SECTION A : SOLUTION

1. **(C)**

Let a and b be the required numbers.

We have:

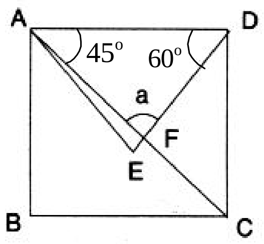
$a+b=55$

$ab=HCF\times LCM=5\times 120=600$

Therefore, the required sum is:

$\frac{1}{a}+\frac{1}{b}=\frac{b+a}{ab}=\frac{55}{600}=\frac{11}{120}$

2. **(D)**



$\angle ADF=60^{o}$

$\angle DAF=45^{o}$

$\therefore a=180^{o}-105^{o}=75^{o}$

3. **(B)**

Let the speeds of the cars starting from A and B be x km/hr and y km/hr respectively. According to the problem, we have (make sure you understand this step):

$$\left.\begin{array}{l}9x-9y=90\\ \frac{9}{7}x+\frac{9}{7}y=90\end{array}\right\} \quad \ldots\ldots\ldots\ldots \text{(i)}$$

$$\Rightarrow \left.\begin{array}{l}x-y=10\\ x+y=70\end{array}\right\}\begin{array}{l}\ldots\ldots\text{(iii)}\\ \ldots\ldots\text{(iv)}\end{array}$$

On adding (iii) and (iv), we get $x=40\,\text{km/hr}$.

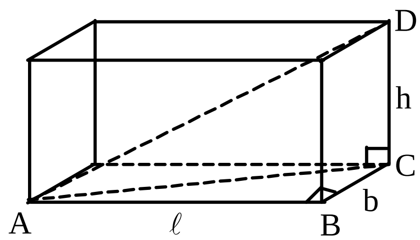
On subtracting (iii) from (iv), we get $y=30\,\text{km/hr}$. The speed of the faster car is $40\,\text{km/hr}$.

4. **(C)**

It is easy to show that a, b and c will themselves be in GP.

5. **(B)**

Consider the following figure:



The length of the diagonal of this cuboid can be calculated as follows:

$AD = \sqrt{AC^2 + CD^2}$

$= \sqrt{\left(AB^2 + BC^2\right) + CD^2}$

$= \sqrt{\ell^2 + b^2 + h^2}$

Thus, the length of the longest pole will be the length of the diagonal, which will be

$\sqrt{10^2 + 10^2 + 5^2} = 15\,m$.

6. **(C)**

The height of the cone is $H = 2R$. Now, the radius and height of the top (conical) half of the cone is $\frac{R}{2}$ and $\frac{H}{2} = R$. We have:

$$V_{\text{entire cone}} = \frac{1}{3}\pi R^2 H = \frac{1}{3}\pi R^2 (2R) = \frac{2}{3}\pi R^3$$

$$V_{\text{top conical half}} = \frac{1}{3}\pi\left(\frac{R}{2}\right)^2\left(\frac{H}{2}\right) = \frac{1}{12}\pi R^3$$

$$\Rightarrow V_{\text{bottom half}} = V_{\text{entire cone}} - V_{\text{top conical half}} = \frac{2}{3}\pi R^3 - \frac{1}{12}\pi R^3 = \frac{7}{12}\pi R^3$$

The required ratio is

$$\frac{V_{\text{bottom half}}}{V_{\text{top conical half}}} = \frac{\frac{7}{12}\pi R^3}{\frac{1}{12}\pi R^3} = 7$$

7. **(C)**

$(-1)^n + (-1)^{4n} = 0$ will be possible, when n is any odd natural number.

8. **(B)**

Let the length of the rectangle be x units and the breadth be y units

Then, $(x+2)(y+2) = xy + 76$

$\Rightarrow 2x + 2y + 4 = 76 \quad \Rightarrow x + y = 36$ ……… (1)

In the second case: $(x+3)(y-3) = xy - 21$

$\Rightarrow 3y - 3x - 9 = -21$

$\Rightarrow 3x - 3y = 21 - 9 = 12$

$\Rightarrow x - y = 4$ ………….. (2)

From (1), $y = 36 - x$

Substituting the value of y in (2), we get

$x - [36 - x] = 4 \Rightarrow x - 36 + x = 4$

$\Rightarrow 2x = 40 \therefore x = 20$ units

And $y = 36 - 20 = 16$ units

Hence, length $= 20$ units and breadth $= 16$ units.

9. **(A)**

$A(\Delta ABC) = \frac{1}{2}AB.AC = \frac{1}{2}AD.BC$

$\therefore \quad c.b = AD.a$

$AD = \frac{b.c}{a} = \frac{bc}{\sqrt{b^2 + c^2}}$

10. **(D)**

$AB = AC$

$\therefore \quad 2AB = AB + AC$

$= AP + PB + AQ + QC$

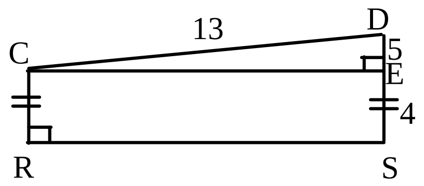
$= AP + PR + AQ + QR$

$= AP + AQ + (PR + QR)$

$= AP + AQ + QP$

$= peri(\Delta APQ)$

11. **(C)**



Draw $CE \perp DS$

Then $ES = CR = 4$

$\therefore DE = 5$

$\therefore CE = 12$

12. **(C)**

At worst, one will pull out one of each of the four colors, and then pull out any color guaranteeing a match, so the answer is 5

13. **(C)**

$x + y = 4xy$

$\therefore \frac{1}{x} + \frac{1}{y} = \frac{x+y}{xy} = \frac{4xy}{xy} = 4$

14. **(D)**

Consider ΔABC with $AB = AC = 10$ and $BC = 12$. Draw $AD \perp BC$

Then $BD = 6$ and $AB = 10$ gives $AD = 8$

$\therefore A(\Delta ABC) = 48$

$\therefore$ The length of the rectangle $= 12$ and perimeter $= 32$

15. **(D)**

x = 20 and y = 10.

16. **(C)**

The triangle inequality gives BD < AD + AB = 14, BD >BC − CD = 12, so BD = 13.

17. **(D)**

$128 = 2^7$. Kimaya's brothers could then be 8, and she could be 2.

2 + 8 + 8 = 18.

18. **(B)**

By rearranging some of the mini-triangles in ABC, we find that the 6 mini-triangles is the area of one of the hexagons, so the 6 triangles plus the one hexagons is two hexagons, and since the area of one of the triangles in the hexagon is $\frac{1.\sqrt{3}}{2.2} = \frac{\sqrt{3}}{4}$, the area of the whole hexagon is $\frac{3\sqrt{3}}{2}$ meaning the area of ABC is $3\sqrt{3}$, so our answer is **B**

19. **(D)**

A(ΔAED) = A(ΔBEC) implies A(ΔABD) = A(ΔABC)

Hence ΔABC and ΔABD have same height with respect to the base AB that is AB || CD giving $\Delta ABE \sim \Delta CDE$.

$\therefore$ AE : EC = 3 : 4

20. **(D)**

$$\frac{2a^{-1} + \frac{a^{-1}}{2}}{a} = \frac{2 \times 2 + 1}{\frac{1}{2}} = 10$$

21. **(B)**

She started reading on Sunday Total number of days needed is1 + 2 + 3 + ...15 = 120

120 ÷ 7 = 17and remainder is 1 $\Rightarrow$

$\therefore$ The number of weeks and days taken is 17, and 1 respectively 1 day from Sunday is Monday.

22. **(B)**

Total area of the lateral faces $= 900 - 360 = 540\ \text{cm}^2$.

Number of lateral faces it has $\frac{540}{30} = 18$

23. **(B)**

Let the distance AB be d . then the average speed $= \frac{2d}{\frac{d}{40} + \frac{d}{60}} = \frac{2.2400}{100} = 48$

24. **(B)**

PB = 15, BQ = 20 implies PQ = 25

While PQ = QR = RS = SP. implies that □PQRS is a rhombus so its diagonals are perpendicular bisectors. Let M be the point of intersection of diagonals.

PM = 15, MQ = 20 implies PR || BC and SQ || AB

Hence perimeter = 2(40 + 30) = 140

25. **(B)**

According to Angle bisector property.

$\frac{BA}{BC} = \frac{AD}{DC} = \frac{3}{8}$, hence, 8BA = 3BC

Since we want integers, we try BA = 3 and BC = 8. Therefore AC = 11 = AB + BC.

$\therefore$ The triangle becomes a segment.

So we go to BA = 6 and BC = 16. This gives a perimeter of 33.

SECTION B : SOLUTION

26. **28 cm^2**

Area of shaded region = 2 (Area of sector $\overline{BAD}$ – Area of ΔABD)

27. **155**

In first round each player will play with 15 others

$\therefore$ The number of matches played in first round is $= \frac{1}{2}.15.16 = 120 =$

$\therefore$ The number of matches played in second round is $= \frac{1}{2}.7.8 = 28 =$

$\therefore$ The number of matches played in third round is $= \frac{1}{2}.3.4 = 6$

$\therefore$ The number of matches played in last round is = 1