(0) + 2f(4) = 0 + 2\times4 = \boxed{8}$

Ans is $\boxed{x = 3}$.

SA-03. THE SUM UP TO 10 TERMS OF THE SERIES $1.3 + 5.7 + 9.11 + \ldots$ is:

SOLN. SERIES is THE PRODUCT OF TWO APS.

AP 1: $1, 5, 9, 13 \ldots$

its general term $a_{n_1} = 1 + (n-1)4 = 4n - 3.$

AP 2: $3, 7, 11, 15 \ldots$

its general term $a_{n_2} = 3 + (n-1)4 = 4n - 1.$

Means, General term of given series will be

$(4n-3)(4n-1) = 16n^2 - 16n + 3$

$\Sigma(16n^2 - 16n + 3) = 16\Sigma n^2 - 16\Sigma n + 3n.$

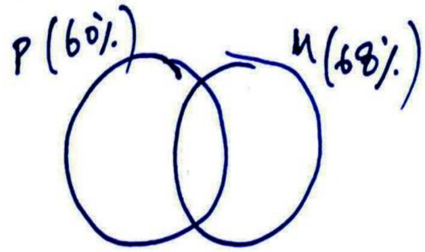
$16\left(\frac{n(n+1)(2n+1)}{6}\right) - 16.\frac{n(n+1)}{2} + 3n.$

put $n = 10$, we get sum as 5310. $\boxed{\text{Ans. } 5310}$

IPMAT INDORE 2021 ~~QA~~ :

SA-04. IN A CLASS, 60% AND 68% OF STUDENTS PASSED THEIR PHYSICS & MATHS EXAMS RESPECTIVELY, THEN AT LEAST WHAT % OF THE STUDENTS PASSED BOTH THEIR PHYSICS AND MATHS EXAMS?

SOLN.



$n(A \cup B) = n(A) + n(B) - n(A \cap B)$

$n(A \cap B) = n(A) + n(B) - n(A \cup B)$

or, n[passed in both P & M] = n[passed in Math] + n[passed in Physics] − n[passed in atleast one of the subjects]

= 68% + 60% − n(P or M)

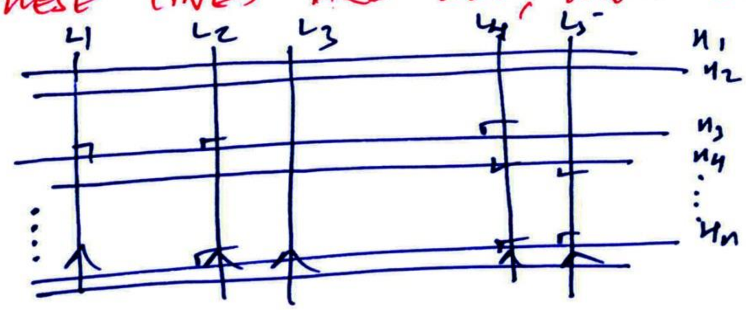
In order to minimize our L.H.S. (as Q. asks), we need to maximize the VALUE OF −VE TERM, WHICH CAN BE 100%.

∴ [n(passed in both)] = 68% + 60% − 100%

= 28%. Ans. $\boxed{28\%}$

MINIMUM.

SA-05 THERE ARE 5 PARALLEL LINES ON A PLANE. ON THE SAME PLANE, THERE ARE n OTHER LINES WHICH ARE PERPENDICULAR TO THE 5 PARALLEL LINES. IF THE NUMBER OF DISTINCT RECTANGLES FORMED BY ALL THESE LINES ARE 360, THEN THE VALUE OF n IS :



$$\text{No. of Rectangles} = {}^5C_2 \times {}^nC_2 = 360$$

$$= 10 \times \frac{n!}{(n-2)! \times 2!} = 360$$

$$= \frac{n(n-1)\cancel{(n-2)!}}{\cancel{(n-2)!}\,2} = 36.$$

$$\Rightarrow n(n-1) = 72$$

Solving, $n = 9$. $\boxed{\text{Ans. } 9}$

SA-06. WHAT IS THE MINIMUM NUMBER OF WEIGHTS WHICH ~~ARE~~ ENABLES US TO WEIGHT ANY INTEGER NUMBER OF GRAM OF GOLD FROM 1 to 100 ON A STANDARD BALANCE WITH TWO PANS (WEIGHTS CAN BE PLACED ONLY ON THE LEFT PAN). ?

Soln. MINIMUM 7 WEIGHTS WILL BE REQUIRED.

using the Rule, $2^n \leq 100$, where $n = 0, 1, 2 \ldots$

∴ 1st weight $2^0 = 1$ gm, 2nd weight $2^1 = 2$ gm, 3rd weight $2^2 = 4$ gm, 4th weight $2^3 = 8$ gm, 5th weight $2^4 = 16$ gm, 6th weight $2^5 = 32$ gm, 7th weight $2^6 = 64$ gm.

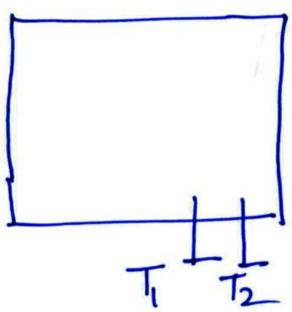
ANY integer NUMBER OF GRAM OF GOLD CAN BE WEIGHED USING DIFFERENT COMBINATION OF THESE 7 WEIGHTS ONLY.

$\boxed{\text{Ans. } 7}$

IPMAT INDORE 2024 QA

SA-7 THERE ARE TWO TAPS T_1 AND T_2, AT THE BOTTOM OF A WATER TANK, EITHER OR BOTH OF WHICH MAY BE OPENED TO EMPTY THE WATER TANK, EACH AT A CONSTANT RATE. IF T_1 IS OPENED KEEPING T_2 CLOSED, THE WATER TANK (INITIALLY FULL) BECOMES EMPTY IN HALF AN HOUR. IF BOTH T_1 & T_2 ARE KEPT OPEN, THE WATER TANK (INITIALLY FULL) ~~IT TAKES FOR THE~~ BECOMES EMPTY IN 20 MIN. THEN THE TIME (IN MINUTES) IT TAKES FOR WATER TANK (initiall full) to BECOME EMPTY, IF T_2 IS OPEN WHILE T_1 IS CLOSED IS :

SOLN.



$T_1 \Rightarrow 30$ min

$T_1 + T_2 \Rightarrow 20$ min

LCM = 60 min (ASSUME IT TO BE THE WORK / CAPACITY OF THE TANK)

RATE

-2 LPM

-3 LPM.

Rate of T_1 + Rate of T_2 = Net Rate of emptying.

$-2\,LPM + x = -3\,LPM.$

$x = -1\,LPM$ (−ve sign indicates emptying rate)

So time reqd. by T_2 to empty the tank $= \frac{60}{1} = 60$ min.

$\boxed{\text{Ans. 60 min}}$

$\left[\because \text{time} = \frac{\text{WORK}}{\text{RATE}}\right]$

IPMAT INDORE 2021 QA.

SA-8 IT IS GIVEN THAT THE SEQUENCE $\{x_n\}$ SATISFIES $x_1 = 0$, $x_{n+1} = x_n + 1 + 2\sqrt{1+x_n}$ FOR $n = 1, 2, \ldots$
THEN x_{31} IS:

SOLN. $x_1 = 0$

put $n=1$, $x_2 = x_1 + 1 + 2\sqrt{1+x_1} = 0+1+2\sqrt{1+0} = 3 = 2^2-1$

put $n=2$, $x_3 = x_2 + 1 + 2\sqrt{1+x_2} = 3+1+2\sqrt{1+3} = 8 = 3^2-1$

put $n=3$, $x_4 = x_3 + 1 + 2\sqrt{1+x_3} = 8+1+2\sqrt{1+8} = 15 = 4^2-1$

$\vdots$

$x_{31} = 31^2 - 1 = 961 - 1 = 960$ $\boxed{\text{Ans. } 960}$

Ans. 960.

SA-09. IF ONE OF THE LINES GIVEN BY THE EQUATION $2x^2 + axy + 3y^2 = 0$ COINCIDES WITH ONE OF THOSE GIVEN BY $2x^2 + bxy - 3y^2 = 0$ AND THE OTHER LINES REPRESENTED BY THEM ARE PERPENDICULAR, THEN $a^2 + b^2$ IS:

SOLN. Let $2x^2 + axy + 3y^2 = (y - mx)(y - m'x) = y^2 + (-m-m')xy + mm'x^2$

$2x^2 + bxy - 3y^2 = (y + \frac{1}{m}x)(y - m'x) = y^2 + (\frac{1}{m} - m')xy - \frac{m'}{m}x^2$

Comparing the coefficient of like terms, we get

$\left(\frac{2}{3}\right)x^2 + \left(\frac{a}{3}\right)xy + y^2 = mm'x^2 + (-m-m')xy + y^2$

$\left(\frac{2}{-3}\right)x^2 + \left(\frac{b}{-3}\right)xy + y^2 = -\frac{m'}{m}x^2 + \left(\frac{1}{m} - m'\right)xy + y^2$

Solving we get $m = \pm 1$, $m' = \pm\frac{2}{3}$

$$\begin{cases} mm' = \frac{2}{3} & -m-m' = \frac{a}{3} \\ -\frac{m'}{m} = \frac{2}{-3} & \frac{1}{m} - m' = \frac{b}{-3} \end{cases}$$

$\therefore$ put $m = 1$ & $m' = \frac{2}{3} \Rightarrow a = -5$

& put $m = -1$ & $m' = -\frac{2}{3} \Rightarrow b = 1$

So $a^2 + b^2 = 25 + 1 = 26$. $\boxed{\text{Ans. } 26}$

IPMAT INDORE 2024 QA:

SA-10. IN A CLASS CONSISTING OF 20 STUDENTS, EACH STUDENT REGISTERED FOR 5 COURSES AND EACH COURSE INSTRUCTOR CONDUCTS AN EXAM OF 200 MARKS FOR EACH STUDENT. AVERAGE PERCENTAGE MARKS OF THE STUDENT ACROSS THE REGISTERED COURSES IS 80%. HOWEVER, 2 STUDENTS APPLY FOR REVALUATION AND THE MARKS OF NONE OF THEM ARE REDUCED AND THE AVERAGE PERCENTAGE MARKS OF ALL THE STUDENTS BECOME 80.02%. AFTER REVALUATION. THEN THE MAXIMUM POSSIBLE INCREASE IN THE MARKS OF ANY ONE OF THOSE STUDENT IS ?

SOLN.

TOTAL MARKS = 200 × 5 = 1000

AVERAGE MARKS (BEFORE REVAL.) = 800

AVERAGE MARKS (AFTER REVAL.) = 80.2

CHANGE IN AVERAGE = 0.2

WE KNOW, CHANGE IN AVG. = $\frac{\text{NET ADDITION OF MARKS}}{\text{NO. OF STUDENTS}}$

$$0.2 = \frac{\text{Net Addition of marks.}}{30}$$

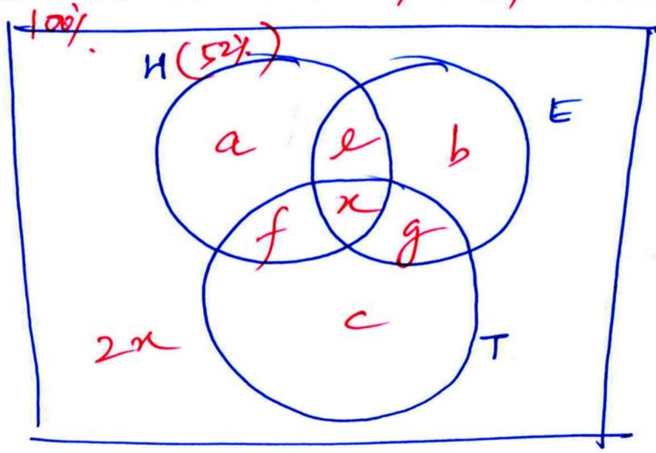
$$6 = a+b$$

So the maximum value of a or b can be 6. When other is zero. $\boxed{\text{Ans } 6}$

IPMAT INDORE 2021 QA

MCQ-01 50% OF THE PEOPLE SPEAK EXACTLY ONE LANGUAGE OF HINDI, ENGLISH AND TELUGU. 40% PEOPLE SPEAK ATLEAST 2 OF THEM. MOREOVER, THE NUMBER OF PEOPLE WHO DO NOT SPEAK ANY LANGUAGE IS TWICE THE NO. OF PEOPLE WHO SPEAK ALL THREE. IF 52% PEOPLE SPEAK HINDI AND 25% PEOPLE SPEAK ONLY ONE OF TELUGU OR ENGLISH, THEN FIND THE NO. OF PEOPLE WHO SPEAK HINDI AND EXACTLY ONE OTHER LANGUAGE.

SOLN.



Given

$a+b+c = 50\%$ — ①

$e+f+g+x = 40\%$ — ②

Adding two eqn.

$a+b+c+e+f+g+x = 90\%$

$\therefore 2x = 100\% - 90\%$

$2x = 10\%$

$x = 5\%$

Also given $b+c = 25\%$

FROM DIAGRAM $b+g+c = 90\% - [52\%]$

$= 38\%$

$\therefore g = 38\% - 25\% = 13\%$

Now put the value of g & x in eqn ②

$e+f+g+x = 40\%$

$e+f+13\%+5\% = 40\%$

$e+f = 40\% - 18\% = 22\%$

No. of people who speak HINDI AND EXACTLY ONE OTHER LANGUAGE

$= e+f$

$= 22\%$

ANS. 22%

IPM-AT INDORE 2024 (QA)

MCQ-02

In an AP $S_5 = S_9$, where S_n is sum of n terms. Find the ratio of third term and fifth term of the series.

Soln. Given $S_5 = S_9$

$$\frac{5}{2}[2a+4d] = \frac{9}{2}[2a+8d]$$

$$\cancel{\frac{5}{2}}\times 2[a+2d] = \cancel{\frac{9}{2}}\times 2[a+4d]$$

$$\frac{a+2d}{a+4d} = \frac{9}{5} = \frac{a_3}{a_5}$$

Ans $a_3 : a_5 = 9:5$ $\boxed{\text{Ans } 9:5}$

MCQ-03

In a triangle the angles A, B & C are in AP. If $\sin(2A+B) = 1/2$. Find $\sin(B+2C)$.

Soln. let the angle A, B & C be $a-d, a, a+d$.

$$a-d+a+a+2d = 180^\circ$$

$$3a = 180^\circ \quad | \quad a = 60^\circ$$

Given $\sin(2A+B) = \frac{1}{2}$

$\therefore 2A+B = 30^\circ$ or 150°

$2(a-d)+a = 30^\circ$

$3a-2d = 30^\circ$

$3\times 60^\circ - 2d = 30^\circ$

$d = 75^\circ$ | Angle A will become -ve. Not possible

or $2A+B = 150^\circ$

$3a-2d = 150^\circ$

$2d = 30^\circ$

$d = 15^\circ$

$A = 45^\circ, B = 60^\circ, C = 75^\circ$

$\therefore \sin(B+2C) = \sin(60+150)$

$\sin 210 = \sin(180+30) = -\sin 30 = -1/2$

$\boxed{\text{Ans. } -1/2}$

18 MAY INDORE 2021 QA:

MCQ-104. A TRAIN LEAVES A POINT AT 12PM. TWO HOURS LATER ANOTHER TRAIN LEAVES AND CROSSES THE FIRST TRAIN at 8pm. THE SUM OF SPEED WAS 140 KMPH. WHAT TIME WILL THE SECOND TRAIN CROSS THE FIRST. IF IT LEAVES 5 HRS LATER FROM STARTING POINT.

Soln:

AT 2PM

Start point ← '2a' km → T_1 → 'a' kmph.

T_2 → 'b' km/h

let the speed of train first & train second be 'a' & 'b' kmph

after 2pm, both train will meet after $= \dfrac{2a}{b-a} = 6$ hrs.

(∵ from 2pm–8pm, it is 6 hrs)

$\Rightarrow 2a = 6b - 6a$

$8a = 6b$

$\boxed{b : a = 4 : 3}$

Given $a + b = 140$ kmph.

$3x + 4x = 140$.

$7x = 140$ / $x = 20$.

$b = 80$ km/h.

$a = 60$ km/h.

Now, AT 5PM

← $60 \times 5 = 300$ km → T_1 → (60) km/h

T_2 → (80) km/h.

Time taken by train 2 to meet / cross 1st train after 5pm $= \dfrac{300}{80-60} = \dfrac{300}{20} = 15$ HR.

means @ 8AM NEXT DAY.

$\boxed{\text{Ans } 8\text{AM}}$

IPMAT INDORE 2024 QA

MCQ 05 FIND THE UNIT DIGIT OF

$$283^{85} - 325^{21} + 317^{96}$$

SOLN: USING CONCEPT OF CYCLICITY | POWER CYCLE,

UNIT DIGIT OF $(283^{85}) = (3)^{85}$

Divide 85 by cyclicity of 3 i.e. 4.

Remainder = 1.

$\therefore = (3)^1 = 3$

Similarly UNIT DIGIT OF $(325)^{21} = 5$.

& UNIT DIGIT OF $(317)^{96} = (7)^{96} = (7)^4$

$= 1$.

Then putting these unit digit in operations, we get

$283^{85} - 325^{21} + 317^{96} = \underline{\boxed{3}} - \underline{\boxed{5}} + \underline{\boxed{1}}$

Add. then 2.

$= \underline{\boxed{4}} - \underline{\boxed{5}}$.

large no. small no.

$\therefore 14 - 5 = \boxed{9}$

Ans. 9.

IPMAT INDORE 2021 — QA

MCQ 06 FIND THE X-intercept OF EQN. WHICH PASSES THROUGH INTERSECTION OF $2x+y=4$ AND $x+y=2$ AND IS PERPENDICULAR TO $x-3y=4$.

SOLN. First find the point of intersection coordinates.

Solve
$$2x+y=4$$
$$x+y=2$$
$(x=2, y=0)$. It means our line passes through point $(2,0)$.

Our line is also perpendicular to
$$x-3y=4$$

Any line ⊥r. to $x-3y-4=0$ will be in the form $3x+y+\lambda=0$ (where, λ → constant)

As this line passes through $(2,0)$ this point should satisfy the eqn.

put $x=2$ & $y=0$, we get $\lambda=-6$.

$\therefore$ Eqn. of our line ⇒ $3x+y-6=0$.
$$3x+y=6$$

Transforming it into intercept form, we get
$$\frac{x}{2}+\frac{y}{6}=1.$$

x → intercept $= 2$. $\boxed{\text{Ans 2.}}$

IPMAT INDORE 2021 QA

MCQ 07 IF $\log_2\log_3\log_4 a = \log_2\log_4\log_2 b = \log_2\log_2\log_3 c = 0$.

FIND $a+b+c = ?$

SOLN.

Take $\log_2\log_3\log_4 a = 0$

$\log_3\log_4 a = 1 \quad (\because \log_2 1 = 0)$

$\log_4 a = 3 \quad (\because \log_3 3 = 1)$

Converting it into exponential form, we get

$a = 4^3 = 64$.

Similarly $b = 2^4 = 16$

& $c = 3^2 = 9$

$\therefore a+b+c = 64+16+9 = 89$ $\boxed{\text{Ans. 89.}}$

MCQ 08. THERE ARE 10 POINTS IN A PLANE, 5 OF WHICH ARE COLLINEAR AND NO OTHER 3 POINTS ARE COLLINEAR. WHAT ARE THE NUMBER OF STRAIGHT LINES THAT CAN BE DRAWN.

SOLN:- $^{10}C_2 - {}^5C_2 + 1$

$45 - 10 + 1 = 36$. $\boxed{\text{Ans. 36.}}$

IPMAT INDORE 2021 QA

MCQ 9 LET $f(x) = ax^2 + bx + c$
$g(x) = -2x$.
IF $g(x)$ PASSES THROUGH (a, b) & $f(x)$ CUTS x-AXIS AT $(-2, 0)$, THEN MINIMUM VALUE OF $f(x) + 9a + 1$ IS.

SOLN- $g(x)$ passes through (a, b), means this point should satisfy the line $g(x) = -2x$

$\therefore \; b = -2a$ —— ①

Also $f(x)$ passes through $(-2, 0)$, therefore

$f(x) = ax^2 + bx + c$
$0 = a(-2)^2 + b(-2) + c$
$0 = 4a - 2b + c$ —— ②

From eqn ② $c = 2b - 4a$.
$= 2(-2a) - 4a$ (from eqn ①)
$c = -4a - 4a = -8a$ —— ③

The given expression is

$E = f(x) + 9a + 1$

$E = ax^2 + bx + c + 9a + 1$
$E = ax^2 + (-2a)x + (-8a) + 9a + 1$
$E = ax^2 - 2ax + a + 1$

we have to find E's minimum value,

$\frac{dE}{dx} = 2ax - 2a = 0$
$x = 1$.

put $x = 1$ in $E = ax^2 - 2ax + a + 1$
$= a - 2a + a + 1$

$\boxed{E_{min} = 1}$ Ans. 1.

IPMAT INDORE 2021 QA.

MCQ 10. IF $f(x+xy) = f(x) + f(xy)$ SATISFIES ALL REAL VALUES OF x & y

$f(2021) = 1$, find $f(2020) = ?$

SOLN. THIS FUNCTIONAL EQN. HOLDS TRUE FOR ONLY ONE KIND OF FUNCTION i.e.,

$\boxed{f(x) = k \cdot x}$, when $k \rightarrow$ is any constant.

$\therefore$ if $f(2021) = 1$

It means $k \cdot 2021 = 1$

$\therefore k = \frac{1}{2021}$. —— ①

$\therefore f(2020) = k \cdot 2020$.

putting the value of k from eqn ①,

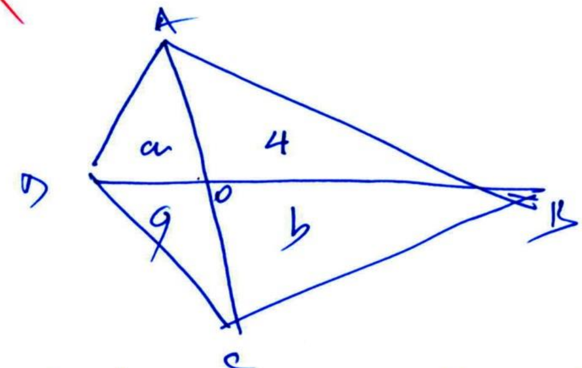
$f(2020) = \frac{2020}{2021}$.

$\boxed{\text{Ans. } \frac{2020}{2021}}$

IPMAT INDORE 2024 QA

MCQ 11 IN A QUADRILATERAL ABCD, DIAGONAL AC AND BD INTERSECT AT O. IF AREAS OF TRIANGLES AOB AND ΔCOD ARE 4 & 9 SQ. UNITS RESPECTIVELY. FIND THE MINIMUM AREA OF QUADRILATERAL ABCD.

SOLN:



let the area of Δ AOD & Δ BOC be 'a' & 'b' sq. units resp.

property 1: In any quadrilateral, product of areas of opposite Δs formed by 2 diagonals is a constant.

Using it, we get $4 \times 9 = a \times b$.

or $36 = ab$ —— (1)

property 2: In algebra we know, $(a+b)_{min}$ can be obtained if ~~a·b = a constant~~ (given) only when $a = b$.

In order to minimize the area of Qd. ABCD, sum of a & b should be minimum or $(a+b)_{min} = ?$

from eqn (1), we have $a \cdot b = 36$

$a \cdot a = 36$

$a^2 = 36$ | $a = b = 6$.

$\therefore$ minimum value of $a+b = 6+6 = 12$

$\therefore$ min. Ar. of Qd ABCD $= 12 + 9 + 4 = 25$

$\boxed{\text{Ans. 25 sq. UNITS}}$

IPMAT INDORE 2021 QA.

MCQ 12 WHAT IS THE HIGHEST POSSIBLE RATIO OF A 4-DIGIT NO. AND SUM OF ITS DIGITS?

Soln- let the 4-digit no. be ABCD.
in expanded form 1000A+100B+10C+D.

Required ratio will be maximum only when the DIGITS B, C, D ARE '0'.

eg $\frac{9000}{9+0+0+0} = \frac{9000}{9} = 1000$ (max. Ratio)

or $\frac{2000}{2+0+0+0} = \frac{2000}{2} = 1000$ (")

Taking any other no.

$\frac{1234}{(1+2+3+4)} = 123.4$ (too less compared to 1000)

$\boxed{\text{Ans. } 1000}$

why it happens?
lets us assume the ratio required is greater or equal to 1000.

$\frac{1000a+100b+10c+d}{a+b+c+d} \geq 1000$

we get - $0 \geq 900b + 990c + 999d$

only condition possible is $0 = 900b + 990c + 999d$
when $b=c=d=0$
& a could be any non-zero digit from (1-9)

INDORE IPM AT 2021 (QA)

MCQ 13 FIND THE NUMBER OF 5-DIGIT NUMBERS SUCH THAT ONLY ODD DIGITS OCCUPY THE ODD PLACES AND REPETITION OF DIGITS NOT ALLOWED.

SOLN. 5 ways × 7 ways × 4 ways × 6 ways × 3 ways.

1 3 5 (odd positions)

1, 3, 5, 7, 9

5 odd digits.

After filling odd positions with odd digits, we can fill even places with 7 left out digits.

$\therefore$ $5 \times 7 \times 4 \times 6 \times 3$

$35 \times 24 \times 3$.

$35 \times 72 = 2520$

five-digit nos. can be formed.

Ans. $\boxed{\text{Ans. } 2520}$

IPMAT INDORE 2021 (QA)

MCQ|| DIRECTION FOR Q:14 — 18.

IN A FOOTBALL TOURNAMENT, SIX TEAMS NAMELY A, B, C, D, E AND F TAKE PART WHEREIN EACH TEAM PLAYS WITH EXACTLY ONE MATCH WITH REST OF THE FIVE TEAMS.

2 POINTS ARE AWARDED TO THE TEAM WHO WINS THE MATCH, 1 POINT TO EACH TEAM IF THE MATCH ENDS IN A DRAW AND NO POINTS TO THE TEAM WHO LOSES THE MATCH.

IT IS FURTHER KNOWN THAT TEAM E & F HAVE LESS THAN 5 POINTS AT THE END OF THE TOURNAMENT.

THE TABLE GIVEN BELOW REPRESENTS THE FINAL POINT TABLE OF ALL SIX TEAM AT THE END OF THE TOURNAMENT. HOWEVER SOME OF THE VALUE BEEN ERASED FROM THE TABLE. IT IS FURTHER KNOWN THAT TEAM B DEFEATED TEAM C AND TEAM C DEFEATED TEAM D.

TEAM	MATCHES PLAYED	MATCHES WON	MATCH LOST	MATCH ENDING IN A DRAW	TOTAL POINTS.
A	5		0		8
B	5		2		6
C	5		2		5
D	5		1		5
E	5		1		
F	5				

DILR 1

SOLN :.

TOTAL MATCHES PLAYED BETWEEN 6 TEAMS.

$= {}^6C_2 = 15$ matches. (A playing with B, B playing with A is same)

IN A MATCH, TOTAL POINTS AWARDED = 2

(i) 2 points to winning team, 0 to loosing team.
(ii) 1 point to each team, which ends in a draw.

TOTAL POINTS AWARDED IN 15 MATCHES $= 15 \times 2 = 30$ points

TOTAL POINTS BAGGED BY E & F TOGETHER

$= 30 - [8+6+5+5] = 30 - 24 = 6$ points.

CASES:- E+F = 6 points.
(i) 4 + 2 ⇒ ONLY POSSIBILITY.
(ii) 3 + 3 ⇒ NOT POSSIBLE
(iii) 2 + 4 ⇒ NOT POSSIBLE

JUSTIFICATION FOR THE POSSIBILITY OF CASE (i) ONLY.

E SCORES LESS THAN 5 POINTS (GIVEN).
E ALSO LOST 1 MATCH OUT OF 5 PLAYED (GIVEN)
MEANS REST OF THE 4 MATCHE SHOULD END IN A DRAW. AND ITS SCORES COMES OUT AS 4 POINTS.
IF WE TAKE E WON 1 MATCH, DRAWS 3, THEN ITS TOTAL POINT WILL BECOME 5 [NOT POSSIBLE].

FINAL CONCLUSION E LOSES 1 & DRAWS 4
TOTAL POINTS = 4 points.

F LOSES 3 & DRAWS 2
TOTAL POINTS = 2 points.

DILR 2

JUSTIFICATION FOR 2 DRAWS FOR F.

AS E HAD 4 DRAWS, ONE OF THESE MUST BE PLAYED AGAINST F. MEANS F DEFINITELY HAD ONE DRAW WITH E. (ALSO IN TABLE, B'S POINT (6) SHOWS THAT IT DIDNT DRAW ANY) IN ORDER TO SCORE 2 POINTS, F CAN HAVE 2 DRAWS ONLY AND 3 LOST MATCHES.

NOW LETS FILL THE TABLE

TEAM	MATCHES PLAYED	MATCHES WON(X2)	MATCH LOST(X0)	MATCH ENDING IN A DRAW(X1)	TOTAL POINTS
A	5	3	0	2	8
B	5	3	2	0	6
C	5	2	2	1	5
D	5	1	1	3	5
E	5	0	1	4	4
F	5	0	3	2	2

MCQ 14 THE TOTAL POINTS WITH TEAM 'F' AT THE END OF THE TOURNAMENT ARE [2 POINTS : ANS]

MCQ 15. WHICH TEAM WAS NOT DEFEATED BY TEAM A.
ONE TEAM MUST BE D [IT HAS 3 DRAWS, WHICH CAN'T BE WITH C & B.
∴ A—D MUST BE A DRAW]
ONE TEAM MUST BE E [E HAD 4 DRAWS, EXCEPT WITH B]
∴ A—E MUST BE A DRAW.

MCQ 16 WHICH TEAM HAD PLAYED THE HIGHEST NUMBER OF DRAW MATCHES DURING THE TOURNAMENT ?
[Ans: TEAM E]

DILR 3

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MCQ 17 THE TOTAL NUMBER OF MATCHES THAT ENDED IN A DRAW DURING THE TOURNAMENT IS

SOLN: Adding all the entries in 'DRAW' column of the table we get 12 draw matches.

HALVING THEM WILL GIVE US THE CORRECT NO. OF MATCHES THOSE END IN A DRAW

$\therefore \frac{12}{2} = 6$ matches.

[IN 12, A DRAW MATCH WITH D, & D DRAW MATCH WITH A CONSIDERED SEPARATELY.]

WHEREAS, IT SHOULD BE TAKEN AS SINGLE DRAWN MATCH.

Ans. 6.

MCQ 18. DURING THE TOURNAMENT, TEAM E WAS DEFEATED BY WHICH TEAM?

SOLN. VERY OBVIOUSLY, E had 4 draw matches and 1 lost.

(From the table, B had no 'draw')

THUS 'B' MUST have beaten 'E'.

Ans. B