



Your Personal Exams Guide



NDA



CDS



SSC CGL



CBSE UGC NET



IAS



SSC CHSL



CTET



MPSC



AFCAT



CSIR UDC NET



IBPS PO



UP POLICE



SSC MTS



SBI PO



BPSC



UP TET



IBPS RRB



IBPS CLERK



IES



UPSC CAPF



SSC Stenogr..



RRB NTPC



SSC GD



RBI GRADE B



RBI Assistant



DSSSB

SSC CGL 2020 (Tier-II: Quant) Previous Year Paper (29-Jan-2022)

Total Time: 2 Hour

Total Marks: 200

Instructions

Sl No.	Section Name	No. of Question	Maximum Marks	Negative Marks	Positive Marks
1	Quantitative Aptitude	100	200	0.5	2

- 1.) A total of 120 minutes is allotted for the examination.
- 2.) The server will set your clock for you. In the top right corner of your screen, a countdown timer will display the remaining time for you to complete the exam. Once the timer reaches zero, the examination will end automatically. The paper need not be submitted when your timer reaches zero.
- 3.) There will, however, be sectional timing for this exam. You will have to complete each section within the specified time limit. Before moving on to the next section, you must complete the current one within the time limits.

Your Personal Exams Guide

Quantitative Aptitude

1. If the selling price of 7 articles is equal to the cost price of 8 articles, then what is the profit percentage (correct to one decimal place)? (+2, -0.5)
 - a. 15.4%
 - b. 14.3%
 - c. 13.9%
 - d. 11.7%

2. If $2x^2 + 5x + 1 = 0$, then one of the values of $x - \frac{1}{2x}$ is: (+2, -0.5)
 - a. $\frac{\sqrt{13}}{2}$
 - b. $\frac{13}{2}$
 - c. $\frac{\sqrt{17}}{2}$
 - d. $\frac{5}{2}$

3. A started a business with a capital of Rs. 54,000 and admitted B and C after 4 months and 6 months, respectively. At the end of the year, the profit was divided among the three in the ratio 1 : 4 : 5. What is the sum (in Rs.) of the capitals invested by B and C? (+2, -0.5)
 - a. 8,60,400
 - b. 8,64,000
 - c. 8,40,060
 - d. 8,46,000

4. The volume of a solid hemisphere is $19,404 \text{ cm}^3$. Its total surface area (in cm^2) is: (+2, -0.5)

(Take $\pi = \frac{22}{7}$)

a. 2772

b. 3465

c. 2079

d. 4158

5. If $2x - y = 2$ and $xy = \frac{3}{2}$, then what is the value of $x^3 - \frac{y^3}{8}$? (+2, -0.5)

a. $\frac{5}{2}$

b. $\frac{13}{4}$

c. $\frac{9}{2}$

d. $-\frac{5}{4}$

6. The value of $0.4\overline{6} + 0.7\overline{23} - 0.3\overline{9} \times 0.\overline{7}$ is: (+2, -0.5)

a. $0.\overline{97}$

b. $0.\overline{77}$

c. $0.\overline{57}$

d. $0.\overline{87}$

7. In $\triangle ABC$, $\angle A = 66^\circ$ and $\angle B = 50^\circ$. If the bisectors of $\angle B$ and $\angle C$ meet at P, then $\angle BPC - \angle PCA = ?$ (+2, -0.5)

- a. 93°
- b. 81°
- c. 91°
- d. 83°

8. The base of right pyramid is an equilateral triangle, each side of which is 20 cm. Each slant edge is 30 cm. The vertical height (in cm) of the pyramid is: (+2, -0.5)

- a. $10\sqrt{3}$
- b. $5\sqrt{\frac{23}{3}}$
- c. $5\sqrt{3}$
- d. $10\sqrt{\frac{23}{3}}$

9. If $847 \times 385 \times 675 \times 3025 = 3^a \times 5^b \times 7^c \times 11^d$, then the value of $ab - cd$ is: (+2, -0.5)

- a. 5
- b. 4
- c. 1
- d. 7

10. A discount of 10% is offered on the price of an article if the payment is made online. An additional discount of 5% is given to credit card holders. A person wishes to buy a watch priced at Rs. 60,000 by paying online through credit card. How much does he need to pay (in Rs.)? (+2, -0.5)

- a. 62,150
- b. 61,250
- c. 53,100
- d. 51,300

11. If $1 + 2\tan^2\theta + 2\sin\theta \sec^2\theta = \frac{a}{b}$, $0^\circ < \theta < 90^\circ$, then $\frac{a+b}{a-b} = ?$ (+2, -0.5)

- a. $\sin\theta$
- b. $\operatorname{cosec}\theta$
- c. $\cos\theta$
- d. $\sec\theta$

12. If $\frac{22\sqrt{2}}{4\sqrt{2}-\sqrt{3+\sqrt{5}}} = a + \sqrt{5}b$, with $a, b > 0$, then what is the value of $(ab) : (a + b)$? (+2, -0.5)

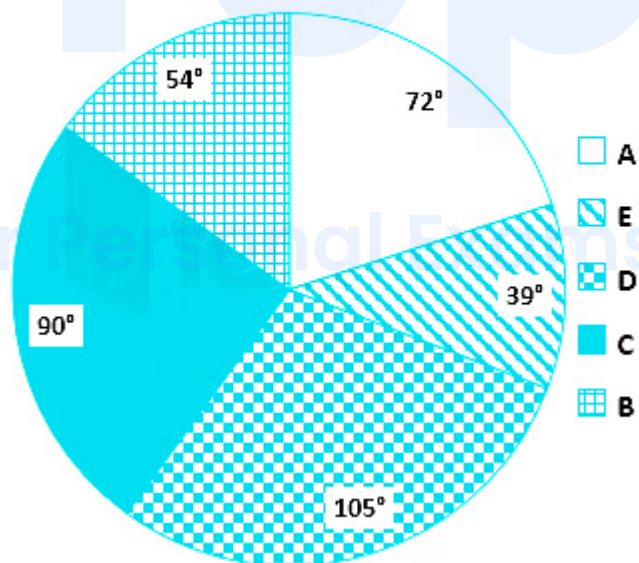
- a. 4 : 7
- b. 8 : 7
- c. 7 : 4
- d. 7 : 8

13. A student goes to school at a speed of $5\frac{1}{2}$ km/h and returns at a speed of 4 km/h. If he takes $4\frac{3}{4}$ hours for the entire journey, then the total distance covered by the student (in km) is: (+2, -0.5)

- a. 16
- b. 22
- c. 24
- d. 11

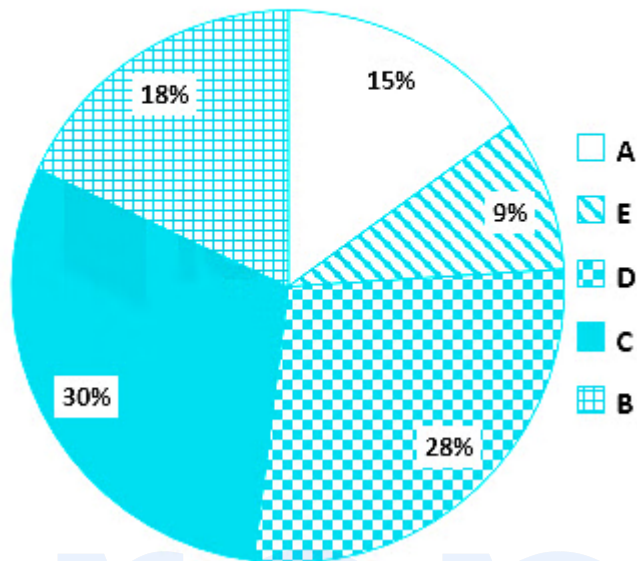
14. Study the given pie charts and answer the question that follows. (+2, -0.5)

Distribution (degree wise) of students appeared in the examination from institutes A, B, C, D & E



Total number of Students appeared = 1200

**Distribution of students (percent wise)
passed the examination from
institutes A, B, C, D and E**



Total number of students passed = 900

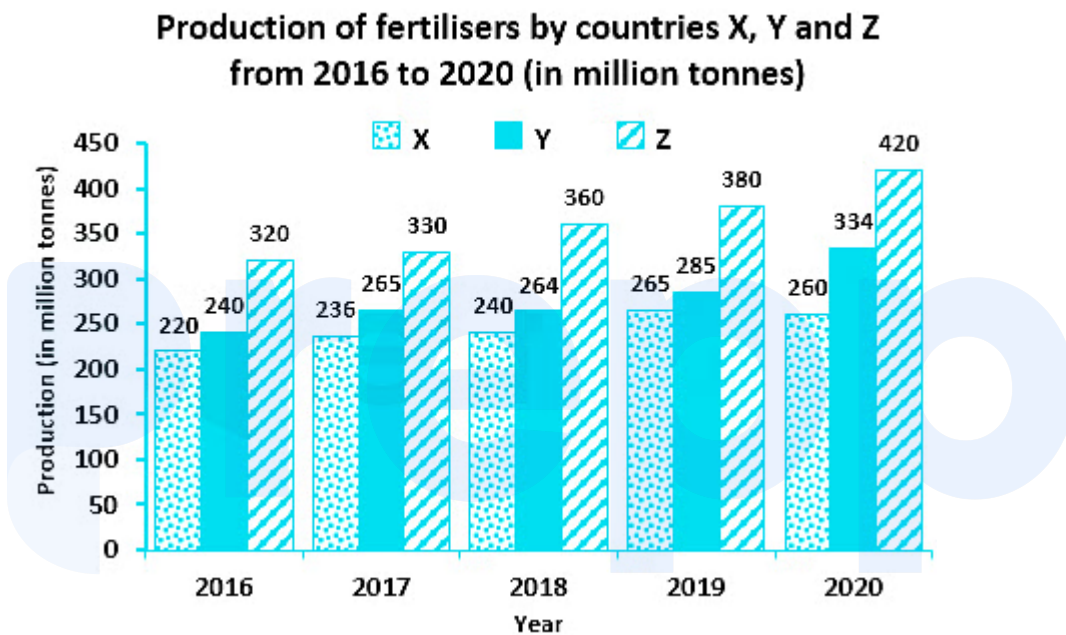
The number of students who passed the examination from institute D exceeds the number of students who appeared from institute A is x . The value of x lies between:

- a. 14 and 17
- b. 8 and 11
- c. 11 and 14
- d. 5 and 8

15. A sum of money becomes Rs. 11,880 after 4 years and Rs. 17,820 after 6 years on compound interest, if the interest is compounded annually. What is the half of the sum (in Rs.)? (+2, -0.5)
- a. 2,410

- b. 2,750
- c. 2,530
- d. 2,640

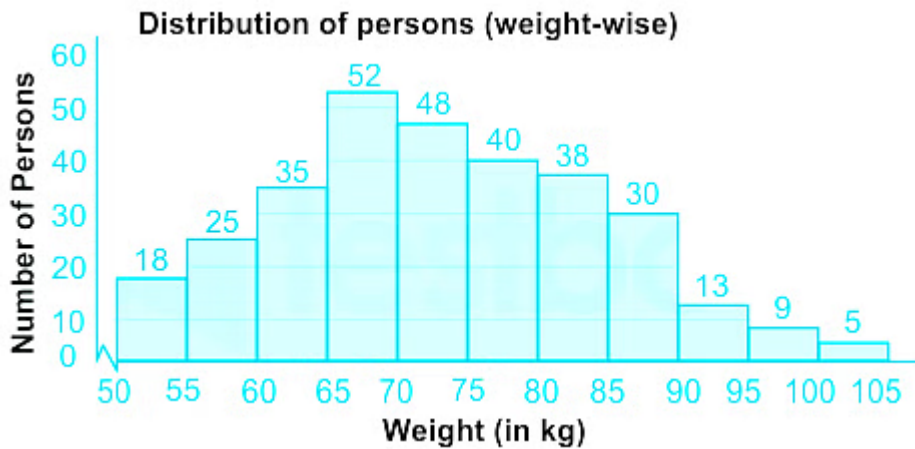
16. Study the given graph and answer the question that follows. (+2, -0.5)



The total production of fertilisers by country Y in 2017 and 2019 and by country X in 2016 is what percentage of the total production of fertilisers by country Z in 2016, 2018 and 2020?

- a. 77%
- b. 70%
- c. 60%
- d. 69%

17. Study the given histogram and answer the question that follows. (+2, -0.5)



The number of persons weighing 55 kg or more but less than 75 kg is what percentage more than the number of persons weighing 80 kg or more but less than 100 kg (correct to one decimal place)?

- a. 88.2%
- b. 77.8%
- c. 68.4%
- d. 66.7%

18. The slant height and radius of a right circular cone are in the ratio 29 : 20. If its volume is $4838.4 \pi \text{ cm}^3$, then its radius is: (+2, -0.5)

- a. 24 cm
- b. 20 cm
- c. 25 cm
- d. 28 cm

19. If $x^2 - \sqrt{7}x + 1 = 0$, then what is the value of $x^5 + \frac{1}{x^5}$? (+2, -0.5)

a. $21\sqrt{7}$

b. $25\sqrt{7}$

c. $19\sqrt{7}$

d. $27\sqrt{7}$

20. ABCD is a cyclic quadrilateral and BC is a diameter of the circle. If $\angle DBC = 29^\circ$, then $\angle BAD = ?$ (+2, -0.5)

a. 122°

b. 119°

c. 129°

d. 111°

21. The monthly expenses of a person are $66\frac{2}{3}\%$ more than her monthly savings. If her monthly income increases by 44% and her monthly expenses increase by 60%, then there is an increase of Rs. 1,040 in her monthly savings. What is the initial expenditure (in Rs.)? (+2, -0.5)

a. 13,000

b. 10,000

c. 12,000

d. 9,000

22. Two pipes A and B can fill a cistern in $12\frac{1}{2}$ hours and 25 hours, respectively. The pipes were opened simultaneously, and it was found (+2, -0.5)

that, due to leakage in the bottom, it took one hour 40 minutes more to fill the cistern. If the cistern is full, in how much time (in hours) will the leak alone empty 70% of the cistern?

- a. 35
- b. 50
- c. 30
- d. 40

23. A sum of Rs. 46,800 is divided among A, B, C and D in such a way that the ratio of the combined share of A and D to the combined share of B and C is 8 : 5. The ratio of the share of B to that of C is 5 : 4. A receives Rs. 18,400. If x is the difference between the shares of A and B and y is the difference between the shares of C and D, then what is the value of $(x - y)$ (in Rs.)? (+2, -0.5)

- a. 6000
- b. 6500
- c. 5000
- d. 7000

24. The ratio of the distance between two places A and B to the distance between places B and C is 3 : 5. A man travels from A and B at a speed of x km/h and from B to C at a speed of 50 km/h. If his average speed for the entire journey is 40 km/h, then what is the value of $(x - 10) : (x + 1)$? (+2, -0.5)

- a. 20 : 31
- b. 31 : 20

c. 10 : 11

d. 11 : 10

25. Alloy A contains metals x and y only in the ratio 5 : 2, while alloy B contains them in the ratio 3 : 4. Alloy c is prepared by mixing alloys A and B in the ratio 4 : 5. the percentage of x in alloy C is: (+2, -0.5)

a. $55\frac{1}{9}$

b. $55\frac{4}{9}$

c. $55\frac{2}{9}$

d. $55\frac{5}{9}$

26. The curved surface area and the volume of a cylindrical object are 88 cm^2 and 132 cm^3 , respectively. The height (in cm) of the cylindrical object is: (+2, -0.5)

(Take $\pi = \frac{22}{7}$)

a. 6

b. $4\frac{2}{3}$

c. $3\frac{2}{3}$

d. 4

27. In an examination, average marks of a student per paper were 71. If he would have obtained 35 more marks in science; 11 more marks in history and 4 more marks in computer science, his average marks per paper would have been 76. How many papers were there in the examination? (+2, -0.5)

- a. 18
- b. 12
- c. 10
- d. 15

28. If a 10-digit number 75462A97B6 is divisible by 72, then the value of $\sqrt{8A - 4B}$ is: (+2, -0.5)

- a. $\sqrt{21}$
- b. $\sqrt{27}$
- c. $\sqrt{28}$
- d. $\sqrt{30}$

29. ABCD is a quadrilateral in which $AB \parallel DC$. E and F are the midpoints of the diagonals AC and BD, respectively. If $AB = 18$ cm and $CD = 6$ cm, then $EF =$? (+2, -0.5)

- a. 8 cm
- b. 9 cm
- c. 6 cm
- d. 12 cm

30. AB and CD are two chords in a circle with centre O and AD is a diameter. AB and CD produced meet at a point P outside the circle. If $\angle APD = 25^\circ$ and $\angle DAP = 39^\circ$, then the measure of $\angle CBD$ is: (+2, -0.5)

- a. 29°
- b. 27°
- c. 26°
- d. 32°

31. The ratio of the incomes of A and B in the last year was 4 : 3. The ratios of their individual incomes in the last year and the present year are 3 : 4 and 5 : 6, respectively. If their total income in the present year is Rs. 24.12 lakhs, then the sum of the income (in Rs. lakhs) of A in the last year and that of B in the present year is: (+2, -0.5)

- a. 22.17
- b. 21.28
- c. 20.52
- d. 10.98

32. In $\triangle ABC$, O is the point of intersection of the bisectors of $\angle B$ and $\angle A$. If $\angle BOC = 108^\circ$, then $\angle BAO = ?$ (+2, -0.5)

- a. 27°
- b. 18°
- c. 40°
- d. 36°

33. A, B and C invested their capitals in the ratio 2 : 3 : 5. The ratio of months for which they invested is 4 : 2 : 3, respectively. If the difference between the profit shares of A and B is Rs. 1,86,000, then C's share of profit (in Rs.) is: (+2, -0.5)

- a. 15,39,000
- b. 19,35,000
- c. 13,95,000
- d. 10,29,500

34. The graphs of the equations (+2, -0.5)

$4x + \frac{1}{3}y = \frac{8}{3}$ and $\frac{1}{2}x + \frac{3}{4}y + \frac{5}{2} = 0$ intersect at a point P. The point P also lies on the graph of the equation:

- a. $x + 2y - 5 = 0$
- b. $3x - y - 7 = 0$
- c. $x - 3y - 12 = 0$
- d. $4x - y + 7 = 0$

35. In 6 minutes, $\frac{4}{13}$ of a bucket is filled. How much time will it take to fill the remaining bucket? (+2, -0.5)

- a. 14 minutes 30 seconds
- b. 11 minutes 30 seconds
- c. 13 minutes 30 seconds
- d. 12 minutes 30 seconds

36. An article was sold for Rs. 716 after offering a discount of 10.5%. If a discount of 6.5% is given, then for how much (in Rs.) should it be sold? (+2, -0.5)

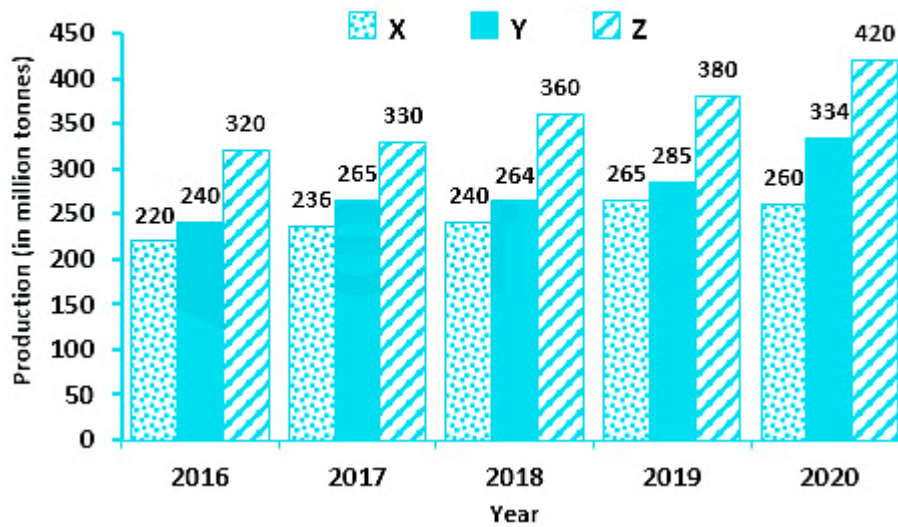
- a. 732
- b. 675
- c. 756
- d. 748

37. G is the centroid of a triangle ABC, whose sides $AB = 35$ cm, $BC = 12$ cm, and $AC = 37$ cm. The length of BG is (correct to one decimal place): (+2, -0.5)

- a. 11.7 cm
- b. 12.3 cm
- c. 17.5 cm
- d. 12.9 cm

38. Study the given graph and answer the question that follows. (+2, -0.5)

Production of fertilisers by countries X, Y and Z
from 2016 to 2020 (in million tonnes)



What is the ratio of the total production of fertilisers by country X in 2017 and country Y in 2020 to the production of fertilisers by country Z in 2019?

- a. 27 : 20
- b. 3 : 2
- c. 4 : 3
- d. 19 : 12

Your Personal Exams Guide

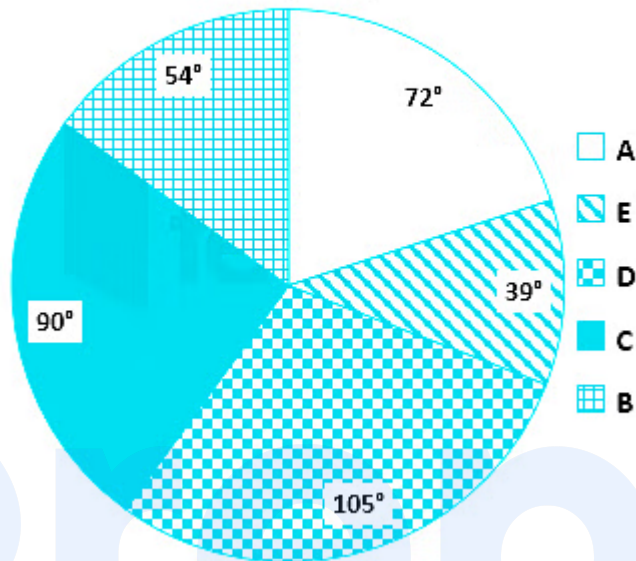
39. Let $x = \frac{5\frac{3}{4} - \frac{3}{7} \times 15\frac{3}{4} + 2\frac{2}{35} \div 1\frac{11}{25}}{\frac{3}{4} \div 5\frac{1}{4} + 5\frac{3}{5} \div 3\frac{4}{15}}$. When y is added to x, the result is $\frac{7}{13}$. What is the value of y? (+2, -0.5)

- a. $\frac{1}{13}$
- b. $\frac{4}{13}$
- c. $\frac{2}{13}$
- d. $\frac{9}{13}$

40. Study the given pie charts and answer the question that follows.

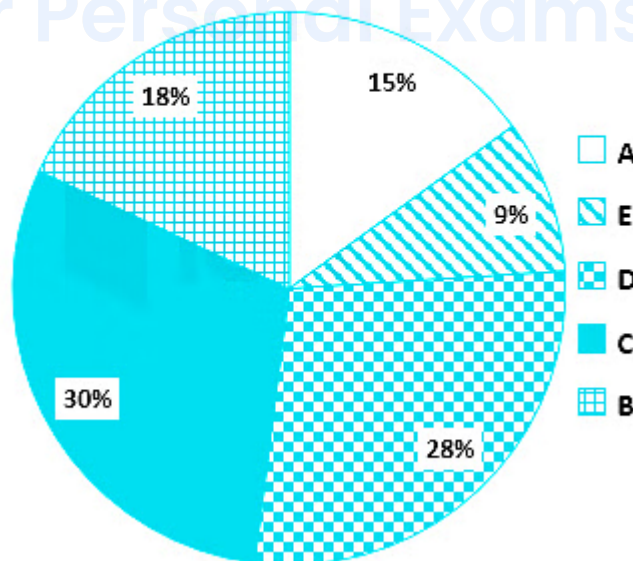
(+2, -0.5)

**Distribution (degree wise) of students
appeared in the examination from
institutes A, B, C, D & E**



Total Number of Students appeared = 1200

**Distribution of students (percent wise)
passed the examination from
institutes A, B, C, D and E**



Total Number of Students passed = 900

Which institute has the second highest percentage of students who passed to the students who appeared from that institute?

- a. D
- b. B
- c. C
- d. E

41. A covered a distance of 240 km at a certain speed. Had his speed been 8 km/h less, then the time taken would have been one hour more for covering the same distance. How much time (in hours) will he take to cover a distance of 480 km at his original speed? (+2, -0.5)

- a. 8
- b. 10
- c. 11
- d. 9

Your Personal Exams Guide

42. The value of $\frac{4\tan^2 30^\circ + \sin^2 30^\circ \cos^2 45^\circ + \sec^2 48^\circ - \cot^2 42^\circ}{\cos 37^\circ \sin 53^\circ + \sin 37^\circ \cos 53^\circ + \tan 18^\circ \tan 72^\circ}$ is: (+2, -0.5)

- a. $\frac{49}{24}$
- b. $\frac{35}{48}$
- c. $\frac{35}{24}$
- d. $\frac{59}{48}$

43. If the sum of two positive numbers is 65 and the square root of their product is 26, then the sum of their reciprocals is: (+2, -0.5)

- a. $\frac{5}{52}$
- b. $\frac{7}{52}$
- c. $\frac{1}{52}$
- d. $\frac{3}{52}$

44. The total surface area of a cylinder is 4092 cm^2 and the diameter of its base is 21 cm. What is 50% volume (in cm^3) of the cylinder (nearest to an integer)? (+2, -0.5)

- a. 8922
- b. 8822
- c. 8932
- d. 8832

45. Eight years ago, the ratio of ages of A and B was 5 : 4. The ratio of their present ages is 6 : 5. What will be the sum (in years) of the ages of A and B after 7 years from now? (+2, -0.5)

- a. 112
- b. 90
- c. 102
- d. 80

46. In ΔPQR , S is a point on the side QR such that $\angle QPS = \frac{1}{2} \angle PSR$, $\angle QPR = 78^\circ$ and $\angle PRS = 44^\circ$. What is the measure of $\angle PSQ$? (+2, -0.5)

- a. 58°
- b. 56°
- c. 68°
- d. 64°

47. If $\sin A = \frac{5}{13}$ and $7 \cot B = 24$, then the value of $(\sec A \cos B) (\operatorname{cosec} B \tan A)$ is: (+2, -0.5)

- a. $\frac{13}{14}$
- b. $\frac{15}{13}$
- c. $\frac{65}{42}$
- d. $\frac{13}{7}$

48. An article is sold at a certain price. If it is sold at $33\frac{1}{3}\%$ of this price, there is a loss of $33\frac{1}{3}\%$. What is the percentage profit if the article is sold at 80% of its original selling price? (+2, -0.5)

- a. 50%
- b. 40%
- c. 60%
- d. 70%

49. The sum of the interior angles of a regular polygon A is 1260 degrees and each interior angle of a regular polygon B is $128\frac{4}{7}$ degrees. The sum of the number of sides of polygons A and B is: (+2, -0.5)

- a. 19
- b. 16
- c. 18
- d. 17

50. The base of a right prism is a triangle with sides 16 cm, 30 cm and 34 cm. Its height is 32 cm. The lateral surface area (in cm^2) and the volume (in cm^3) are, respectively: (+2, -0.5)

- a. 2624 and 7040
- b. 2560 and 7680
- c. 2688 and 7680
- d. 2560 and 6400

51. In $\triangle ABC$, M is the midpoint of the side AB. N is a point in the interior of $\triangle ABC$ such that CN is the bisector of $\angle C$ and $CN \perp NB$. What is the length (in cm) of MN, if $BC = 10$ cm and $AC = 15$ cm? (+2, -0.5)

- a. 2.5
- b. 2
- c. 5

d. 4

52. A circle is inscribed in ΔPQR touching the sides QR, PR and PQ at the points S, U and T, respectively. $PQ = (QR + 5)\text{cm}$, $PQ = (PR + 2)\text{cm}$. If the perimeter of ΔPQR is 32 cm, then PR is equal to: (+2, -0.5)

- a. 8 cm
- b. 11 cm
- c. 13 cm
- d. 10 cm

53. If the sum of 40% of a number and 30% of the same number is 70, then the number is: (+2, -0.5)

- a. 150
- b. 125
- c. 200
- d. 100

54. The value of $\frac{1}{4-\sqrt{15}} - \frac{1}{\sqrt{15}-\sqrt{14}} + \frac{1}{\sqrt{14}-\sqrt{13}} - \frac{1}{\sqrt{13}-\sqrt{12}} + \frac{1}{\sqrt{12}-\sqrt{11}} - \frac{1}{\sqrt{11}-\sqrt{10}} + \frac{1}{\sqrt{10}-3} - \frac{1}{3-\sqrt{8}}$ is: (+2, -0.5)

- a. $2 - 2\sqrt{2}$
- b. $4 + 2\sqrt{2}$
- c. $4 - 2\sqrt{2}$

d. $2 + 2\sqrt{2}$

55. $\frac{(1+\sec \theta \cos \theta)^2 (\sec \theta - \tan \theta)^2 (1+\sin \theta)}{(\sin \theta + \sec \theta)^2 + (\cos \theta + \csc \theta)^2}$, $0^\circ < \theta < 90^\circ$, is equal to: (+2, -0.5)

a. $\sin \theta$

b. $1 - \cos \theta$

c. $1 - \sin \theta$

d. $\cos \theta$

56. A solid metallic cuboid of dimensions 12 cm × 54 cm × 72 cm is melted and converted into 8 cubes of the same size. What is the sum of the lateral surface areas (in cm²) of 2 such cubes? (+2, -0.5)

a. 2592

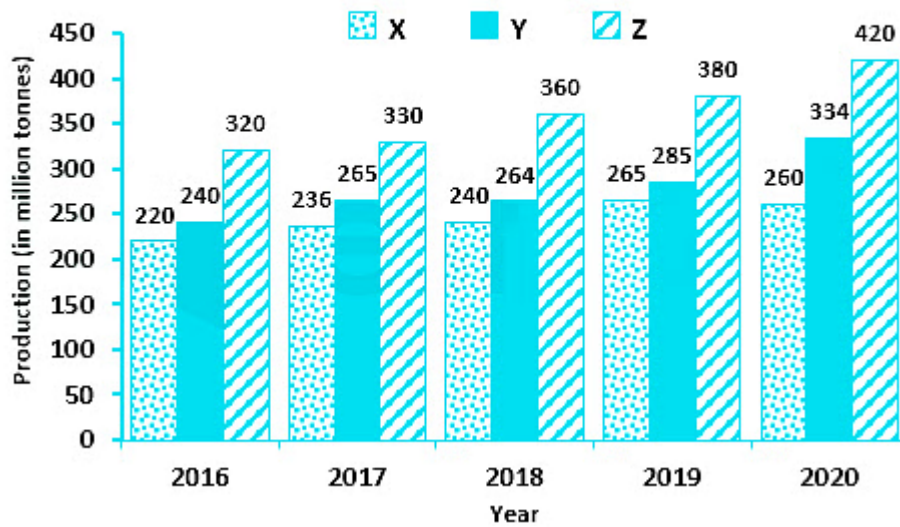
b. 2268

c. 1944

d. 3888

57. Study the given graph and answer the question that follows: (+2, -0.5)

Production of fertilisers by countries X, Y and Z
from 2016 to 2020 (in million tonnes)



The average production of fertilisers by country Z in 2017, 2018 and 2020 is what percentage more than the average production of fertilisers by country X in 2018 and 2020?

- a. 45%
- b. 32.4%
- c. 48%
- d. 49.6%

58. What is the difference (in Rs.) between the interests on Rs. 50,000 for one year at 8% per annum compounded half yearly and yearly? (+2, -0.5)

- a. 100
- b. 80
- c. 70
- d. 50

59. The radius of the base of a cylindrical tank is 4 m. If three times the sum of the areas of its two circular faces is twice the area of its curved surface, then the capacity (in kilolitres) of the tank is: (+2, -0.5)
- a. 54π
 - b. 96π
 - c. 144π
 - d. 108π
60. 4 men and 5 women can complete a work in 15 days, whereas 9 men and 6 women can complete it in 10 days. To complete the same work in 7 days, how many women should assist 4 men? (+2, -0.5)
- a. 14
 - b. 11
 - c. 15
 - d. 13
61. The radius of a solid right circular cone is 36 cm and its height is 105 cm. The total surface area (in cm^2) of the cone is: (+2, -0.5)
- a. 3969π
 - b. 4296π
 - c. 5292π
 - d. 3996π

62. The income of A is 80% of B's income and the expenditure of A is 60% of B's expenditure. If the income of A is equal to 90% of B's expenditure, then by what percentage are the savings of A more than B's savings? (+2, -0.5)

- a. 140%
- b. 125%
- c. 100%
- d. 150%

63. S and T are points on the sides PQ and PR, respectively, of ΔPQR such that $PS \times PR = PQ \times PT$. If $\angle Q = 96^\circ$ and $\angle PST = \angle PRQ + 34^\circ$, then $\angle QPR = ?$ (+2, -0.5)

- a. 25°
- b. 26°
- c. 22°
- d. 24°

64. If $3 \tan \theta = 2\sqrt{3} \sin \theta$, $0^\circ < \theta < 90^\circ$, then the value of $\frac{\cos^2 2\theta + \cot^2 2\theta}{\sin^2 \theta + \tan^2 2\theta}$ is: (+2, -0.5)

- a. $\frac{20}{39}$
- b. $\frac{20}{27}$
- c. $\frac{4}{13}$
- d. $\frac{4}{3}$

65. A trader gains 25% by selling an article with 20% discount on its marked price. If the cost price of the article increases by 30%, then how much discount (in %) should he offer on the same marked price to gain 15% of profit? (+2, -0.5)

- a. 5.08%
- b. 4.87%
- c. 4.32%
- d. 5.12%

66. If an article is sold for Rs. 355, there is a loss of 29%. At what price (in Rs.) should it be sold to gain 31% of profit? (+2, -0.5)

- a. 625
- b. 675
- c. 655
- d. 635

67. The value of $\frac{3(\cot^2 47^\circ - \sec^2 43^\circ) - 2(\tan^2 23^\circ - \cos^2 67^\circ)}{\cos^2(68^\circ + \theta) - \tan(\theta + 61^\circ) - \tan^2(22^\circ - \theta) + \cot(29^\circ - \theta)}$ is: (+2, -0.5)

- a. -1
- b. 0
- c. 5
- d. 1

68. What is the area (in unit squares) of the region enclosed by the graphs of the equations (+2, -0.5)

$$2x - 3y + 6 = 0, 4x + y = 16 \text{ and } y = 0?$$

- a. 14
- b. 11.5
- c. 10.5
- d. 12

69. A tap can fill a tank in $5\frac{1}{2}$ hours. Because of a leak, it took $8\frac{1}{4}$ hours to fill the tank. In how much time (in hours) will the leak alone empty 30% of the tank? (+2, -0.5)

- a. $\frac{17}{2}$
- b. $\frac{5}{2}$
- c. $\frac{9}{2}$
- d. $\frac{99}{20}$

70. A saves 35% of his income. If his income increases by 20.1% and his expenditure increases by 20%, then by what percentage do his savings increase or decrease? (correct to one decimal place) (+2, -0.5)

- a. 20.3% of increase
- b. 19.75% of decrease
- c. 18.5% of decrease

d. 21.9% of increase

71. The value of $(2\frac{6}{7} \text{ of } 4\frac{1}{5} \div \frac{2}{3}) \times 5\frac{1}{9} \div (\frac{3}{4} \times 2\frac{2}{3} \text{ of } \frac{1}{2} \div \frac{1}{4})$ is: (+2, -0.5)

a. 19

b. 23

c. 25

d. 21

72. The income of A is $\frac{2}{3}$ of B's income and the expenditure of A is $\frac{3}{4}$ of B's expenditure. If $\frac{1}{3}$ of the income of B is equal to the expenditure of A, then the ratio of the savings of A to those of B is: (+2, -0.5)

a. 5 : 3

b. 4 : 3

c. 3 : 5

d. 3 : 4

73. If a, b and c are positive numbers such that $(a^2 + b^2) : (b^2 + c^2) : (c^2 + a^2) = 34 : 61 : 45$, then $b - a : c - b : c - a =$ _____ (+2, -0.5)

a. 1 : 2 : 3

b. 3 : 1 : 2

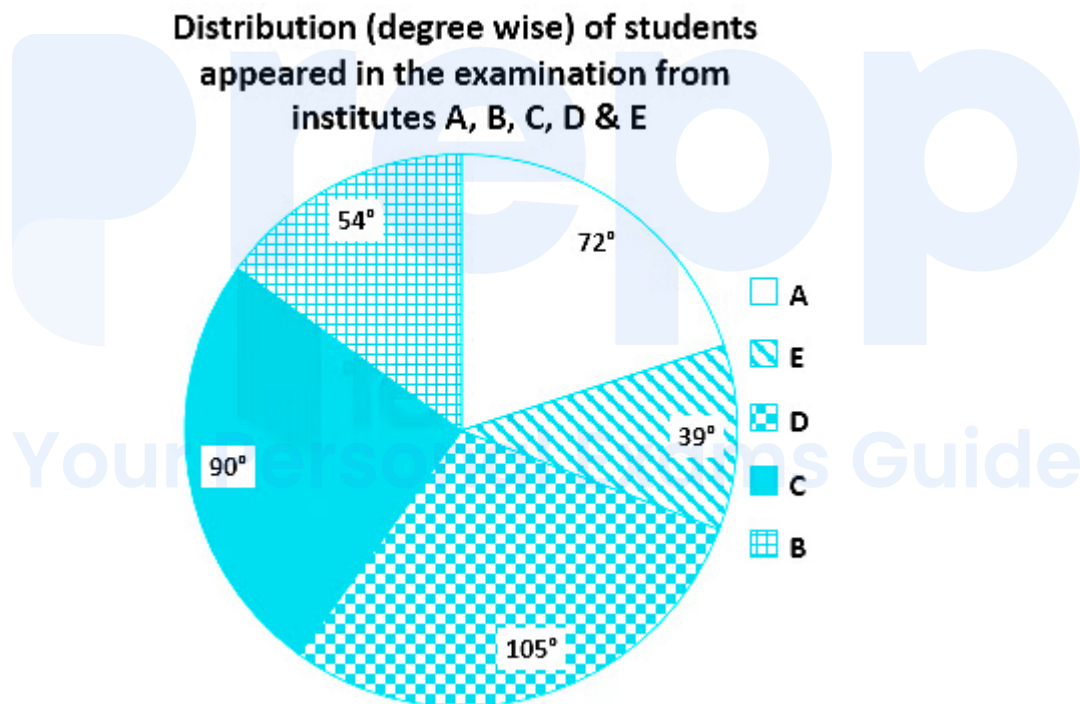
c. 2 : 1 : 3

d. 3 : 2 : 1

74. Let $x = (433)^{24} - (377)^{38} + (166)^{54}$. What is the units digit of x ? (+2, -0.5)

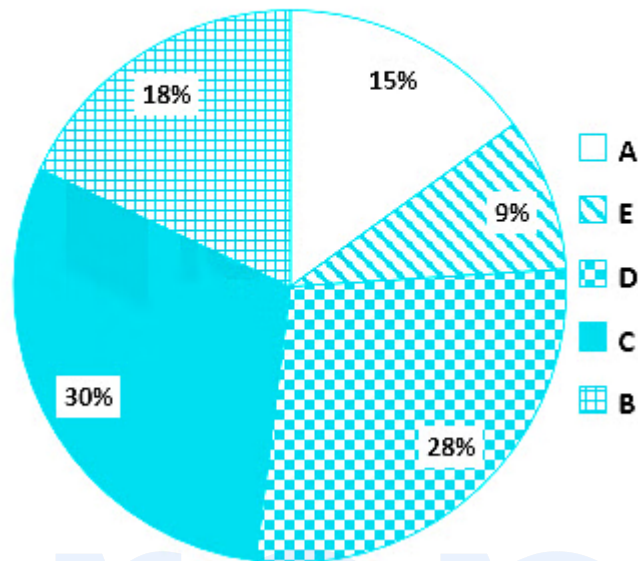
- a. 7
- b. 6
- c. 8
- d. 9

75. Study the given pie charts and answer the question that follows. (+2, -0.5)



Total Number of Students appeared = 1200

Distribution of students (percent wise)
passed the examination from
institutes A, B, C, D and E



Total Number of Students passed = 900

The number of students who passed the examination from institute C is what percentage of the total number of students who appeared from institutes D and E?

- a. 52.1%
- b. 56.25%
- c. 54.25%
- d. 58.3%

76. The surface area of a sphere is 221.76 cm^2 . Its volume (in cm^3) is (correct to one decimal place):

(Take $\pi = \frac{22}{7}$)

- a. 289.8

- b. 315.6
- c. 280.4
- d. 310.5

77. The value of $\frac{1}{4} + \frac{[(20.35)^2 - (8.35)^2] \times 0.0175}{(1.05)^2 + (1.05)(27.65)}$ is: (+2, -0.5)

- a. $\frac{9}{20}$
- b. $\frac{3}{10}$
- c. $\frac{7}{20}$
- d. $\frac{3}{20}$

78. The angle of elevation of the top of a tower $25\sqrt{3}$ m high from two points on the level ground on its opposite sides are 45° and 60° . What is the distance (in m) between the two points (correct to one decimal place)? (+2, -0.5)

- a. 58.4
- b. 68.3
- c. 50.6
- d. 45.3

79. O is a point in the interior of $\triangle ABC$ such that $OA = 12$ cm, $OC = 9$ cm, $\angle AOB = \angle BOC = \angle COA$ and $\angle ABC = 60^\circ$. What is the length (in cm) of OB? (+2, -0.5)

- a. $6\sqrt{2}$
- b. $4\sqrt{6}$

c. $6\sqrt{3}$

d. $4\sqrt{3}$

80. In $\triangle ABC$, $\angle B = 78^\circ$, AD is bisector of $\angle A$ meeting BC at D, and $AE \perp BC$ at E. (+2, -0.5)
If $\angle DAE = 24^\circ$, then the measure of $\angle ACB$ is:

a. 38°

b. 42°

c. 30°

d. 32°

81. $\left(\frac{\tan^3 \theta}{\sec^2 \theta} + \frac{\cot^3 \theta}{\csc^2 \theta} + 2 \sin \theta \cos \theta \right) \div (1 + \operatorname{cosec}^2 \theta + \tan^2 \theta)$, $0^\circ < \theta < 90^\circ$ is equal (+2, -0.5)
to:

a. $\sec \theta$

b. $\operatorname{cosec} \theta \sec \theta$

c. $\sin \theta \cos \theta$

d. $\operatorname{cosec} \theta$

82. Let $0^\circ < \theta < 90^\circ$. $(1 + \cot^2 \theta)(1 + \tan^2 \theta) \times (\sin \theta - \operatorname{cosec} \theta)(\cos \theta - \sec \theta)$ (+2, -0.5)
is equal to:

a. $\sec \theta + \operatorname{cosec} \theta$

b. $\sin \theta \cos \theta$

c. $\sin \theta + \cos \theta$

d. $\sec \theta \operatorname{cosec} \theta$

83. Three fractions x , y and z are such that $x > y > z$. When the smallest of them is divided by the greatest, the result is $\frac{9}{16}$, which exceeds y by 0.0625. If $x + y + z = 2\frac{3}{12}$, then what is the value of $x + z$? (+2, -0.5)

a. $\frac{7}{4}$

b. $\frac{3}{4}$

c. $\frac{1}{4}$

d. $\frac{5}{4}$

84. If $a + b = 8$, $ab = 10$, then the value of $a^3 + b^3$ is: (+2, -0.5)

a. 111

b. 215

c. 272

d. 312

85. One cup has juice and water in the ratio 5 : 2, while another cup of the same capacity has them in the ratio 7 : 4, respectively. If contents of both the cups (when full) are poured in a vessel, then what will be the final ratio of water to juice in the vessel? (+2, -0.5)

a. 25 : 26

b. 25 : 52

c. 26 : 25

d. $52 : 25$

86. The volume of a solid cylinder is 2002 cm^3 and its height is 13 cm. What is the area (in cm^2) of its base? (+2, -0.5)

(Take $\pi = \frac{22}{7}$)

a. 154

b. 308

c. 77

d. 231

87. The sum of and difference between the LCM and HCF of two numbers are 512 and 496, respectively. If one number is 72, then the other number is: (+2, -0.5)

a. 56

b. 40

c. 80

d. 64

88. The value of $(1\frac{1}{3} \div 2\frac{6}{7} \text{ of } 5\frac{3}{5}) \times (6\frac{2}{5} \div 4\frac{1}{2} \text{ of } 5\frac{1}{3}) \div (\frac{3}{4} \times 2\frac{2}{3} \div \frac{5}{9} \text{ of } 1\frac{1}{5}) = k$, where k lies between: (+2, -0.5)

a. 0.007 and 0.008

b. 0.7 and 0.8

c. 0.0007 and 0.0008

d. 0.07 and 0.08

89. In $\triangle LMN$, $LM = 5\sqrt{2}$ cm, $LN = 13$ cm and $\angle LMN = 135^\circ$. What is the length (in cm) of MN ? (+2, -0.5)

a. $7\sqrt{2}$

b. 8

c. 7

d. $8\sqrt{2}$

90. A and B can do a work in $26\frac{2}{3}$ days. B and C together can complete the same work in 48 days, while A and C together can complete the same work in 30 days. How long (in days) will A alone take to complete 60% of the work? (+2, -0.5)

a. 20

b. 24

c. 32

d. 36

91. If $a + b + c = 1$, $ab + bc + ca = -22$ and $abc = -40$, then what is the value of $a^3 + b^3 + c^3$? (+2, -0.5)

a. -53

b. 27

c. 67

d. -51

92. When the price of an item was reduced by 20%, its sale increased by x%. If there is an increase of 25% in receipt of the revenue, then the value of x is: (+2, -0.5)

a. 54.35

b. 55.35

c. 57.75

d. 56.25

93. The numbers of students in section A and section B of a class are 50 and 62, respectively. The average score in mathematics of all the students is 75. If the average score of students in section A is 20% more than that of students in section B, then what is the average score of students in section A (correct to one decimal place)? (+2, -0.5)

a. 84.3

b. 82.6

c. 85.7

d. 87.5

94. $\frac{1+\cos\theta-\sin^2\theta}{\sin\theta(1+\cos\theta)} \times \frac{\sqrt{\sec^2\theta+\operatorname{cosec}^2\theta}}{\tan\theta+\cot\theta}$, $0^\circ < \theta < 90^\circ$, is equal to: (+2, -0.5)

a. $\cot\theta$

b. $\tan\theta$

c. $\operatorname{cosec}\theta$

d. $\sec \theta$

95. A person marks an article 36% above the cost price and offers 30% discount on the marked price. What is the loss or gain percentage? (+2, -0.5)

- a. Loss 6.5%
 - b. Loss 4.8%
 - c. Gain 8.5%
 - d. Gain 7.2%
-

96. A loan is to be returned in two equal yearly instalments. If the rate of interest is 10% p.a. compounded annually and each instalment is Rs. 5,808, then 60% of the total interest (nearest to a Rs.) charged in this scheme is: (+2, -0.5)

- a. 913
 - b. 911
 - c. 917
 - d. 922
-

97. If the amount obtained by A by investing Rs. 9,100 for three years at a rate of 10% p.a. on simple interest is equal to the amount obtained by B by investing a certain sum of money for five years at a rate of 8% p.a. on simple interest, then 90% of the sum invested by B (in Rs.) is: (+2, -0.5)

- a. 8,540
- b. 8,450

c. 7,800

d. 7,605

98. The radius of a spherical balloon is inflated from 3.5 cm to 4.9 cm by pushing air into it. What is the percentage increase in the volume of the original balloon? (+2, -0.5)

a. 174.4%

b. 73.6%

c. 74.4%

d. 173.6%

99. If $7 \sin^2 \theta + 4 \cos^2 \theta = 5$ and θ lies in the first quadrant, then what is the value of $\frac{\sqrt{3} \sec \theta + \tan \theta}{\sqrt{2} \cot \theta - \sqrt{3} \cos \theta}$? (+2, -0.5)

a. $3\sqrt{2}$

b. $2(\sqrt{2} - 1)$

c. $4\sqrt{2}$

d. $2(1 + \sqrt{2})$

100. If $x = \sqrt{1 + \frac{\sqrt{3}}{2}} - \sqrt{1 - \frac{\sqrt{3}}{2}}$, then the value of $\frac{\sqrt{3}-x}{\sqrt{3}+x}$ (corrected to two decimal places) is: (+2, -0.5)

a. 0.25

b. 0.27

c. 0.17

d. 0.19

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Answers

1. Answer: b

Explanation:

Given:

The selling price of 7 articles = The cost price of 8 articles

Formula used:

$$\text{Gain} = \text{SP} - \text{CP}$$

$$\text{Gain\%} = \text{Gain}/\text{CP} \times 100$$

Calculation:

The selling price of 7 articles = The cost price of 8 articles

$$\Rightarrow \frac{\text{SP}}{\text{CP}} = \frac{8}{7}$$

Now,

The selling price of an article = Rs. 8

The cost price of an article = Rs. 7

$$\text{Gain} = \text{SP} - \text{CP}$$

$$\Rightarrow \text{Rs. } (8 - 7) = \text{Rs. } 1$$

$$\text{Gain\%} = \left(\frac{1}{7} \times 100 \right)$$

$$\Rightarrow \frac{100}{7}$$

$$\Rightarrow 14.3\%$$

$\therefore$ The required profit% is 14.3%

2. Answer: c

Explanation:

★ Shortcut Trick

$$2x^2 + 5x + 1 = 0$$

Dividing the number by $2x$, we get

$$\Rightarrow x + \frac{5x}{2x} + \frac{1}{2x} = 0$$

$$\Rightarrow x + \frac{1}{2x} = -\frac{5}{2}$$

Using the formula $(a - b)^2 = (a + b)^2 - 4ab$, we get

$$\left(x - \frac{1}{2x}\right)^2 = \left(x + \frac{1}{2x}\right)^2 - 4 \cdot x \cdot \frac{1}{2x}$$

$$\Rightarrow \left(x - \frac{1}{2x}\right)^2 = \left(-\frac{5}{2}\right)^2 - 2$$

$$\Rightarrow \left(x - \frac{1}{2x}\right) = \pm \sqrt{\frac{17}{4}}$$

$\therefore$ The required value is $\frac{\sqrt{17}}{2}$.

★ Alternate Method

Given:

$$2x^2 + 5x + 1 = 0$$

Formula used:

$$(a + b)^2 = a^2 + b^2 + 2ab$$

$$(a - b)^2 = a^2 + b^2 - 2ab$$

Calculation:

$$2x^2 + 5x + 1 = 0$$

Dividing the number by $2x$, we get

$$\Rightarrow x + \frac{5x}{2x} + \frac{1}{2x} = 0$$

$$\Rightarrow x + \frac{1}{2x} = -\frac{5}{2}$$

Now, squaring both sides, we get

$$\Rightarrow \left(x + \frac{1}{2x}\right)^2 = \left(-\frac{5}{2}\right)^2$$

$$\Rightarrow x^2 + \frac{1}{4x^2} + 2 \cdot x \cdot \frac{1}{2x} = \frac{25}{4}$$

$$\Rightarrow x^2 + \frac{1}{4x^2} + 1 = \frac{25}{4}$$

$$\Rightarrow x^2 + \frac{1}{4x^2} = \frac{21}{4} \quad \text{----- (i)}$$

Now, According to the formula

$$(a - b)^2 = a^2 + b^2 - 2ab$$

$$\left(x - \frac{1}{2x}\right)^2 = x^2 + \frac{1}{4x^2} - 2 \cdot x \cdot \frac{1}{2x}$$

$$\Rightarrow \left(x - \frac{1}{2x}\right)^2 = \left(\frac{21}{4} - 1\right) \quad [\text{from (i)}]$$

$$\Rightarrow \left(x - \frac{1}{2x}\right)^2 = \frac{21-4}{4}$$

$$\Rightarrow \left(x - \frac{1}{2x}\right)^2 = \frac{17}{4}$$

$$\Rightarrow x - \frac{1}{2x} = \pm \frac{\sqrt{17}}{2}$$

$\therefore$ The required value is $\frac{\sqrt{17}}{2}$.

3. Answer: b

Explanation:

★ Shortcut Trick

Ratio of investment $\times$ Ratio of time = Ratio of profit

So, Ratio of investment $\times (12 : 8 : 6) = (1 : 4 : 5)$

$\Rightarrow$ Ratio of investment $= (1 : 4 : 5) \div (6 : 4 : 3) = 1/6 : 4/4 : 5/3$

$\Rightarrow$ Ratio of investment $= 1/6 : 4/4 : 5/3$

$\Rightarrow$ Ratio of investment $= 1 : 6 : 10$

According to the question

1 unit = 54000 [A's investment]

16 unit [B + C]'s investment $= 16 \times 54000$

$\therefore$ [B + C]'s investment $= 864000$

★ Alternate Method

Given:

A started a business with a capital = Rs. 54,000

The ratio of the profit $= 1 : 4 : 5$

Calculation:

Let the capital of B be x and C be y respectively

B invested his capitals $= (12 - 4) = 8$ months

C invested his capitals $= (12 - 6) = 6$ months

Now,

According to the question

$$\Rightarrow \frac{54000 \cdot 12}{x \cdot 8} = \frac{1}{4}$$

$$\Rightarrow x = \frac{54000 \cdot 12 \cdot 4}{8}$$

$$\Rightarrow x = (54,000 \times 6)$$

$$\Rightarrow x = 3,24,000$$

Similarly

$$\Rightarrow \frac{54000.12.}{y.6} = \frac{1}{5}$$

$$\Rightarrow y = \frac{54000.12.5}{6}$$

$$\Rightarrow y = (54,000 \times 10)$$

$$\Rightarrow y = 5,40,000$$

Now,

The sum of the capitals invested by B and C = Rs. (3,24,000 + 5,40,000)

$$\Rightarrow \text{Rs. } 8,64,000$$

$\therefore$ The required sum of the capitals invested by B and C is Rs. 8,64,000

4. Answer: d

Explanation:

Given:

The volume of a solid hemisphere = $19,404 \text{ cm}^3$

Formula used:

Volume of hemisphere = $\frac{2}{3}\pi r^3$

Total surface area of hemisphere = $3\pi r^2$

Calculation:

The volume of a solid hemisphere = $19,404 \text{ cm}^3$

$$\frac{2}{3}\pi r^3 = 19,404$$

$$\Rightarrow \frac{2}{3} \times \frac{22}{7} \times r^3 = 19,404$$

$$\Rightarrow 44r^3/21 = 19,404$$

$$\Rightarrow r^3/21 = 441$$

$$\Rightarrow r^3 = 441 \times 21$$

$$\Rightarrow r^3 = 9,261$$

$$\Rightarrow r = 21 \text{ cm}$$

Now,

$$\text{Total surface area of hemisphere} = (3 \times 22/7 \times 21 \times 21) \text{ cm}^2$$

$$\Rightarrow (3 \times 22 \times 3 \times 21) \text{ cm}^2$$

$$\Rightarrow 4158 \text{ cm}^2$$

$\therefore$ The required surface area is 4158 cm^2

5. Answer: b

Explanation:

★ Shortcut Trick

Hit and Trial method $2x - y = 2$ and $xy = \frac{3}{2}$

If we take $y = 1$ and $x = 3/2$ we get both the equation satisfied

So, $x = 3/2$ and $y = 1$

Now, we have to find the value of $x^3 - \frac{y^3}{8}$

$$(3/2)^3 - 1^3/8$$

$$\Rightarrow 27/8 - 1/8 = 26/8 = 13/4$$

$\therefore$ The required value is $\frac{13}{4}$

★ Alternate Method

Given:

$$2x - y = 2$$

$$xy = \frac{3}{2}$$

Formula used:

$$(a - b)^3 = a^3 - b^3 - 3ab(a - b)$$

Calculation:

$$2x - y = 2$$

Dividing the equation by 2, we get

$$\Rightarrow \left(x - \frac{y}{2}\right) = 1 \quad \dots(1)$$

Cubing both sides, we get

$$\Rightarrow \left(x - \frac{y}{2}\right)^3 = 1^3$$

$$\Rightarrow x^3 - \frac{y^3}{8} - \frac{3xy}{2} \times \left(x - \frac{y}{2}\right) = 1$$

$$\Rightarrow x^3 - \frac{y^3}{8} = 1 + \frac{3}{2} \times xy$$

$$\Rightarrow x^3 - \frac{y^3}{8} = 1 + \frac{3}{2} \times \frac{3}{2}$$

$$\Rightarrow x^3 - \frac{y^3}{8} = 1 + \frac{9}{4}$$

$$\Rightarrow x^3 - \frac{y^3}{8} = \frac{4+9}{4}$$

$$\Rightarrow x^3 - \frac{y^3}{8} = \frac{13}{4}$$

∴ The required value is $\frac{13}{4}$

6. Answer: d

Explanation:

Given:

$$0.4\overline{6} + 0.7\overline{23} - 0.3\overline{9} \times 0.\overline{7}$$

Calculation:

$$0.4\overline{6} + 0.7\overline{23} - 0.3\overline{9} \times 0.\overline{7}$$

$$\Rightarrow \frac{46-4}{90} + \frac{723-7}{990} - \frac{39-3}{90} \times \frac{7}{9}$$

$$\Rightarrow \frac{42}{90} + \frac{716}{990} - \left(\frac{36}{90} \times \frac{7}{9} \right)$$

$$\Rightarrow \frac{42}{90} + \frac{716}{990} - \frac{28}{90}$$

$$\Rightarrow \frac{462+716-308}{990}$$

$$\Rightarrow \frac{1178-308}{990}$$

$$\Rightarrow \frac{870}{990}$$

$$\Rightarrow 0.87878787.....$$

$\therefore$ The required value is $0.\overline{87}$

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7. Answer: c

Explanation:

Given:

$$\angle A = 66^\circ$$

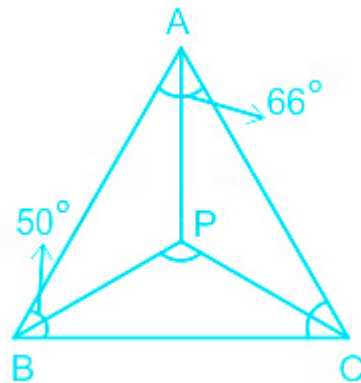
$$\angle B = 50^\circ$$

The bisectors of $\angle B$ and $\angle C$ meet at P

Concept used:

Angle Bisector Theorem – The relative lengths of the two segments that a triangle's side is divided into by a line that bisects the opposite angle

Calculation:



We know that the sum of all the sides of the triangle is 180°

$$\Rightarrow \angle A + \angle B + \angle C = 180^\circ$$

$$\Rightarrow 66^\circ + 50^\circ + \angle C = 180^\circ$$

$$\Rightarrow 116^\circ + \angle C = 180^\circ$$

$$\Rightarrow \angle C = (180^\circ - 116^\circ)$$

$$\Rightarrow \angle C = 64^\circ$$

Now,

By Angle Bisector theorem,

$$\Rightarrow \angle BPC = 90^\circ + \angle A/2$$

$$\Rightarrow \angle BPC = 90^\circ + 66/2$$

$$\Rightarrow \angle BPC = 90^\circ + 33^\circ$$

$$\Rightarrow \angle BPC = 123^\circ$$

Again,

$$\angle PCA = \angle C/2$$

$$\Rightarrow \angle PCA = 64/2$$

$$\Rightarrow \angle PCA = 32^\circ$$

Now,

$$\text{The value of } \angle BPC - \angle PCA = (123^\circ - 32^\circ)$$

$$\Rightarrow 91^\circ$$

$\therefore$ The required value is 91°

8. Answer: d

Explanation:

Given:

The base of right pyramid is an equilateral triangle, each side, $(a) = 20$ cm

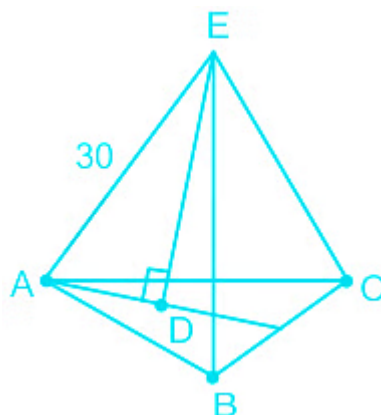
Each slant edge, $(l) = 30$ cm

Concept used:

Circumradius of the equilateral triangle $(r) = \frac{a}{\sqrt{3}}$

$$h = \sqrt{l^2 - r^2}$$

Calculation:



According to the question

Each side of an equilateral triangle = 20 cm

We know that, Circumradius of the equilateral triangle = $\frac{a}{\sqrt{3}}$

$$\Rightarrow AD = \frac{20}{\sqrt{3}} \text{ cm}$$

Now,

$$h = \sqrt{(AE^2 - AD^2)}$$

$$h = \sqrt{[30^2 - (\frac{20}{\sqrt{3}})^2]}$$

$$\Rightarrow h = \sqrt{[(900 - \frac{400}{3})]}$$

$$\Rightarrow h = \sqrt{\frac{2700-400}{3}}$$

$$\Rightarrow h = \sqrt{\frac{2300}{3}}$$

$$\Rightarrow h = 10\sqrt{\frac{23}{3}} \text{ cm}$$

$\therefore$ The vertical height of the pyramid is $10\sqrt{\frac{23}{3}}$ cm.

9. Answer: a

Explanation:

Given:

$$847 \times 385 \times 675 \times 3025 = 3^a \times 5^b \times 7^c \times 11^d$$

Calculation:

We can write the above numbers as

$$847 = 11 \times 11 \times 7 = 11^2 \times 7^1$$

$$385 = 5^1 \times 7^1 \times 11^1$$

$$675 = 3 \times 3 \times 3 \times 5 \times 5 = 3^3 \times 5^2$$

$$3025 = 5 \times 5 \times 11 \times 11 = 5^2 \times 11^2$$

Now, we have

$$847 \times 385 \times 675 \times 3025 = 3^a \times 5^b \times 7^c \times 11^d$$

$$\Rightarrow 11^2 \times 7^1 \times 5^1 \times 7^1 \times 11^1 \times 3^3 \times 5^2 \times 5^2 \times 11^2 = 3^a \times 5^b \times 7^c \times 11^d$$

$$\Rightarrow 3^3 \times 5^5 \times 7^2 \times 11^5 = 3^a \times 5^b \times 7^c \times 11^d$$

On comparing we get

$$\Rightarrow a = 3, b = 5, c = 2 \text{ and } d = 5$$

Now, We have to find the value of $ab - cd$

$$\Rightarrow (3 \times 5 - 2 \times 5)$$

$$\Rightarrow (15 - 10)$$

$$\Rightarrow 5$$

$\therefore$ The required value is 5.

10. Answer: d

Explanation:

Given:

Discount is offered on the price of an article if the payment is made online = 10%

An additional discount is given to credit card holders = 5%

CP of watch by paying online through credit card = Rs. 60,000

Calculation:

CP of watch by paying online through credit card = Rs. 60,000

Discount is offered on the price of an article if the payment is made online = 10%

$$\Rightarrow \text{Rs. } (60,000 \times 90/100)$$

$$\Rightarrow \text{Rs. } 54,000$$

Now,

An additional discount is given to credit card holders = 5%

$$\Rightarrow \text{Rs. } (54,000 \times 95/100)$$

$$\Rightarrow \text{Rs. } 51,300$$

$\therefore$ The required money he need to pay is Rs. 51,300

11. Answer: b

Explanation:

Given:

$$1 + 2\tan^2\theta + 2\sin\theta \sec^2\theta = a/b$$

Formula used:

$$(1 + \tan^2\theta) = \sec^2\theta$$

$$\sec\theta = 1/\cos\theta$$

$$\tan\theta = \sin\theta/\cos\theta$$

Calculation:

$$1 + 2\tan^2\theta + 2\sin\theta \sec^2\theta = a/b$$

$$\Rightarrow 1 + \tan^2\theta + \tan^2\theta + 2\sin\theta \times \sec\theta \times \sec\theta = a/b$$

$$\Rightarrow \sec^2\theta + \tan^2\theta + 2\sin\theta \times 1/\cos\theta \times \sec\theta = a/b$$

$$\Rightarrow \sec^2\theta + \tan^2\theta + 2\tan\theta \times \sec\theta = a/b$$

$$\Rightarrow (\sec\theta + \tan\theta)^2 = a/b \quad [(a + b)^2 = a^2 + b^2 + 2ab]$$

We know that, the reciprocal of $(\sec\theta + \tan\theta) = 1/(\sec\theta - \tan\theta)$

So,

$$\Rightarrow (\sec\theta + \tan\theta) \times 1/(\sec\theta - \tan\theta) = a/b$$

$$\Rightarrow (\sec\theta + \tan\theta)/(\sec\theta - \tan\theta) = a/b$$

Now, By componendo and dividendo method,

$$\Rightarrow (\sec\theta + \tan\theta + \sec\theta - \tan\theta)/(\sec\theta + \tan\theta - \sec\theta + \tan\theta)$$

$$\Rightarrow (\sec\theta + \sec\theta)/(\tan\theta + \tan\theta)$$

$$\Rightarrow (2\sec\theta/2\tan\theta)$$

$$\Rightarrow \sec\theta/\tan\theta$$

$$\Rightarrow (1/\cos\theta)/\sin\theta/\cos\theta$$

$$\Rightarrow (1/\cos\theta \times \cos\theta/\sin\theta)$$

$$\Rightarrow 1/\sin\theta$$

$$\Rightarrow \operatorname{cosec}\theta$$

$\therefore$ The required value is $\operatorname{cosec}\theta$

★ Shortcut Trick

Concept used:

By Value putting method

Calculation:

If we put the value of $\theta = 30^\circ$

Then,

$$1 + 2\tan^2 \theta + 2\sin\theta \sec^2 \theta = \frac{a}{b}$$

$$\Rightarrow 1 + 2\tan^2 30^\circ + 2\sin 30^\circ \sec^2 30^\circ = \frac{a}{b}$$

$$\Rightarrow 1 + 2 \times \left(\frac{1}{\sqrt{3}}\right)^2 + 2 \times \frac{1}{2} \times \left(\frac{2}{\sqrt{3}}\right)^2 = \frac{a}{b}$$

$$\Rightarrow 1 + 2 \times \frac{1}{3} + \frac{4}{3} = \frac{a}{b}$$

$$\Rightarrow 1 + \frac{2}{3} + \frac{4}{3} = \frac{a}{b}$$

$$\Rightarrow \frac{(3 + 2 + 4)}{3} = \frac{a}{b}$$

$$\Rightarrow \frac{9}{3} = \frac{a}{b}$$

$$\Rightarrow \frac{a}{b} = \frac{3}{1}$$

Now,

By componendo and dividendo method,

$$\Rightarrow \frac{a+b}{a-b} = \frac{(3+1)}{(3-1)}$$

$$\Rightarrow \frac{4}{2} = \frac{4}{2}$$

$$\Rightarrow 2$$

Now,

We know that the value of $\operatorname{cosec} 30^\circ = 2$

$\therefore$ The required value is $\operatorname{cosec} \theta$

12. Answer: d

Explanation:

Given:

$$\frac{22\sqrt{2}}{4\sqrt{2}-\sqrt{3+\sqrt{5}}} = a + \sqrt{5}b$$

Formula used:

$$(a + b)^2 = a^2 + b^2 + 2ab$$

Calculation:

$$\frac{22\sqrt{2}}{4\sqrt{2}-\sqrt{3+\sqrt{5}}}$$

Multiplying and Dividing the number $\sqrt{3 + \sqrt{5}}$ by 2, we get:

$$\Rightarrow \frac{(22\sqrt{2})}{4\sqrt{2}-\sqrt{\left(\frac{2(3+\sqrt{5})}{2}\right)}}$$

$$\Rightarrow \frac{(22\sqrt{2})}{4\sqrt{2}-\sqrt{\left(\frac{6+2\sqrt{5}}{2}\right)}}$$

$$\because (\sqrt{5} + 1)^2 = 6 + 2\sqrt{5}$$

$$\Rightarrow \frac{(22\sqrt{2})}{4\sqrt{2}-\sqrt{\left(\frac{(\sqrt{5}+1)^2}{2}\right)}}$$

$$\Rightarrow \frac{(22\sqrt{2})}{4\sqrt{2}-\frac{(\sqrt{5}+1)}{\sqrt{2}}}$$

$$\Rightarrow \frac{22\sqrt{2}}{\frac{(4\sqrt{2}\sqrt{2}-\sqrt{5}-1)}{\sqrt{2}}}$$

$$\Rightarrow \frac{22\sqrt{2} \times \sqrt{2}}{(8-\sqrt{5}-1)}$$

$$\Rightarrow \frac{44}{7-\sqrt{5}}$$

On rationalizing we get

$$\Rightarrow \frac{44}{7-\sqrt{5}} \times \frac{(7+\sqrt{5})}{(7+\sqrt{5})}$$

$$\Rightarrow \frac{44(7+\sqrt{5})}{7^2-5}$$

$$\Rightarrow \frac{44(7+\sqrt{5})}{44}$$

$$\Rightarrow 7 + \sqrt{5}$$

comparing the value with $a + \sqrt{5}b$

$$\Rightarrow 7 + \sqrt{5} = a + \sqrt{5}b$$

$$\Rightarrow a = 7 \text{ and } b = 1$$

Now, The value of $(ab) : (a + b)$

$$\Rightarrow (7 \times 1) : (7 + 1)$$

$$\Rightarrow 7 : 8$$

$\therefore$ The required value is $7 : 8$.

13. Answer: b

Explanation:

★ Shortcut Trick

$\because$ Distance is constant

So, Speed is inversely proportional to Time

$$\text{Speed Ratio} = 11/2 : 4 = 11 : 8$$

$$\text{Time Ratio} = 8 : 11$$

According to the question

$$\text{Total time} = 19/4 \text{ hours}$$

$$\text{So, } (8 + 11) \text{ unit} \rightarrow 19/4 \text{ hours}$$

$$1 \text{ unit} \rightarrow 1/4 \text{ hour}$$

$$8 \text{ unit} \rightarrow 2 \text{ hours}$$

$$\text{Now, Distance} = \text{Speed} \times \text{Time}$$

Distance of one side = $(11/2) \times 2 = 11$ km

$\therefore$ Total distance = $11 \times 2 = 22$ km.

★ Alternate Method

Given:

Speed of students goes to school = $5\frac{1}{2} = 11/2$ km/h

Speed of students in returns = 4 km/h

Time taken to complete the entire journey = $4\frac{3}{4} = 19/4$ hours

Formula used:

Distance = Speed $\times$ Time

Calculation:

Let the distance be D km

According to the question

$$\Rightarrow D/(11/2) + D/4 = 19/4$$

$$\Rightarrow 2D/11 + D/4 = 19/4$$

$$\Rightarrow (8D + 11D)/44 = 19/4$$

$$\Rightarrow 19D/44 = 19/4$$

$$\Rightarrow D = 11$$

Now,

Total time taken = Time taken to going school + Time taken to return

$$\Rightarrow (11 + 11) \text{ km}$$

$$\Rightarrow 22 \text{ km}$$

$\therefore$ The total distance covered by the student is 22 km

14. Answer: c

Explanation:

Calculation:

Total number of students passed = 900

The students passed in the examination from institutes D = 28%

The number of students who passed the examination from institute D = $(900 \times 28/100)$

$\Rightarrow 252$

Total number of students appeared = 1200

The students appeared in the examination from institute A = 72%

$\Rightarrow (72/360 \times 1200)$

$\Rightarrow 240$

Now,

The value of $x = (252 - 240) = 12$

$\therefore$ The value of x lies between 11 and 14

15. Answer: d

Explanation:

★ Shortcut Trick

Ratio of amount = 11880 : 17820

⇒ Ratio of amount = 2 : 3

Let the rate% be R%

According to the question

Amount becomes 2 to 3 in two years

$$\text{So, } 2(1 + R/100)^2 = 3$$

$$\Rightarrow (1 + R/100)^2 = 3/2$$

Now, Let the principal be P

$$\text{So, } P(1 + R/100)^4 = 11880$$

$$\Rightarrow P(3/2)^2 = 11880$$

$$\Rightarrow P = 5280$$

$$\text{So, } P/2 = 5280/2 = 2640$$

∴ The required half of the sum is Rs. 2,640

★ Alternate Method

Given: Your Personal Exams Guide

Total amount after 4 years = Rs. 11,880

Total amount after 6 years = Rs. 17,820

Formula used:

$$A = P[1 + (R/100)]^n$$

Where, P = Principal, R = Rate of interest and n = Number of years

Calculation:

Let the sum of money be Rs. x

Total amount after 4 years = Rs. 11,880

$$\Rightarrow P[1 + (R/100)]^n = 11,880$$

$$\Rightarrow x[1 + (R/100)]^4 = 11,880 \dots(1)$$

Total amount after 6 years = Rs. 17,820

$$\Rightarrow P[1 + (R/100)]^n = 17,820$$

$$\Rightarrow x[1 + (R/100)]^6 = 17,820 \dots(2)$$

Now,

From equation (1) and (2), we get

$$\Rightarrow [1 + (R/100)]^2 = 17,820/11,880$$

$$\Rightarrow [1 + (R/100)]^2 = 3/2$$

Again from equation (1),

$$\Rightarrow 11,880/x = (3/2)^2$$

$$\Rightarrow 11,880/x = 9/4$$

$$\Rightarrow x = (11,880 \times 4/9)$$

$$\Rightarrow x = \text{Rs. } 5,280$$

Now,

The half of the sum = Rs. (5,280/2)

$$\Rightarrow \text{Rs. } 2,640$$

$\therefore$ The required half of the sum is Rs. 2,640

16. Answer: b

Explanation:**Calculation:**

The total production of fertilisers by country Y in 2017 and 2019 and by country X in 2016 = $(265 + 285 + 220) = 770$

The total production of fertilisers by country Z in 2016, 2018 and 2020 = $(320 + 360 + 420) = 1100$

Required percentage = $(770/1100 \times 100)$

$\Rightarrow (770/11)$

$\Rightarrow 70\%$

$\therefore$ The required percentage is 70%

17. Answer: b**Explanation:****Calculation:**

The number of persons weighing 55 kg or more but less than 75 kg = $(25 + 35 + 52 + 48) = 160$

The number of persons weighing 80 kg or more but less than 100 kg = $(38 + 30 + 13 + 9) = 90$

Now,

Required percentage = $[(160 - 90)/90 \times 100]$

$\Rightarrow (70/90 \times 100)$

$\Rightarrow (700/9)$

$$\Rightarrow 77.8\%$$

$\therefore$ The required percentage is 77.8%

18. Answer: a

Explanation:

Given:

The ratio of the slant height and radius of right circular cone = 29 : 20

$$\text{Volume} = 4838.4 \text{ cm}^3$$

Formula used:

$$\text{Volume of cone} = \frac{1}{3}\pi r^2 h$$

$$h^2 = l^2 - r^2$$

Calculation:

Let the ratio of the slant height and radius of right circular cone be $29x$ and $20x$ respectively

According to the question

$$h = \sqrt{l^2 - r^2}$$

$$\Rightarrow h = \sqrt{29x^2 - 20x^2}$$

$$\Rightarrow h = \sqrt{(841 - 400)x^2}$$

$$\Rightarrow h = \sqrt{441x^2}$$

$$\Rightarrow h = 21x \text{ cm}$$

Now,

Volume of cone = 4838.4π

$$\Rightarrow \left(\frac{1}{3} \times \pi \times 400x^2 \times 21x\right) = 4838.4 \pi$$

$$\Rightarrow x^3 = (172.8/100)$$

$$\Rightarrow x^3 = (1728/1000)$$

$$\Rightarrow x = 12/10$$

Now,

The radius = $20x = (20 \times 12/10)$ cm

$$\Rightarrow 24 \text{ cm}$$

$\therefore$ The required radius is 24 cm

19. Answer: c

Explanation:

Given:

$$x^2 - \sqrt{7}x + 1 = 0$$

Formula used:

$$\left(x + \frac{1}{x}\right)^2 = x^2 + \frac{1}{x^2} + \frac{2 \cdot x \cdot 1}{x}$$

$$\left(x + \frac{1}{x}\right)^3 = x^3 + \frac{1}{x^3} + \frac{3 \cdot x \cdot 1}{x} \times \left(x + \frac{1}{x}\right)$$

$$x^5 + \frac{1}{x^5} = \left(x^2 + \frac{1}{x^2}\right) \left(x^3 + \frac{1}{x^3}\right) - \left(x + \frac{1}{x}\right)$$

Calculation:

$$x^2 - \sqrt{7}x + 1 = 0$$

$$\Rightarrow x^2 + 1 = \sqrt{7}x$$

$$\Rightarrow \left(x + \frac{1}{x}\right) = \sqrt{7}$$

Now,

Squaring both sides, we get

$$\left(x + \frac{1}{x}\right)^2 = (\sqrt{7})^2$$

$$\Rightarrow x^2 + \frac{1}{x^2} + \frac{2 \cdot x \cdot 1}{x} = 7$$

$$\Rightarrow x^2 + \frac{1}{x^2} + 2 = 7$$

$$\Rightarrow x^2 + \frac{1}{x^2} = (7 - 2)$$

$$\Rightarrow x^2 + \frac{1}{x^2} = 5$$

Now,

Cubing both sides, we get

$$\left(x + \frac{1}{x}\right)^3 = (\sqrt{7})^3$$

$$\Rightarrow x^3 + \frac{1}{x^3} + \frac{3 \cdot x \cdot 1}{x} \times \left(x + \frac{1}{x}\right) = 7\sqrt{7}$$

$$\Rightarrow x^3 + \frac{1}{x^3} + 3 \times \sqrt{7} = 7\sqrt{7}$$

$$\Rightarrow x^3 + \frac{1}{x^3} + 3\sqrt{7} = 7\sqrt{7}$$

$$\Rightarrow x^3 + \frac{1}{x^3} = (7\sqrt{7} - 3\sqrt{7})$$

$$\Rightarrow x^3 + \frac{1}{x^3} = 4\sqrt{7}$$

Now,

The value of $x^5 + \frac{1}{x^5}$

$$\Rightarrow \left(x^2 + \frac{1}{x^2}\right) \left(x^3 + \frac{1}{x^3}\right) - \left(x + \frac{1}{x}\right)$$

$$\Rightarrow (5 \times 4\sqrt{7}) - \sqrt{7}$$

$$\Rightarrow 20\sqrt{7} - \sqrt{7}$$

$$\Rightarrow 19\sqrt{7}$$

$\therefore$ The required value is $19\sqrt{7}$

20. Answer: b

Explanation:

Given:

$$\angle DBC = 29^\circ$$

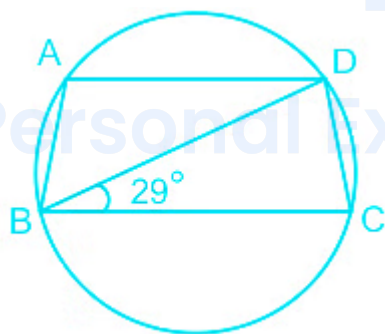
Concept used:

Angle in a semicircle is a right angle.

We know that sum of all the sides of triangles is 180°

The opposite angles in a cyclic quadrilateral is 180°

Calculation:



According to the question

$$\angle DBC = 29^\circ$$

$$\angle BDC = 90^\circ \text{ [Angle in a semicircle is } 90^\circ]$$

We know that sum of all the sides of triangles is 180°

$$\Rightarrow \angle DBC + \angle BDC + \angle BCD = 180^\circ$$

$$\Rightarrow 29^\circ + 90^\circ + \angle BCD = 180^\circ$$

$$\Rightarrow 119^\circ + \angle BCD = 180^\circ$$

$$\Rightarrow \angle BCD = (180^\circ - 119^\circ)$$

$$\Rightarrow \angle BCD = 61^\circ$$

Now,

We know that, the opposite angles in a cyclic quadrilateral is 180°

So,

$$\Rightarrow \angle BAD + \angle BCD = 180^\circ$$

$$\Rightarrow \angle BAD + 61^\circ = 180^\circ$$

$$\Rightarrow \angle BAD = (180^\circ - 61^\circ)$$

$$\Rightarrow \angle BAD = 119^\circ$$

$\therefore$ The required value of $\angle BAD$ is 119°

21. Answer: b

Explanation:

★ Shortcut Trick

$$66.66\% = 2/3$$

According to the question,

If we take saving = 3 units then

Expenditure will be 5 units

Hence, Income = 8 units

Now, from ratio method

Income $\rightarrow [25 : 36] \times (8/25)$ <--- to make Income 8 unit

Exp $\rightarrow [5 : 8]$

New Ratio after multiplying

Income $\rightarrow [8 : 288/25]$

Exp $\rightarrow [5 : 8]$

Saving $\rightarrow 3 : 88/25$

But according to the question

$(88/25 - 3)$ unit $\rightarrow$ Rs. 1040

1 unit $\rightarrow$ Rs. 2000

$\therefore$ The Initial expenditure (5 units) $\rightarrow$ Rs. 10,000

★ Alternate Method

Given: Your Personal Exams Guide

The monthly expenses of a person are $66\frac{2}{3}\%$ more than her monthly savings

Her monthly income increases = 44%

Her monthly expenses increases = 60%

There is an increase in her monthly savings = Rs. 1040

Formula used:

Income = Expenditure + Saving

Saving = Income - Expenditure

Calculation:

Let the number be x

The monthly expenses of a person are $66\frac{2}{3}\%$ more than her monthly savings

$$\Rightarrow 66\frac{2}{3}\% = \left(\frac{200}{300} x \right)$$

$$\Rightarrow \frac{2}{3} x$$

So,

The monthly saving of a person = $3x$

The monthly expenditure of the person = $5x$

The monthly income of the person = $(5x + 3x) = 8x$

Now,

Her monthly income increases = 44%

$$\Rightarrow \left(8x \times \frac{144}{100} \right)$$

$$\Rightarrow \frac{1152x}{100}$$

$$\Rightarrow 11.52x$$

Now, **Your Personal Exams Guide**

Her monthly expenses increases = 60%

$$\Rightarrow \left(5x \times \frac{160}{100} \right)$$

$$\Rightarrow \frac{800x}{100}$$

$$\Rightarrow 8x$$

The savings of the person = $(11.52x - 8x) = 3.52x$

According to the question

There is an increase in her monthly savings = Rs. 1040

$$\Rightarrow (3.52x - 3x) = 1040$$

$$\Rightarrow 0.52x = 1040$$

$$\Rightarrow x = \frac{1040}{0.52}$$

$$\Rightarrow x = 2000$$

Now,

The initial expenditure of a person = $5x = (5 \times 2000)$

$$\Rightarrow \text{Rs. } 10,000$$

$\therefore$ The required expenditure is Rs. 10,000

22. Answer: a

Explanation:

★ Shortcut Trick

Let the capacity of the tank be 25 units

The efficiency of A = 2 unit/hr

The efficiency of B = 1 unit/hr

Combined Efficiency of (A + B) = 3 unit/hr

Time taken by (A + B) to fill the tank = $25/3$ hr

Due to a leak time taken = $25/3 + 5/3$ hours = 10 hours

Combined efficiency of A, B and leak = $25/10 = 2.5$

Efficiency of Leak = $2.5 - 3 = -0.5$ unit

Required time to empty 70% of the tank = $(25 \times 0.7)/(0.5)$

$$\Rightarrow 35 \text{ hours}$$

∴ The required time is 35 hours.

★ Alternate Method

Given:

Pipe A can fill a cistern = $12\frac{1}{2}$ hours = $25/2$ hours

Pipe B can fill a cistern = 25 hours

Calculation:

Pipe A can fill a cistern = $25/2$ hours

Work is done by Pipe A in 1 hour = $2/25$

Pipe B can fill a cistern = 25 hours

Work is done by Pipe B in 1 hour = $1/25$

Work done by both pipes in 1 hour together = $(\frac{2}{25} + \frac{1}{25}) = \frac{3}{25}$

Time taking together by both the pipes = $\frac{25}{3}$ hours

Now,

$\Rightarrow (\frac{25}{3} \times 60) = 500 \text{ min} = 8 \text{ hour } 20 \text{ min} [1 \text{ hour} = 60 \text{ min}]$

Due to leak = (8 hours 20 min + 1 hour 40 min) = 10 hours

Due to the leak was done by the pipe in 1 hour = $(\frac{3}{25} - \frac{1}{10})$

$\Rightarrow \frac{6-5}{50} = \frac{1}{50}$

Time taking to empty the 70% of the cistern = $(50 \times \frac{70}{100})$

$\Rightarrow 35 \text{ hours}$

∴ The required time is 35 hours.

23. Answer: a

Explanation:

Given:

Total sum = Rs. 46,800

The ratio of the combined share of A and D to the combined share of B and C = 8 : 5

The ratio of the share of B to that of C = 5 : 4

A receives = Rs. 18,400

Calculation:

The ratio of the combined share of A and D to the combined share of B and C = 8 : 5

$$\Rightarrow (A + D) : (B + C) = 8 : 5$$

The ratio of the share of B to that of C = 5x : 4x

$$\Rightarrow (5x + 4x) = 9x$$

Now,

We multiply the combined share of A and D and the combined share of B and C by 9

$$\Rightarrow (8 : 5) \times 9$$

$$\Rightarrow 72 : 45$$

The share of A and D = 72 units

The share of B and C = 45 units

According to the question

The ratio of the share of B to that of C

$$\Rightarrow 9x = 45 \text{ units}$$

$$\Rightarrow x = 5 \text{ units}$$

The share of B = $5x = (5 \times 5) = 25$ units

The share of C = $4x = (4 \times 5) = 20$ units

Now,

The combined sum of A to D and B to C = $(72 + 45)$ units = 117 units

$\Rightarrow 117$ units = 46,800

$\Rightarrow 1$ unit = $(46,800/117)$

$\Rightarrow$ Rs. 400

Now,

B receives = $(25 \times 400) =$ Rs. 10,000

C receives = $(20 \times 400) =$ Rs. 8,000

Now,

D receives = Total sum - $(A + B + C)$

$\Rightarrow 46,800 - (18,400 + 10,000 + 8,000)$

$\Rightarrow 46,800 - 36,400$

$\Rightarrow$ Rs. 10,400

$\Rightarrow$ D receives = Rs. 10,400

Now,

x is the difference between the shares of A and B = Rs. $(18,400 - 10,000)$

$\Rightarrow x =$ Rs. 8,400

y is the difference between the shares of C and D = Rs. $(10,400 - 8000)$

$\Rightarrow y =$ Rs. 2,400

Now,

The value of $(x - y) = \text{Rs. } (8,400 - 2,400)$

$\Rightarrow \text{Rs. } 6,000$

$\therefore$ The required value is Rs. 6000

24. Answer: a

Explanation:

Given:

The ratio of the distance between two places A and B to the distance between places B and C = 3 : 5

A man travels from A and B at a speed = x km/hr

A man travels from B and C at a speed = 50 km/hr

His average speed for the entire journey = 40 km/hr

Formula used:

Average speed = Total distance/Total time taken

Calculation:

Let the distance between A and B to the distance between B and C be $3a$ and $5a$ respectively

According to the question

Time taken by man to travel from A and B at a speed of x km/hr = $3a/x$

Time taken by man to travel from B and C at a speed of 50 km/hr = $5a/50$

$\Rightarrow a/10$

Average speed of the entire journey = Total distance/Total time taken

$$\Rightarrow (3a + 5a)/(3a/x + a/10) = 40$$

$$\Rightarrow 8a/(3a/x + a/10) = 40$$

$$\Rightarrow 8a = 40a(3/x + 1/10)$$

$$\Rightarrow 1/5 = (30 + x)/10x$$

$$\Rightarrow 2x = 30 + x$$

$$\Rightarrow (2x - x) = 30$$

$$\Rightarrow x = 30 \text{ km/hr}$$

Now,

$$\text{The value of } (x - 10) : (x + 1) = (30 - 10) : (30 + 1)$$

$$\Rightarrow 20 : 31$$

$\therefore$ The required value is 20 : 31

25. Answer: d

Explanation:

★ Shortcut Trick

$$\text{Alloy A} = 5 : 2 \text{ --sum--} \rightarrow 7] \times 4$$

$$\text{Alloy B} = 3 : 4 \text{ --sum--} \rightarrow 7] \times 5$$

Since the sum of quantity is same so multiplication by 4 and 5 just because the amount of A and B are taken in the ratio 4 : 5

$$\text{Alloy A} = 20 : 8$$

$$\text{Alloy B} = 15 : 20$$

$$\text{Alloy C} = 35 : 28 = 5 : 4$$

$$\text{Total quantity} = 5 + 4 = 9$$

$$\text{Required \%} = (5/9) \times 100\% = 55\frac{5}{9}$$

$\therefore$ The required percentage of x in alloy C is $55\frac{5}{9}$.

★ Alternate Method

Given:

The mixture of x and y in Alloy A = 5 : 2

The mixture of x and y in Alloy B = 3 : 4

The ratio of A and B in alloy C = 4 : 5

Calculation:

Let the quantity of metal x in alloy C be x

$$\text{Quantity of metal x in alloy A} = \frac{5}{7}$$

$$\text{Quantity of metal y in alloy A} = \frac{2}{7}$$

$$\text{Quantity of metal x in alloy B} = \frac{3}{7}$$

$$\text{Quantity of metal y in alloy B} = \frac{4}{7}$$

According to the question

$$\text{The ratio of x and y in alloy C} = [(\frac{5}{7} \times 4) + (\frac{3}{7} \times 5)] / [(\frac{2}{7} \times 4) + (\frac{4}{7} \times 5)]$$

$$\Rightarrow (\frac{20}{7} + \frac{15}{7}) / (\frac{8}{7} + \frac{20}{7})$$

$$\Rightarrow (\frac{35}{7}) / (\frac{28}{7})$$

$$\Rightarrow (\frac{35}{7} \times \frac{7}{28})$$

$$\Rightarrow \frac{5}{4}$$

Now,

$$\text{Quantity of x in alloy C} = \frac{5}{(5+4)}$$

$$\Rightarrow \frac{5}{9}$$

$$\text{Percentage of x in alloy C} = \left(\frac{5}{9} \times 100 \right)$$

$$\Rightarrow \frac{500}{9}$$

$$\Rightarrow 55\frac{5}{9}$$

$\therefore$ The required percentage of x in alloy C is $55\frac{5}{9}$

26. Answer: b

Explanation:

Given:

The curved surface area of cylinder = 88 cm^2

The volume of the cylinder = 132 cm^3

Formula used:

Curved surface area of cylinder = $2\pi rh$

Volume of the cylinder = $\pi r^2 h$

Calculation:

According to the question

$$\frac{\text{The curved surface area of cylinder}}{\text{Volume of the cylinder}} = \frac{88}{132}$$

$$\Rightarrow \frac{2\pi rh}{\pi r^2 h} = \frac{88}{132}$$

$$\Rightarrow \frac{2}{r} = \frac{2}{3}$$

$$\Rightarrow r = 3 \text{ cm}$$

Now,

Putting the value of r in Curved surface area of cylinder

$$\Rightarrow 2 \times \frac{22}{7} \times 3 \times h = 88$$

$$\Rightarrow \frac{132h}{7} = 88$$

$$\Rightarrow \frac{3h}{7} = 2$$

$$\Rightarrow 3h = 14$$

$$\Rightarrow h = \frac{14}{3}$$

$$\Rightarrow h = 4\frac{2}{3}$$

$\therefore$ The height of the cylindrical object is $4\frac{2}{3}$

27. Answer: c

Explanation:

★ Shortcut Trick

Let the number of papers be n

Increased marks = $35 + 11 + 4 = 50$ marks

Increase in average = $76 - 71 = 5$

According to the concept of average

Increase marks is equally divided into each papers

So, $n \times 5 = 50$

$\Rightarrow n = 10$

∴ Total number of papers in exam is 10.

★ Alternate Method

Given:

The average marks of a student per paper = 71

The numbers obtained in science = 35 marks more

The numbers obtained in history = 11 marks more

The numbers obtained in computer science = 4 marks more

Calculation:

Let the number of papers in the examination be x

According to the question

$$\Rightarrow 76 \times x = 71 \times x + 35 + 11 + 4$$

$$\Rightarrow 76x = 71x + 50$$

$$\Rightarrow (76x - 71x) = 50$$

$$\Rightarrow 5x = 50$$

$$\Rightarrow x = 10$$

∴ There were 10 papers in the examination

28. Answer: c

Explanation:

Given:

The 10-digit number = 75462A97B6 is divisible by 72

Concept used:

When a number is divisible by 72, then it must be divisible by 8×9

Divisibility rule of 8 – If the last three digits of a number are divisible by 8, then the number is completely divisible by 8.

Divisibility rule of 9 – If the sum of digits of the number is divisible by 9, then the number itself is divisible by 9.

Calculation:

The 10-digit number = 75462A97B6

When a number is divisible by 8, then the last three digit number is divisible by 8

The last three-digit number = 7B6

When, $B = 3$ or $B = 7$

Case I:

If we take $B = 3$

Then the number becomes 75462A9736

Now, When a number is divisible by 9,

Then the sum of its digits is divisible by 9.

$$\Rightarrow (7 + 5 + 4 + 6 + 2 + A + 9 + 7 + 3 + 6)$$

$$\Rightarrow 49 + A$$

Now, A can be 5

$$\text{So, } \sqrt{8A - 4B} = \sqrt{(8 \times 5 - 4 \times 3)} = \sqrt{28}$$

Case II.

If we take $B = 7$

Then the number becomes 75462A9776

Now, When a number is divisible by 9,

Then the sum of its digits is divisible by 9.

$$\Rightarrow (7 + 5 + 4 + 6 + 2 + A + 9 + 7 + 7 + 6)$$

$$\Rightarrow 53 + A$$

Now, A can be 1

$$\text{So, } \sqrt{8A - 4B} = \sqrt{(8 \times 1 - 4 \times 7)} = \sqrt{-20}$$

Which is not possible.

$\therefore$ The correct answer is $\sqrt{28}$.

29. Answer: c

Explanation:

Given:

ABCD is a quadrilateral in which $AB \parallel DC$.

E and F are the midpoints of the diagonals AC and BD

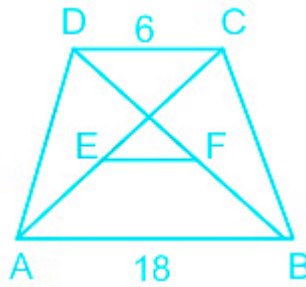
$$AB = 18 \text{ cm}$$

$$CD = 6 \text{ cm}$$

Concept used:

The length of line joining midpoints of the diagonals is half the difference of the length of parallel sides of the trapezium.

Calculation:



ABCD is a quadrilateral in which $AB \parallel DC$.

E and F are the midpoints of the diagonals AC and BD

We know that, the length of line joining midpoints of the diagonals is half the difference of the length of parallel sides of the trapezium.

So,

$$\Rightarrow EF = \frac{1}{2} (\text{Difference of its parallel sides})$$

$$\Rightarrow EF = \frac{1}{2} (AB - DC)$$

$$\Rightarrow EF = \frac{1}{2} (18 - 6)$$

$$\Rightarrow EF = \frac{1}{2} \times 12$$

$$\Rightarrow EF = 6 \text{ cm}$$

$\therefore$ The value of EF is 6 cm

30. Answer: c

Explanation:

Given:

AB and CD are two chords in a circle with centre O and AD is a diameter

AB and CD produced meet at a point P outside the circle

$$\angle APD = 25^\circ$$

$$\angle DAP = 39^\circ$$

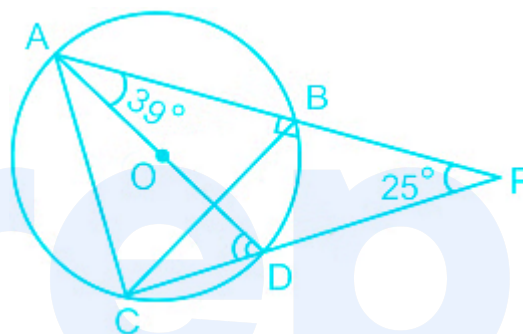
Concept used:

Exterior angle theorem – An exterior angle of a triangle is equal to the sum of its two opposite non-adjacent interior angles.

The angle subtended from a diameter is 90°

The opposite angles of a triangle is equal

Calculation:



According to the question

We know that, an exterior angle of a triangle is equal to the sum of its two opposite non-adjacent interior angles.

So, In $\triangle ADP$

$$\angle ADC = \angle DAP + \angle DPA$$

$$\Rightarrow \angle ADC = 25^\circ + 39^\circ$$

$$\Rightarrow \angle ADC = 64^\circ$$

Now,

Angles in the same segment are equal

$$\text{So, } \angle ADC = \angle ABC = 64^\circ \text{ ----(I)}$$

Since, AD is a diameter

So, $\angle ABD = 90^\circ$

$\Rightarrow \angle ABC + \angle CBD = 90^\circ$

$\Rightarrow 64^\circ + \angle CBD = 90^\circ$ [From (i)]

$\Rightarrow \angle CBD = 26^\circ$

$\therefore$ The value of $\angle CBD$ is 26° .

31. Answer: c

Explanation:

★ Shortcut Trick

The incomes of A and B in the last year = $4 : 3$

We should write this ratio as $15 \times (4 : 3) = 60 : 45$

15 is the LCM of 3 [from ratio $3 : 4$] and 5 [from ratio $5 : 6$]

Now, Present income of A = $60 \times 4/3 = 80$

Present income of B = $45 \times 6/5 = 54$

According to the question

$(80 + 54)$ unit $\rightarrow 24.12$ lakh

1 unit $\rightarrow 0.18$ lakh

Required value = $(60 + 54)$ unit

$\therefore$ Required value = 114×0.18 lakh = 20.52 lakh.

★ Alternate Method

Given:

The ratio of the incomes of A and B in the last year = 4 : 3

The ratios of their individual incomes in the last year = 3 : 4

The ratios of their individual incomes in the present year = 5 : 6

Total income in the present year = Rs. 24.12 lakhs

Calculation:

The ratio of the incomes of A and B in the last year = $4x : 3x$... (1)

The ratio of income of A the last year to the present year = $3x : 4x$ (2)

The ratio of income of B the last year to the present year = $5x : 6x$ (3)

To equate last year income of A and B in the above equation we will multiply 15 in equation (1) and 20 in equation (2) and 9 in equation (3)

Now,

The ratio of the incomes of A and B in the last year = $60x : 45x$ (4)

The ratio of income of A the last year to the present year = $60x : 80x$ (5)

The ratio of income of B the last year to the present year = $45x : 54x$... (6)

Now,

From equation (5) and (6), we get

The ratio of present income of A to the income of B = $80x : 54x$

According to the question

$$\Rightarrow (80x + 54x) = 24.12 \text{ lakh}$$

$$\Rightarrow 134x = 24.12 \text{ lakh}$$

$$\Rightarrow x = 24.12/134$$

$$\Rightarrow x = 0.18$$

Now,

The sum of the income of A in the last year and that of B in the present year = $(60 \times 0.18 + 54 \times 0.18)$

$\Rightarrow$ Rs. $(10.8 + 9.72)$

$\Rightarrow$ Rs. 20.52 lakhs

$\therefore$ The required sum is Rs. 20.52 lakhs

32. Answer: b

Explanation:

Given:

In $\triangle ABC$, O is the point of intersection of the bisectors of $\angle B$ and $\angle A$

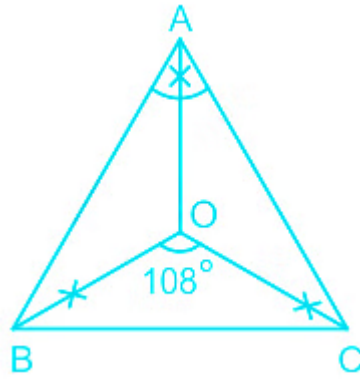
$\angle BOC = 108^\circ$

Concept used:

If the bisector of $\angle ABC$ and $\angle ACB$ of a triangle ABC meet at a point O then, $\angle BOC = 90^\circ + \frac{1}{2} \angle A$

Angle bisector theorem - An angle bisector of an angle of a triangle divides the opposite side into two parts that are proportional to the other two sides of the triangle.

Calculation:



If the bisector of $\angle ABC$ and $\angle ACB$ of a triangle ABC meet at a point O then, $\angle BOC = 90^\circ + \frac{1}{2} \angle A$

$$\Rightarrow 108^\circ = 90^\circ + \frac{1}{2} \angle A$$

$$\Rightarrow \frac{1}{2} \angle A = (108^\circ - 90^\circ)$$

$$\Rightarrow \frac{1}{2} \angle A = 18^\circ$$

$$\Rightarrow \angle A = 36^\circ$$

Now,

We know that, a n angle bisector of an angle of a triangle divides the opposite side into two parts that are proportional to the other two sides of the triangle.

So, **Your Personal Exams Guide**

$$\Rightarrow \angle BAO = \frac{\angle A}{2}$$

$$\Rightarrow \angle BAO = \frac{36}{2}$$

$$\Rightarrow \angle BAO = 18^\circ$$

$\therefore$ The value of $\angle BAO = 18^\circ$

33. Answer: c

Explanation:

Given:

The ratio of capitals invested by A, B and C = 2 : 3 : 5

The ratio of months for which they invested = 4 : 2 : 3

The difference between the profit shares of A and B = Rs. 1,86,000

Formula used:

Profit = Time $\times$ Money

Calculation:

The ratio of profit of A, B and C = $(2 \times 4) : (3 \times 2) : (5 \times 3)$

$\Rightarrow 8 : 6 : 15$

Let the ratio of profit of A, B and C be $8x : 6x : 15x$ respectively

According to the question

$\Rightarrow (8x - 6x) = \text{Rs. } 1,86,000$

$\Rightarrow 2x = \text{Rs. } 1,86,000$

$\Rightarrow x = \text{Rs. } 93,000$

Now,

The C's share of profit = Rs. $(15 \times 93,000)$

$\Rightarrow \text{Rs. } 13,95,000$

$\therefore$ The required share of C is 13,95,000

34. Answer: b

Explanation:

Given:

$$4x + \frac{1}{3}y = \frac{8}{3} \text{ and}$$

$$\frac{1}{2}x + \frac{3}{4}y + \frac{5}{2} = 0$$

Calculation:

$$4x + \frac{1}{3}y = \frac{8}{3} \dots(1)$$

$$\frac{1}{2}x + \frac{3}{4}y + \frac{5}{2} = 0$$

$$\Rightarrow \frac{1}{2}x + \frac{3}{4}y = -\frac{5}{2} \dots(2)$$

Now,

Multiplying the number by 3 in equation (1), we get

$$\Rightarrow 12x + y = 8 \dots(3)$$

Again, multiplying the number by 24 in equation (2), we get

$$\Rightarrow 12x + 18y = -60 \dots(4)$$

Now,

From equation (3) and (4), we get

$$\Rightarrow (18y - y) = (-60 - 8)$$

$$\Rightarrow 17y = -68$$

$$\Rightarrow y = -4$$

Now, Putting the value of y in equation (3), we get

$$\Rightarrow 12x - 4 = 8$$

$$\Rightarrow 12x = 12$$

$$\Rightarrow x = 1$$

So, P(1, -4)

Now,

According to given option

$$x + 2y - 5 = 0$$

$$\Rightarrow (1 - 8 - 5) = 0$$

$$\Rightarrow -12 \text{ is not equal to } 0$$

So, It is not satisfying the point P

Again,

$$3x - y - 7 = 0$$

$$\Rightarrow (3 + 4 - 7) = 0$$

$$\Rightarrow (7 - 7) = 0$$

$$\Rightarrow 0 = 0$$

It is satisfying the point P

Again,

$$x - 3y - 12 = 0$$

$$\Rightarrow (1 + 12 - 12) = 0$$

$$\Rightarrow (13 - 12) = 0$$

$$\Rightarrow 1 \text{ is not equal to } 0$$

So, It is not satisfying the point P

Again,

$$4x - y + 7 = 0$$

$$\Rightarrow (4 + 4 + 7) = 0$$

$$\Rightarrow 15 \text{ is not equal to } 0$$

So, It is not satisfying the point P

$\therefore$ The point P also lies on the graph of the equation is $3x - y - 7 = 0$

35. Answer: c

Explanation:

Given:

In 6 minutes, $\frac{4}{13}$ of a bucket is filled

Calculation:

Total capacity of the bucket be 13 units

According to the question

4 unit is filled in 6 min

Then,

1 unit is filled in $= \frac{6}{4} = \frac{3}{2}$ min

Now, **Your Personal Exams Guide**

The rest part $= (13 - 4)$ units $= 9$ units

1 unit is filled in $= \frac{3}{2}$ min

Then,

9 unit is filled in $= (9 \times \frac{3}{2})$

$\Rightarrow \frac{27}{2}$ min

$\Rightarrow 13$ minutes 30 seconds

$\therefore$ Time taken to fill the remaining bucket is 13 minutes 30 seconds

★ Alternate Method

Remaining part of bucket = $1 - 4/13 = 9/13$

Now, from the unitary method

$4/13$ part is filled in 6 min

1 part is filled in $6 \times 13/4$ min

$9/13$ part is filled in $6 \times (13/4) \times (9/13) = 27/2$ min

∴ The required time is 13 min and 30 seconds.

36. Answer: d

Explanation:

★ Shortcut Trick

$10.5\% = 21/200$

M.P = 200 units, Discount = 21 unit

S.P = 179 unit → 716

1 unit → 4

Now, $6.5\% = 13/200$

S.P = $(200 - 13)$ unit

S.P = 187 unit = 187×4 [Since M.P in both ratio is same so same unit is used]

S.P = Rs. 748

∴ The required S.P is Rs. 748.

★ Alternate Method

Given:

An article was sold = Rs. 716

Discount = 10.5%

Formula used:

$$SP = MP(100 - \text{Discount\%})/100$$

Calculation:

Let the marked price be x

Now,

$$SP = MP(100 - \text{Discount\%})/100$$

$$\Rightarrow 716 = x \frac{(100 - 10.5)}{100}$$

$$\Rightarrow 716 = x \frac{89.5}{100}$$

$$\Rightarrow 716 = \frac{89.5x}{100}$$

$$\Rightarrow x = \frac{716 \times 100}{89.5}$$

$$\Rightarrow x = (8 \times 100)$$

$$\Rightarrow x = \text{Rs. } 800$$

Now,

At a discount of 6.5%

$$\Rightarrow SP = MP(100 - \text{Discount\%})/100$$

$$\Rightarrow SP = 800 \times \frac{100 - 6.5}{100}$$

$$\Rightarrow SP = 800 \times \frac{93.5}{100}$$

$$\Rightarrow SP = (8 \times 93.5)$$

$$\Rightarrow SP = \text{Rs. } 748$$

∴ The required article sold at Rs. 748

37. Answer: b

Explanation:

Given:

G is the centroid of a triangle ABC,

AB = 35 cm

BC = 12 cm

AC = 37 cm

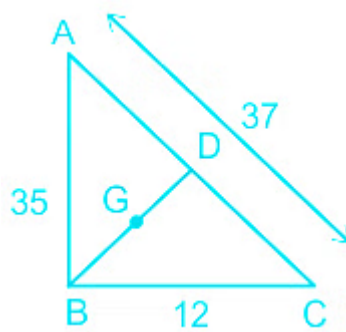
Concept used:

Circum-radius = $\Delta ABC = \text{Hypotenuse}/2$

The median of a triangle divides it into two triangles of equal areas

The centroid of a triangle divides the median in the ratio 2 : 1

Calculation:



We can say ΔABC is a right angle triangle 90° at B.

Point G is on BD

As we know, BD is circum-radius

$$\Rightarrow \text{Circum-radius} = \Delta ABC = \text{Hypotenuse}/2$$

$$\Rightarrow \frac{37}{2}$$

$$\Rightarrow BD = BG + GD$$

$$\Rightarrow BG : GD = 2 : 1 \text{ [The centroid of a triangle divides the median in the ratio } 2 : 1\text{], i.e.}$$

$$\frac{GD}{BG} = \frac{1}{2}$$

Adding 1 to both the sides, we get:

$$\frac{GD}{BG} + 1 = \frac{1}{2} + 1$$

$$\frac{GD+BG}{BG} = \frac{BD}{BG} = \frac{3}{2}$$

$$BG = \frac{2}{3} \times BD$$

$$BG = \frac{2}{3} \times \frac{37}{2}$$

$$BG = \frac{37}{3}$$

$$= 12.3 \text{ cm}$$

$\therefore$ The length of BG is 12.3 cm

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38. Answer: b

Explanation:

Calculation:

The ratio of the total production of fertilisers by country X in 2017 and country Y in 2020 = $(236 + 334) = 570$

The production of fertilisers by country Z in 2019 = 380

Now,

The ratio of the total production of fertilisers by country X in 2017 and country Y in 2020 to the production of fertilisers by country Z in 2019 = (570 : 380)

$$\Rightarrow 3 : 2$$

$\therefore$ The required ratio is 3 : 2

39. Answer: b

Explanation:

Concept Used:

Follow the BODMAS rule according to the table given below:

B	Brackets in order (), {}, []	ब्रैकेट (), {}, [] क्रम में
O	of	का
D	Division (÷)	विभाजन (÷)
M	Multiplication (×)	गुणा (×)
A	Addition (+)	जोड़ (+)
S	Subtraction (-)	घटाव (-)

Calculation:

$$\begin{aligned} & \frac{5\frac{3}{4} - \frac{3}{7} \times 15\frac{3}{4} + 2\frac{2}{35} \div 1\frac{11}{25}}{\frac{3}{4} \div 5\frac{1}{4} + 5\frac{3}{5} \div 3\frac{4}{15}} \\ & \Rightarrow \left(\frac{23}{4} - \frac{3}{7} \times \frac{63}{4} + \frac{72}{35} \div \frac{36}{25} \right) / \left(\frac{3}{4} \div \frac{21}{4} + \frac{28}{5} \div \frac{49}{15} \right) \\ & \Rightarrow \left(\frac{23}{4} - \frac{3}{7} \times \frac{63}{4} + \frac{72}{35} \times \frac{25}{36} \right) / \left(\frac{3}{4} \div \frac{21}{4} + \frac{28}{5} \div \frac{49}{15} \right) \\ & \Rightarrow \left(\frac{23}{4} - \frac{27}{4} + \frac{10}{7} \right) / \left(\frac{3}{4} \times \frac{4}{21} + \frac{28}{5} \times \frac{15}{49} \right) \\ & \Rightarrow \left(\frac{23}{4} - \frac{27}{4} + \frac{10}{7} \right) / \left(\frac{1}{7} + \frac{12}{7} \right) \\ & \Rightarrow \frac{161-189+40}{28} / \left(\frac{13}{7} \right) \end{aligned}$$

$$\Rightarrow \frac{201-189}{28} / \left(\frac{13}{7} \right)$$

$$\Rightarrow \left(\frac{12}{28} \right) / \left(\frac{13}{7} \right)$$

$$\Rightarrow \left(\frac{3}{7} \times \frac{7}{13} \right)$$

$$\Rightarrow \frac{3}{13}$$

$$\text{So, } x = \frac{3}{13}$$

Now,

According to the question

$$\Rightarrow y + \frac{3}{13} = \frac{7}{13}$$

$$\Rightarrow y = \left(\frac{7}{13} - \frac{3}{13} \right)$$

$$\Rightarrow y = \frac{4}{13}$$

$\therefore$ The value of y is $\frac{4}{13}$

40. Answer: a

Explanation:

Calculation:

Total number of students appeared = 1200

Numbers of students appeared in the examination from institutes A = 72°

$$\Rightarrow (72/360 \times 1200)$$

$$\Rightarrow 240$$

Numbers of students appeared in the examination from institutes B = 54°

$$\Rightarrow (54/360 \times 1200)$$

⇒ 180

Numbers of students appeared in the examination from institutes C = 90°

⇒ $(90/360 \times 1200)$

⇒ 300

Numbers of students appeared in the examination from institutes D = 105°

⇒ $(105/360 \times 1200)$

⇒ 350

Numbers of students appeared in the examination from institutes E = 39°

⇒ $(39/360 \times 1200)$

⇒ 130

Now,

Total number of students passed = 900

Numbers of students passed in the examination from institutes A = 15%

⇒ $(900 \times 15/100)$

⇒ 135

Numbers of students passed in the examination from institutes B = 18%

⇒ $(900 \times 18/100)$

⇒ 162

Numbers of students passed in the examination from institutes C = 30%

⇒ $(900 \times 30/100)$

⇒ 270

Numbers of students passed in the examination from institutes D = 28%

$$\Rightarrow (900 \times 28/100)$$

$$\Rightarrow 252$$

Numbers of students passed in the examination from institutes E = 9%

$$\Rightarrow (900 \times 9/100)$$

$$\Rightarrow 81$$

The percentage of students of institutes A passed to the students who appeared from that institute = $(135/240 \times 100)$

$$\Rightarrow 56.25\%$$

The percentage of students of institutes B passed to the students who appeared from that institute = $(162/180 \times 100)$

$$\Rightarrow 90\%$$

The percentage of students of institutes C passed to the students who appeared from that institute = $(270/300 \times 100)$

$$\Rightarrow 90\%$$

The percentage of students of institutes D passed to the students who appeared from that institute = $(252/350 \times 100)$

$$\Rightarrow 72\%$$

The percentage of students of institutes E passed to the students who appeared from that institute = $(81/130 \times 100)$

$$\Rightarrow 62.30\%$$

Now,

We can see that the percentage of B and C is same which is also the highest = 90%

So, the second highest percentage of students who passed to the students who appeared is from institute D = 72%

∴ The required answer is Institute D

41. Answer: b

Explanation:

Given:

Distance covered by A = 240 km

Had his speed been 8 km/h less, then the time taken would have been one hour more for covering the same distance

Formula used:

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

Calculation:

$$\text{Time taken by A to cover the total distance with speed } x \text{ km/h} = \frac{240}{x}$$

$$\text{Time taken by A to cover the total distance with speed } (x - 8) \text{ km/h} = \frac{240}{x-8}$$

According to the question

$$\Rightarrow \frac{240}{x-8} - \frac{240}{x} = 1$$

$$\Rightarrow 240 \left(\frac{1}{x-8} - \frac{1}{x} \right) = 1$$

$$\Rightarrow \left(\frac{1}{x-8} - \frac{1}{x} \right) = \frac{1}{240}$$

$$\Rightarrow \left(\frac{x-x+8}{x(x-8)} \right) = \frac{1}{240}$$

$$\Rightarrow \frac{8}{x^2-8x} = \frac{1}{240}$$

$$\Rightarrow x^2 - 8x = 1920$$

$$\Rightarrow x^2 - 8x - 1920 = 0$$

$$\Rightarrow x^2 - 48x + 40x - 1920 = 0$$

$$\Rightarrow x(x - 48) + 40(x - 48) = 0$$

$$\Rightarrow (x + 40)(x - 48) = 0$$

$$\Rightarrow x = -40, 48 \text{ [Not taking the negative sign]}$$

$$\text{So, } x = 48$$

Now,

$$\text{Time taken to cover 480 km at his original speed} = \frac{480}{48}$$

$$\Rightarrow 10 \text{ hours}$$

$\therefore$ The required time is 10 hours

42. Answer: d

Explanation:

Given:

$$\frac{4\tan^2 30^\circ + \sin^2 30^\circ \cos^2 45^\circ + \sec^2 48^\circ - \cot^2 42^\circ}{\cos 37^\circ \sin 53^\circ + \sin 37^\circ \cos 53^\circ + \tan 18^\circ \tan 72^\circ}$$

Formula used:

$$\tan 30^\circ = \frac{1}{\sqrt{3}}$$

$$\sin 30^\circ = \frac{1}{2}$$

$$\cos 45^\circ = \frac{1}{\sqrt{2}}$$

$$\sec^2 \theta - \tan^2 \theta = 1$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\tan \theta \times \cot \theta = 1$$

Calculation:

$$\frac{4\tan^2 30^\circ + \sin^2 30^\circ \cos^2 45^\circ + \sec^2 48^\circ - \cot^2 42^\circ}{\cos 37^\circ \sin 53^\circ + \sin 37^\circ \cos 53^\circ + \tan 18^\circ \tan 72^\circ}$$

$$\Rightarrow \frac{4 \times (1/\sqrt{3})^2 + (1/2)^2 \cdot (1/\sqrt{2})^2 + (\sec^2 48^\circ - \tan^2 48^\circ)}{(\sin 53^\circ \cdot \sin 53^\circ + \cos 53^\circ \cdot \cos 53^\circ + \tan 18^\circ \times \cot 18^\circ)}$$

$$\Rightarrow \frac{4 \times (1/3) + (1/4) \times (1/2) + 1}{(\sin^2 53^\circ + \cos^2 53^\circ) + (1)}$$

$$\Rightarrow [(4/3) + (1/8) + 1]/(1 + 1)$$

$$\Rightarrow [(32 + 3 + 24)/24]/2$$

$$\Rightarrow [59/(24 \times 2)]$$

$$\Rightarrow 59/48$$

$\therefore$ The required value is $\frac{59}{48}$.

43. Answer: a

Explanation:

Given:

The sum of two positive numbers = 65

The square root of their product = 26

Calculation:

Let the two numbers be a and b respectively

According to the question

$$\Rightarrow a + b = 65$$

$$\text{And, } \sqrt{ab} = 26$$

$$\Rightarrow ab = (26 \times 26) = 676$$

Now,

The sum of the reciprocals = $\frac{1}{a} + \frac{1}{b}$

$$\Rightarrow \frac{a+b}{ab}$$

$$\Rightarrow \frac{65}{676}$$

$$\Rightarrow \frac{5}{52}$$

$\therefore$ The sum of their reciprocals $\frac{5}{52}$

44. Answer: a

Explanation:

Given:

The total surface area of a cylinder = 4092 cm^2

The diameter of the base = 21 cm

Formula used:

Total surface area of cylinder = $2\pi r(r + h)$

Radius = $\frac{\text{Diameter}}{2}$

Volume of the cylinder = $\pi r^2 h$

Calculation:

The diameter of the base = 21

The radius of the base = $\frac{21}{2}$

According to the question

Total surface area of cylinder = $2\pi r(r + h)$

$$\Rightarrow 2 \times \frac{22}{7} \times \frac{21}{2} \left(\frac{21}{2} + h \right) = 4092$$

$$\Rightarrow \left(\frac{21}{2} + h \right) = 62$$

$$\Rightarrow h = \left(62 - \frac{21}{2} \right)$$

$$\Rightarrow h = \frac{124-21}{2}$$

$$\Rightarrow h = \frac{103}{2}$$

Now,

Volume of the cylinder = $\pi r^2 h$

$$\Rightarrow \left(\frac{22}{7} \times \frac{21}{2} \times \frac{21}{2} \times \frac{103}{2} \right) \text{cm}^3$$

$$\Rightarrow \frac{71379}{4} \text{cm}^3$$

Now,

$$50\% \text{ volume of the cylinder} = \left(\frac{1}{2} \times \frac{71379}{4} \right) \text{cm}^3$$

$$\Rightarrow 8922 \text{cm}^3$$

$\therefore$ The required 50% volume is 8922cm^3

45. Answer: c

Explanation:

★ Shortcut Trick

Age ratio of A and B = 5 : 4 [8 years ago]

Age ratio of A and B = 6 : 5 [Present age]

Difference between the ratio of age of A or B = 1 unit

And this 1 unit $\rightarrow$ 8 years [Gap of age in years]

So, The present age of A = 6 units = $6 \times 8 = 48$

And the present age of B = 5 units = $5 \times 8 = 40$

So, The required sum of ages = $(48 + 7) + (40 + 7)$

$\Rightarrow 102$ years.

$\therefore$ The required sum is 102 years.

★ Alternate Method

Given:

The ratio of ages of A and B , eight years ago = 5 : 4

The ratio of their present ages = 6 : 5

Calculation:

Eight years ago, the ratio of ages of A and B be $5x$ and $4x$ respectively

According to the question

$$\Rightarrow \frac{(6x-8)}{(5x-8)} = \frac{5}{4}$$

$$\Rightarrow 24x - 32 = 25x - 40$$

$$\Rightarrow (25x - 24x) = (40 - 32)$$

$$\Rightarrow x = 8$$

Now,

The present age of A = $6x = (6 \times 8) = 48$

The present age of B = $5x = (5 \times 8) = 40$

Now,

The sum of the ages of A and B after 7 years from now = $(48 + 7) + (40 + 7)$

$\Rightarrow (55 + 47)$ years

$\Rightarrow$ 102 years

$\therefore$ The required sum is 102 years

46. Answer: d

Explanation:

Given:

$$\angle QPS = \frac{1}{2} \angle PSR$$

$$\angle QPR = 78^\circ$$

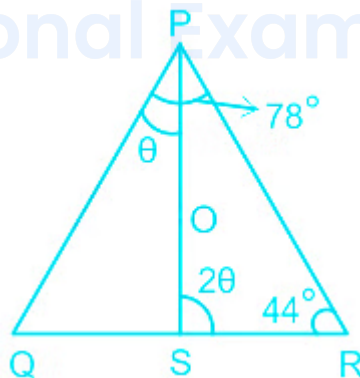
$$\angle PRS = 44^\circ$$

Concept used:

The sum of all the sides of the triangle is 180°

An exterior angle of a triangle is equal to the sum of the two interior opposite angles

Calculation:



According to the question

$$\angle QPS = \frac{1}{2} \angle PSR$$

Let $\angle PSR = 2\theta$ and $\angle QPS = \theta$

We know that the sum of all the sides of the triangle is 180°

$$\Rightarrow \angle QPR + \angle PRS + \angle RQP = 180^\circ$$

$$\Rightarrow 78^\circ + 44^\circ + \angle RQP = 180^\circ$$

$$\Rightarrow 122^\circ + \angle RQP = 180^\circ$$

$$\Rightarrow \angle RQP = (180^\circ - 122^\circ)$$

$$\Rightarrow \angle RQP = 58^\circ$$

Now,

The exterior angle of $\angle PSQ = 2\theta$

We know that an exterior angle of a triangle is equal to the sum of the two interior opposite angles

$$\Rightarrow 2\theta = \theta + 58^\circ$$

$$\Rightarrow (2\theta - \theta) = 58^\circ$$

$$\Rightarrow \theta = 58^\circ$$

Now,

The value of $\angle PSQ = (180^\circ - 2\theta)$

$$\Rightarrow (180^\circ - 2 \times 58^\circ)$$

$$\Rightarrow (180^\circ - 116^\circ)$$

$$\Rightarrow 64^\circ$$

$\therefore$ The required value of $\angle PSQ$ is 64°

47. Answer: c

Explanation:

Given:

$$\sin A = \frac{5}{13}$$

$$7 \cot B = 24$$

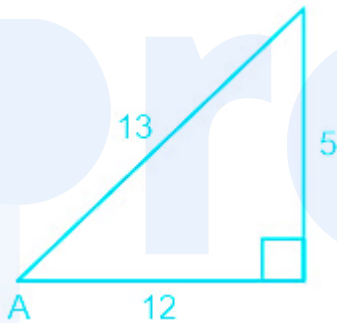
$$\Rightarrow \cot B = \frac{24}{7}$$

Formula used:

$$B^2 = H^2 - P^2$$

$$H^2 = B^2 + P^2$$

Calculation:



$$\sin \theta = \frac{P}{H} = \frac{5}{13}$$

By Pythagoras theorem

$$\Rightarrow B^2 = H^2 - P^2$$

$$\Rightarrow B^2 = (13^2 - 5^2)$$

$$\Rightarrow B^2 = (169 - 25)$$

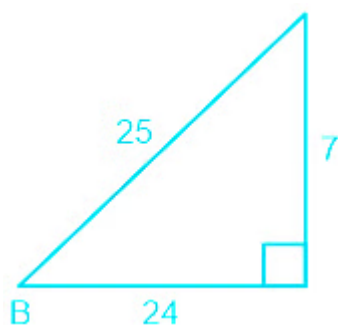
$$\Rightarrow B^2 = 144$$

$$\Rightarrow B = 12$$

$$\sec A = \frac{H}{B} = \frac{13}{12}$$

$$\tan A = \frac{P}{B} = \frac{5}{12}$$

Again,



$$\cot B = \frac{B}{P} = \frac{24}{7}$$

By Pythagoras theorem

$$\Rightarrow H^2 = B^2 + P^2$$

$$\Rightarrow H^2 = (24^2 + 7^2)$$

$$\Rightarrow H^2 = (576 + 49)$$

$$\Rightarrow H^2 = 625$$

$$\Rightarrow H = 25$$

$$\cos B = \frac{B}{H} = \frac{24}{25}$$

$$\operatorname{cosec} B = \frac{H}{P} = \frac{25}{7}$$

Now,

The value of $(\sec A \cos B) (\operatorname{cosec} B \tan A)$

$$\Rightarrow \left(\frac{13}{12} \times \frac{24}{25} \times \frac{25}{7} \times \frac{5}{12} \right)$$

$$\Rightarrow \frac{65}{42}$$

$\therefore$ The required value is $\frac{65}{42}$

48. Answer: c

Explanation:

★ Shortcut Trick

[Assume the selling price 300 so that it is easily divisible by 3, because $33.33\% = 1/3$]

Let the original selling price be 300 units

$$\text{Selling price} = 300 \times (1/3) = 100$$

$$\text{Loss} = 33.33\% = 1 : 3 \quad [1 = \text{Loss and } 3 = \text{C.P}]$$

$$\text{So, S.P} = 2 \text{ units} \rightarrow 100$$

$$\text{C.P} = 3 \text{ units} \rightarrow 150$$

Now, New Selling Price = 80% of the original selling price

$$\Rightarrow \text{New Selling Price} = 80\% \times 300 = 240$$

$$\text{So, Required profit\%} = [(240 - 150)/150] \times 100\%$$

$$\therefore \text{The required profit\%} = 60\%$$

★ Alternate Method

Given: Your Personal Exams Guide

An article is sold at a certain price

If it is sold at $33\frac{1}{3}\%$ of this price, there is a loss of $33\frac{1}{3}\%$

Formula used:

$$\text{Profit} = \text{SP} - \text{CP}$$

$$\text{Profit\%} = \frac{\text{Profit}}{\text{CP}} \times 100$$

Calculation:

Let the selling price be 100

If it is sold at $33\frac{1}{3}\%$

$$\Rightarrow SP = \left(\frac{1}{3} \times 100 \right)$$

$$\Rightarrow SP = \frac{100}{3} = 33.33$$

Now,

there is a loss of $33\frac{1}{3}\%$

$$\Rightarrow (100 - 33.33)\% \text{ of the cost price} = 33.33$$

$$\Rightarrow 66.67\% \text{ of the cost price} = 33.33$$

$$\text{cost price} = \left(\frac{33.33}{66.67} \times 100 \right)$$

$$\Rightarrow \text{cost price} = 50$$

Now,

$$80\% \text{ of its original selling price} = 80$$

$$\text{Profit} = (80 - 50) = 30$$

$$\text{Profit}\% = \left(\frac{30}{50} \times 100 \right)$$

$$\Rightarrow 60\%$$

$\therefore$ There required profit% is 60%

★ Shortcut Trick

Let the marked price be 300

$$\text{It is sold at } 33\frac{1}{3}\% = \left(\frac{100}{300} \right) = \frac{1}{3}$$

$$SP = \left(\frac{300 \times 1}{3} \right) = 100$$

Now,

$$\text{There is still a loss of } 33\frac{1}{3}\% = \frac{100}{300} = \frac{1}{3}$$

$$\Rightarrow \left(1 - \frac{1}{3} \right) = \frac{2}{3}$$

$$\text{So, CP} = (100 \times \frac{3}{2})$$

$$\Rightarrow 150$$

Now,

$$\text{Marked price} = 300$$

Original price sold at 80%

$$\Rightarrow \text{New SP} = (\frac{80}{100} \times 300)$$

$$\Rightarrow \text{SP} = 240$$

$$\text{Profit} = \text{SP} - \text{CP}$$

$$\Rightarrow (240 - 150) = 90$$

$$\text{Profit\%} = (\frac{90}{150} \times 100)$$

$$\Rightarrow 60\%$$

$\therefore$ The required profit is 60%

49. Answer: b

Explanation:

Given:

The sum of the interior angles of a regular polygon A = 1260°

Each interior angle of a regular polygon B = $128\frac{4}{7} = \frac{900}{7}$

Formula used:

Sum of all interior angles = $(n - 2) \times 180^\circ$

Each interior angle = $\frac{180(n-2)}{n}$

Where, n = number of sides of polygon

Calculation:

According to the question

The sum of the interior angles of a regular polygon A = 1260

Sum of all interior angles = $(n - 2) \times 180^\circ$

$$\Rightarrow (n - 2) \times 180^\circ = 1260^\circ$$

$$\Rightarrow (n - 2) = \frac{1260}{180}$$

$$\Rightarrow (n - 2) = 7$$

$$\Rightarrow n = (7 + 2)$$

$$\Rightarrow n = 9$$

Now,

Each interior angle of a regular polygon B = $\frac{900}{7}$

Each interior angle = $\frac{180(n-2)}{n}$

$$\Rightarrow \frac{180(n-2)}{n} = \frac{900}{7}$$

$$\Rightarrow 180(n - 2) = \frac{900n}{7}$$

$$\Rightarrow 180n - 360 = \frac{900n}{7}$$

$$\Rightarrow (180n - \frac{900n}{7}) = 360$$

$$\Rightarrow \frac{(1260n - 900n)}{7} = 360$$

$$\Rightarrow \frac{360n}{7} = 360$$

$$\Rightarrow n = 7$$

Now,

The sum of the number of sides of polygons A and B = $(9 + 7)$

$\Rightarrow 16$

$\therefore$ The required sum is 16

50. Answer: b

Explanation:

Given:

The base of a right prism is a triangle with sides = 16 cm, 30 cm and 34 cm.

Height = 32 cm

Formula used:

$$(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{Perpendicular})^2$$

$$\text{Volume of Prism} = \text{Area of base} \times \text{height} = \left(\frac{1}{2} \times b \times h \right) \times l$$

The lateral surface area of prism = Perimeter of base $\times$ height

Calculation:

According to the question

$$(\text{Hypotenuse})^2 = (\text{Base})^2 + (\text{Perpendicular})^2$$

$$\Rightarrow (34)^2 = (16)^2 + (30)^2$$

$$\Rightarrow 1156 = (256 + 900)$$

$$\Rightarrow 1156 = 1156$$

Now, we can say triangle is a right angle triangle

As we know,

$$\text{Volume of Prism} = \frac{1}{2} \times b \times h \times l$$

$$\Rightarrow \frac{1}{2} \times 16 \times 30 \times 32 \text{ cm}^2$$

$$\Rightarrow (8 \times 30 \times 32) \text{ cm}^3$$

$$\Rightarrow 7680 \text{ cm}^3$$

Now,

The lateral surface area of prism = Perimeter of base $\times$ height

$$\Rightarrow (16 + 30 + 34) \times 32 \text{ cm}^2$$

$$\Rightarrow (80 \times 32) \text{ cm}^2$$

$$\Rightarrow 2560 \text{ cm}^2$$

$\therefore$ The required value is 2560 and 7680.

51. Answer: a

Explanation:

Given:

In $\triangle ABC$, M is the midpoint of the side AB

N is a point in the interior of $\triangle ABC$ such that CN is the bisector of $\angle C$ and $CN \perp NB$

BC = 10 cm

AC = 15 cm

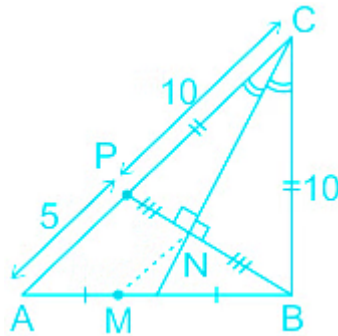
Concept used:

Midpoint theorem – The line segment in a triangle joining the midpoint of two sides of the triangle is said to be parallel to its third side and is also half of the length of the third side

Calculation:

Construction: Produce BN to P which meets AC at P.

And Join MN



According to the question

In $\triangle NPC$ and $\triangle NBC$

$$\angle N = \angle N [90^\circ]$$

$$BC = PC [\text{corresponding side}]$$

$$BN = NP [\text{corresponding angle}]$$

$$\Rightarrow \triangle NPC \cong \triangle NBC$$

Hence, $NB = NP$ (It means Point N is the midpoint of side BP)

$$\text{And } BC = PC = 10 \text{ cm}$$

$$\text{So, } AP = AC - PC$$

$$\Rightarrow AP = (15 - 10) \text{ cm}$$

$$\Rightarrow AP = 5 \text{ cm}$$

Now, In $\triangle ABP$

M and N are the midpoints of AB and BP

So, According to the midpoint theorem

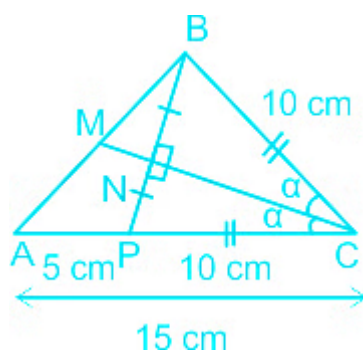
$$\Rightarrow MN = \frac{AP}{2}$$

$$\Rightarrow \frac{5}{2} \text{ cm}$$

$$\Rightarrow 2.5 \text{ cm}$$

$\therefore$ The length of MN is 2.5 cm

★ Shortcut Trick



The using mid-point theorem,

In $\triangle BAP$

$$MN = \frac{AP}{2} = \frac{5}{2} = 2.5 \text{ cm}$$

52. Answer: b

Explanation:

Given:

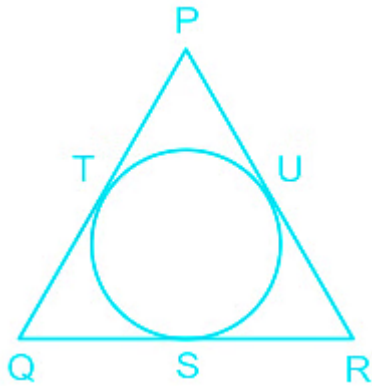
$$PQ = (QR + 5) \text{ cm}$$

$$PQ = (PR + 2) \text{ cm}$$

Formula used:

Perimeter of the triangle $\Delta PQR = (PQ + QR + PR)$

Calculation:



Let the value of QR be x

$$PQ = (QR + 5)$$

$$\Rightarrow PQ = (x + 5)$$

Again,

$$PQ = (PR + 2)$$

$$\Rightarrow (x + 5) = (PR + 2)$$

$$\Rightarrow PR = (x + 5 - 2)$$

$$\Rightarrow PR = (x + 3)$$

Now,

According to the question

The perimeter of the $\Delta PQR = 32 \text{ cm}$

$$\Rightarrow (PQ + QR + PR) = 32 \text{ cm}$$

$$\Rightarrow (x + 5 + x + x + 3) = 32 \text{ cm}$$

$$\Rightarrow (3x + 8) = 32$$

$$\Rightarrow 3x = (32 - 8)$$

$$\Rightarrow 3x = 24$$

$$\Rightarrow x = \frac{24}{3}$$

$$\Rightarrow x = 8$$

Now,

$$\text{The value of PR} = (x + 3) = (8 + 3)$$

$$\Rightarrow 11 \text{ cm}$$

$\therefore$ The required value of PR is 11 cm

53. Answer: d

Explanation:

★ Shortcut Trick

Let the number be 10 unit

$$40\% \text{ of } 10 = 4, 30\% \text{ of } 10 = 3$$

According to the question

$$(4 + 3) \text{ unit} \rightarrow 70$$

$$7 \text{ unit} \rightarrow 70$$

$$1 \text{ unit} \rightarrow 10$$

$$10 \text{ unit} \rightarrow 100$$

$\therefore$ The required number is 100.

★ Alternate Method

Given:

The sum of 40% of a number and 30% of the same number = 70

Calculation:

Let the number be x

According to the question

$$\Rightarrow \left(\frac{40}{100} \times x + \frac{30}{100} \times x \right) = 70$$

$$\Rightarrow \frac{40x}{100} + \frac{30x}{100} = 70$$

$$\Rightarrow \frac{70x}{100} = 70$$

$$\Rightarrow x = \frac{100 \times 70}{70}$$

$$\Rightarrow x = 100$$

∴ The required number is 100

54. Answer: c

Explanation:

Given:

$$\text{The value} = \frac{1}{4-\sqrt{15}} - \frac{1}{\sqrt{15}-\sqrt{14}} + \frac{1}{\sqrt{14}-\sqrt{13}} - \frac{1}{\sqrt{13}-\sqrt{12}} + \frac{1}{\sqrt{12}-\sqrt{11}} - \frac{1}{\sqrt{11}-\sqrt{10}} + \frac{1}{\sqrt{10}-3} - \frac{1}{3-\sqrt{8}}$$

Calculation:

$$\frac{1}{4-\sqrt{15}} - \frac{1}{\sqrt{15}-\sqrt{14}} + \frac{1}{\sqrt{14}-\sqrt{13}} - \frac{1}{\sqrt{13}-\sqrt{12}} + \frac{1}{\sqrt{12}-\sqrt{11}} - \frac{1}{\sqrt{11}-\sqrt{10}} + \frac{1}{\sqrt{10}-3} - \frac{1}{3-\sqrt{8}}$$

Rationalizing the number, we get

$$\Rightarrow \left(\frac{1}{4-\sqrt{15}} \times \frac{4+\sqrt{15}}{4+\sqrt{15}} \right) - \left(\frac{1}{\sqrt{15}-\sqrt{14}} \times \frac{\sqrt{15}+\sqrt{14}}{\sqrt{15}+\sqrt{14}} \right) + \left(\frac{1}{\sqrt{14}-\sqrt{13}} \times \frac{\sqrt{14}+\sqrt{13}}{\sqrt{14}+\sqrt{13}} \right) - \left(\frac{1}{\sqrt{13}-\sqrt{12}} \times \frac{\sqrt{13}+\sqrt{12}}{\sqrt{13}+\sqrt{12}} \right) +$$

$$\left(\frac{1}{\sqrt{12}-\sqrt{11}} \times \frac{\sqrt{12}+\sqrt{11}}{\sqrt{12}+\sqrt{11}} \right) - \left(\frac{1}{\sqrt{11}-\sqrt{10}} \times \frac{\sqrt{11}+\sqrt{10}}{\sqrt{11}+\sqrt{10}} \right) + \left(\frac{1}{\sqrt{10}-3} \times \frac{\sqrt{10}+3}{\sqrt{10}+3} \right) - \left(\frac{1}{3-\sqrt{8}} \times \frac{\sqrt{3}+\sqrt{8}}{\sqrt{3}+\sqrt{8}} \right)$$

$$\Rightarrow \left(\frac{4+\sqrt{15}}{4^2-15} \right) - \left(\frac{\sqrt{15}+\sqrt{14}}{15-14} \right) + \left(\frac{\sqrt{14}+\sqrt{13}}{14-13} \right) - \left(\frac{\sqrt{13}+\sqrt{12}}{13-12} \right) + \left(\frac{\sqrt{12}+\sqrt{11}}{12-11} \right) - \left(\frac{\sqrt{11}+\sqrt{10}}{11-10} \right) + \left(\frac{\sqrt{10}+\sqrt{3}}{10-3^2} \right) - \left(\frac{\sqrt{3}+\sqrt{8}}{3^2-8} \right)$$

$$\Rightarrow (4 + \sqrt{15}) - (\sqrt{15} + \sqrt{14}) + (\sqrt{14} + \sqrt{13}) - (\sqrt{13} + \sqrt{12}) + (\sqrt{12} + \sqrt{11}) - (\sqrt{11} + \sqrt{10}) + (\sqrt{10} + \sqrt{3}) - (\sqrt{3} + \sqrt{8})$$

$$\Rightarrow 4 + \sqrt{15} - \sqrt{15} - \sqrt{14} + \sqrt{14} + \sqrt{13} - \sqrt{13} - \sqrt{12} + \sqrt{12} + \sqrt{11} - \sqrt{11} - \sqrt{10} + \sqrt{10} + \sqrt{3} - \sqrt{3} - \sqrt{8}$$

$$\Rightarrow 4 - \sqrt{8}$$

$$\Rightarrow 4 - 2\sqrt{2}$$

∴ The required value is $4 - 2\sqrt{2}$

55. Answer: c

Explanation:

Given:

$$\frac{(1+\sec \theta \cos \theta)^2 (\sec \theta - \tan \theta)^2 (1+\sin \theta)}{(\sin \theta + \sec \theta)^2 + (\cos \theta + \csc \theta)^2}$$

Formula used:

$$\sec \theta = \frac{1}{\cos \theta}$$

$$\operatorname{cosec} \theta = \frac{1}{\sin \theta}$$

$$\sec \theta = \frac{1}{\cos \theta}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\Rightarrow \cos^2 \theta = 1 - \sin^2 \theta$$

Calculation:

$$\frac{(1+\sec \theta \cos \theta)^2 (\sec \theta - \tan \theta)^2 (1+\sin \theta)}{(\sin \theta + \sec \theta)^2 + (\cos \theta + \csc \theta)^2}$$

$$\begin{aligned}
 &\Rightarrow \left(1 + \frac{1}{\cos\theta} \times \frac{1}{\sin\theta}\right)^2 \left(\frac{1}{\cos\theta} - \frac{\sin\theta}{\cos\theta}\right)^2 (1 + \sin\theta) / \left(\sin\theta + \frac{1}{\cos\theta}\right)^2 + \left(\cos\theta + \frac{1}{\sin\theta}\right)^2 \\
 &\Rightarrow \left(\frac{\sin\theta \cdot \cos\theta + 1}{\sin\theta \cdot \cos\theta}\right)^2 \left(\frac{1 - \sin\theta}{\cos\theta}\right)^2 (1 + \sin\theta) / \left(\frac{\sin\theta \cdot \cos\theta + 1}{\cos\theta}\right)^2 + \left(\frac{\sin\theta \cdot \cos\theta + 1}{\sin\theta}\right)^2 \\
 &\Rightarrow \left(\frac{\sin\theta \cdot \cos\theta + 1}{\sin\theta \cdot \cos\theta}\right)^2 \frac{(1 - \sin\theta)^2}{\cos^2\theta} \times (1 + \sin\theta) / \frac{(\sin\theta \cdot \cos\theta + 1)^2}{\cos^2\theta} + \frac{(\sin\theta \cdot \cos\theta + 1)^2}{\sin^2\theta} \\
 &\Rightarrow \left(\frac{\sin\theta \cdot \cos\theta + 1}{\sin\theta \cdot \cos\theta}\right)^2 \frac{(1 - \sin\theta)^2}{\cos^2\theta} \times (1 + \sin\theta) / \frac{\sin^2\theta(\sin\theta \cdot \cos\theta + 1)^2 + \cos^2\theta(\sin\theta \cdot \cos\theta + 1)^2}{\sin^2\theta \cdot \cos^2\theta} \\
 &\Rightarrow \frac{(\sin\theta \cdot \cos\theta + 1)^2}{\sin^2\theta \cdot \cos^2\theta} \times \frac{(1 - \sin\theta)^2}{1 - \sin^2\theta} \times (1 + \sin\theta) / \frac{(\sin\theta \cdot \cos\theta + 1)^2 \sin^2\theta + \cos^2\theta}{\sin^2\theta \cdot \cos^2\theta} \\
 &\Rightarrow \frac{(1 - \sin\theta)^2}{1 - \sin^2\theta} \times (1 + \sin\theta) \\
 &\Rightarrow \frac{(1 - \sin\theta)^2}{(1 - \sin\theta)(1 + \sin\theta)} \times (1 + \sin\theta) \\
 &\Rightarrow 1 - \sin\theta
 \end{aligned}$$

∴ The required value is $1 - \sin\theta$

56. Answer: a

Explanation:

Given:

Length of cuboid = 12 cm

Breadth of cuboid = 54 cm

Height of the cuboid = 72 cm

It is converted into 8 cubes of the same size

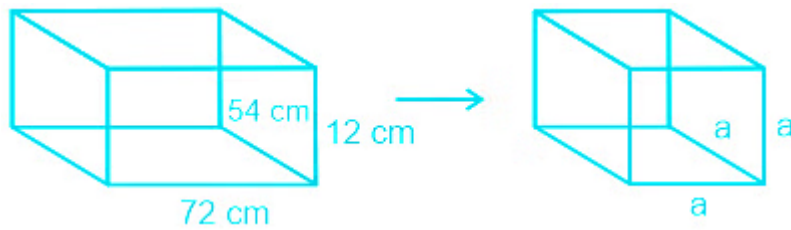
Formula used:

Volume of the cuboid = $l b h$

Volume of cube = a^3

Lateral surface area of the cube = $4a^2$

Calculation:



According to the question

$$\Rightarrow lbh = 8 \times a^3$$

$$\Rightarrow (12 \times 54 \times 72) = 8 \times a^3$$

$$\Rightarrow (12 \times 54 \times 9) = a^3$$

$$\Rightarrow a^3 = 5832$$

$$\Rightarrow a = 18 \text{ cm}$$

Now,

The sum of the lateral surface area of the two such cubes = $(4a^2 + 4a^2)$

$$\Rightarrow 8a^2$$

$$\Rightarrow 8 \times 18 \times 18 \text{ cm}^2$$

$$\Rightarrow 2592 \text{ cm}^2$$

$\therefore$ The required sum is 2592 cm^2

57. Answer: c

Explanation:

Calculation:

The average production of fertilisers by country Z in 2017, 2018 and 2020 = $\left(\frac{330+360+420}{3}\right)$

$$\Rightarrow \frac{1110}{3}$$

$$\Rightarrow 370$$

The average production of fertilisers by country X in 2018 and 2020 = $\left(\frac{240+260}{2}\right)$

$$\Rightarrow \frac{500}{2}$$

$$\Rightarrow 250$$

Required percentage = $\frac{(370-250)}{250} \times 100$

$$\Rightarrow \frac{120}{250} \times 100$$

$$\Rightarrow (24 \times 2)\%$$

$$\Rightarrow 48\%$$

$\therefore$ The required average production is 48%

58. Answer: b

Explanation:

★ Shortcut Trick

Rate% for 1 year when compounded yearly = 8%

Rate% for 1 year when compounded half-yearly = $[4 + 4 + (4 \times 4)/100]\%$

$$\Rightarrow 8.16\%$$

Difference between rate percent = $8.16\% - 8\% = 0.16\%$

Difference between interest = 0.16% of 50000 = 80

$\therefore$ The required difference is Rs. 80

★ Alternate Method

Given:

Principal = Rs. 50,000

Rate = 8%

Formula used:

$$A_1 = P(1 + r)^t$$

$$A_2 = P\left(1 + \frac{r}{2}\right)^{2t}$$

Calculation:

When interest is yearly

$$A_1 = P(1 + r)^t$$

$$\Rightarrow 50,000 \times \left(1 + \frac{8}{100}\right)^1$$

$$\Rightarrow \left(50,000 \times \frac{108}{100}\right)$$

$$\Rightarrow \text{Rs. } 54,000$$

Now,

When interest is half-yearly

$$A_2 = P\left(1 + \frac{r}{2}\right)^{2t}$$

$$\Rightarrow 50,000 \times \left(1 + \frac{8}{200}\right)^2$$

$$\Rightarrow \left(50,000 \times \frac{208}{200} \times \frac{208}{200}\right)$$

$$\Rightarrow (5 \times 52 \times 208)$$

$$\Rightarrow \text{Rs. } 54,080$$

Now,

The difference between the interests on compound half-yearly and yearly = Rs. (54,080 – 54,000)

⇒ Rs. 80

∴ The required difference is Rs. 80

59. Answer: b

Explanation:

Given:

The radius of the base of a cylindrical tank = 4 m

Three times the sum of the areas of its two circular faces is twice the area of its curved surface

Formula used:

Area of circle = πr^2

Curved surface area of cylinder = $2\pi rh$

Volume of the cylinder = $\pi r^2 h$

Calculation:

Let h be the height of the cylinder

According to the question

Three times the sum of the areas of its two circular faces is twice the area of its curved surface

$$\Rightarrow 3 \times (\pi r^2 + \pi r^2) = 2 \times 2\pi rh$$

$$\Rightarrow 6\pi r^2 = 4\pi rh$$

$$\Rightarrow (6 \times \pi \times 4 \times 4) = (4 \times \pi \times 4 \times h)$$

$$\Rightarrow h = 6 \text{ m}$$

Now,

The capacity of the tank = $\pi r^2 h$

$$\Rightarrow (\pi \times 4 \times 4 \times 6)$$

$$\Rightarrow 96\pi$$

$\therefore$ The required capacity of the tank is 96π

60. Answer: d

Explanation:

Given:

4 men and 5 women can complete a work in 15 days,

9 men and 6 women can complete it in 10 days.

Calculation:

According to the question

Total work = Total work

$$\Rightarrow (4m + 5w) \times 15 = (9m + 6w) \times 10$$

$$\Rightarrow (60m + 75w) = (90m + 60w)$$

$$\Rightarrow (90m - 60m) = (75w - 60w)$$

$$\Rightarrow 30m = 15w$$

$$\Rightarrow 2m = 1w$$

$$\Rightarrow m : w = 1 : 2$$

$$\text{Total work} = (4m + 5w) \times 15$$

$$\Rightarrow (4 \times 1 + 5 \times 2) \times 15$$

$$\Rightarrow (4 + 10) \times 15$$

$$\Rightarrow (14 \times 15)$$

$$\Rightarrow 210$$

Let x women assist 4 men to complete the work in 7 days, then

$$\Rightarrow (4 \times 1 + x \times 2) \times 7 = 210$$

$$\Rightarrow (4 + 2x) = \frac{210}{7}$$

$$\Rightarrow (4 + 2x) = 30$$

$$\Rightarrow 2x = (30 - 4)$$

$$\Rightarrow 2x = 26$$

$$\Rightarrow x = 13$$

$\therefore$ 13 women assist 4 men

★ Shortcut Trick

According to the question

$$(4m + 5w) \times 15 = (9m + 6w) \times 10$$

$$\Rightarrow 60m + 75w = 90m + 60w$$

$$\Rightarrow 30m = 15w$$

$$\Rightarrow m : w = 1 : 2$$

$$\text{Total work} = (4m + 5w) \times 15$$

$$\Rightarrow (4 + 10) \times 15$$

$$\Rightarrow 210$$

According to the question

$$\Rightarrow (4 + 2 \times x) \times 7 = 210$$

$$\Rightarrow 28 + 14x = 210$$

$$\Rightarrow 14x = 182$$

$$\Rightarrow x = 13$$

$\therefore$ The required women is 13

61. Answer: c

Explanation:

Given:

The radius of a solid right circular cone = 36 cm

Height = 105 cm

Formula used:

$$l^2 = r^2 + h^2$$

Total surface area of cone = $\pi r(r + l)$

Calculation:

According to the question

Radius (r) = 36 cm

Height (h) = 105 cm

$$l^2 = r^2 + h^2$$

$$\Rightarrow l^2 = (36^2 + 105^2)$$

$$\Rightarrow l^2 = (1296 + 11025)$$

$$\Rightarrow l^2 = 12321 \text{ cm}^2$$

$$\Rightarrow l = 111 \text{ cm}$$

Now,

$$\text{Total surface area of cone} = [\pi \times 36(36 + 111)] \text{ cm}^2$$

$$\Rightarrow (36\pi \times 147) \text{ cm}^2$$

$$\Rightarrow 5292 \pi \text{ cm}^2$$

$\therefore$ The required total surface area is $5292 \pi \text{ cm}^2$

62. Answer: a

Explanation:

★ Shortcut Trick

Ratio Method

Income of A : B = 4 : 5

Expenditure of A : B = 3 : 5

Here, 90% of B's expenditure = $5 \times 90\% = 9/2$

So, Income of A = $9/2$ unit

For making income of A, $9/2$, we have to multiply the 1st ratio by $9/8$

Income of A : B = $[4 : 5] \times 9/8 = 9/2 : 45/8$

Expenditure of A : B = 3 : 5

$$\text{Saving of A : B} = (9/2 - 3) : (45/8 - 5) = 3/2 : 5/8 = 12 : 5$$

$$\therefore \text{Required\%} = [(12 - 5)/5] \times 100\% = 140\%$$

★ Alternate Method

Given:

The income of A is 80% of B's income

The expenditure of A is 60% of B's expenditure

The income of A is equal to 90% of B's expenditure

Calculation:

Let the income of B be $100x$

So,

$$\text{Income of A} = (100x \times \frac{80}{100})$$

$$\Rightarrow 80x$$

For B's expenditure

90% of B's expenditure = A's income

$$\text{B's expenditure} = \frac{90}{100} = 80x$$

$$\Rightarrow \left(\frac{100 \times 8x}{9} \right)$$

$$\Rightarrow \frac{800x}{9}$$

For A's expenditure

A's expenditure = 60% of B's expenditure

$$\Rightarrow \left(\frac{60}{100} \times \frac{800x}{9} \right)$$

$$\Rightarrow \frac{160x}{3}$$

Now,

Savings of A = Income of A – Expenditure of A

$$\Rightarrow (80x - \frac{160x}{3})$$

$$\Rightarrow \frac{240x - 160x}{3}$$

$$\Rightarrow \frac{80x}{3}$$

Now,

Savings of B = Income of B – Expenditure of B

$$\Rightarrow (100x - \frac{800x}{9})$$

$$\Rightarrow \frac{900x - 800x}{9}$$

$$\Rightarrow \frac{100x}{9}$$

Now,

$$\text{Required percentage increase} = (\frac{80x}{3} - \frac{100x}{9}) / (\frac{100x}{9}) \times 100$$

$$\Rightarrow (\frac{240x - 100x}{9}) / (\frac{100x}{9}) \times 100$$

$$\Rightarrow (\frac{140x}{9} \times \frac{9}{100x} \times 100)$$

$$\Rightarrow 140\%$$

$\therefore$ The required percentage is 140%

63. Answer: c

Explanation:

Given:

S and T are points on the sides PQ and PR, respectively, of ΔPQR

$$PS \times PR = PQ \times PT$$

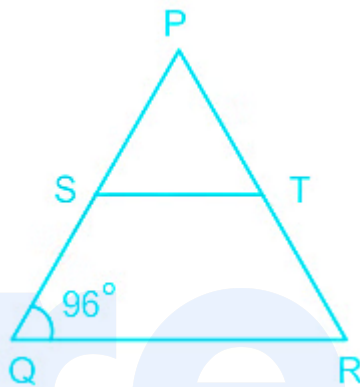
$$\angle Q = 96^\circ$$

$$\angle PST = \angle PRQ + 34^\circ$$

Concept used:

We know that the sum of all the sides of triangle is 180°

Calculation:



$$PS \times PR = PQ \times PT$$

$$\Rightarrow \frac{PS}{PQ} = \frac{PT}{PR}$$

So, from the converse of thales theorem

$$ST \parallel QR$$

So, $\angle Q = \angle PST = 96^\circ$ [By corresponding angles]

$$\text{Given, } \angle PST = \angle PRQ + 34^\circ$$

$$\Rightarrow 96^\circ = \angle PRQ + 34^\circ$$

$$\Rightarrow \angle PRQ = (96^\circ - 34^\circ)$$

$$\Rightarrow \angle PRQ = 62^\circ$$

Now,

We know that the sum of all the sides of triangle is 180°

$$\Rightarrow \angle PQR + \angle PRQ + \angle QPR = 180^\circ$$

$$\Rightarrow 96^\circ + 62^\circ + \angle QPR = 180^\circ$$

$$\Rightarrow 158^\circ + \angle QPR = 180^\circ$$

$$\Rightarrow \angle QPR = (180^\circ - 158^\circ)$$

$$\Rightarrow \angle QPR = 22^\circ$$

$\therefore$ The required value of $\angle QPR$ is 22° .

64. Answer: a

Explanation:

Given:

$$3 \tan \theta = 2\sqrt{3} \sin \theta$$

Formula used:

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\cos 30^\circ = \frac{\sqrt{3}}{2}, \operatorname{cosec} 60^\circ = \frac{2}{\sqrt{3}}$$

$$\cot 60^\circ = \frac{1}{\sqrt{3}}, \sin 30^\circ = \frac{1}{2}, \tan 60^\circ = \sqrt{3}$$

Calculation:

$$\text{We have } 3 \tan \theta = 2\sqrt{3} \sin \theta$$

$$\Rightarrow 3 \frac{\sin \theta}{\cos \theta} = 2\sqrt{3} \sin \theta$$

$$\Rightarrow \frac{3}{\cos \theta} = 2\sqrt{3}$$

$$\Rightarrow \cos \theta = \frac{\sqrt{3}}{2} = \cos 30^\circ$$

$$\Rightarrow \theta = 30^\circ$$

Now,

The value of $\frac{\csc^2 2\theta + \cot^2 2\theta}{\sin^2 \theta + \tan^2 2\theta}$

$$\Rightarrow \frac{\csc^2 60^\circ + \cot^2 60^\circ}{\sin^2 30^\circ + \tan^2 60^\circ}$$

$$\Rightarrow \frac{\left(\frac{2}{\sqrt{3}}\right)^2 + \left(\frac{1}{\sqrt{3}}\right)^2}{\left(\frac{1}{2}\right)^2 + (\sqrt{3})^2}$$

$$\Rightarrow \frac{\frac{4}{3} + \frac{1}{3}}{\frac{1}{4} + 3} = \frac{\frac{5}{3}}{\frac{13}{4}}$$

$$\Rightarrow \frac{20}{39}$$

$\therefore$ The required value is $\frac{20}{39}$.

65. Answer: c

Explanation:

★ Shortcut Trick

$$\frac{M.P}{C.P} = \frac{(100 + \text{Gain}\%)}{(100 - \text{Discount}\%)}$$

$$\frac{M.P}{C.P} = \frac{(100 + 25\%)}{(100 - 20\%)} = \frac{25}{16}$$

$$\text{New, } \frac{M.P}{C.P} = \frac{(100 + 15\%)}{(100 - x\%)} = \frac{115}{(100 - x\%)}$$

According to the question, M.P is constant

$$25 \rightarrow 115$$

$$1 \rightarrow 23/5$$

$$16 \rightarrow (23 \times 16)/5$$

Now, According to the question

$$(23 \times 16)/5 \times 130\% = 100 - x\%$$

$$95.68 = 100 - x\%$$

$$x\% = 4.32\%$$

∴ The required discount percentage is 4.32%

★ Alternate Method

Given:

A trader gains 25% by selling an article with 20% discount on its marked price

The cost price of the article increases by 30%

Formula used:

$$SP = MP - \text{Discount}$$

$$SP = \text{Profit} + CP$$

$$\text{Discount} = MP - SP$$

$$\text{Discount}\% = \frac{\text{Discount}}{MP} \times 100$$

Calculation:

Let the marked price be 100 and cost price be x

$$SP = MP - \text{Discount}$$

$$\Rightarrow SP = (100 - 20) = 80$$

Now,

$$\text{Profit gains} = 25\%$$

$$\Rightarrow x + 25\% \text{ of } x = 80$$

$$\Rightarrow x + \frac{25}{100} \times x = 80$$

$$\Rightarrow x + \frac{x}{4} = 80$$

$$\Rightarrow \frac{4x+x}{4} = 80$$

$$\Rightarrow \frac{5x}{4} = 80$$

$$\Rightarrow 5x = 320$$

$$\Rightarrow x = 64$$

$$CP = 64$$

Now,

The cost price of the article increases by 30%

$$\Rightarrow 64 + 30\% \text{ of } 64$$

$$\Rightarrow 64 + \frac{30}{100} \times 64$$

$$\Rightarrow 64 + \frac{192}{10}$$

$$\Rightarrow 64 + 19.2$$

$$\Rightarrow \text{New CP} = 83.2$$

Now,

According to the question

Discount he offer on the same marked price to gain 15% of profit

$$SP = \text{Profit} + CP$$

$$\Rightarrow (15\% \text{ of } 83.2) + 83.2$$

$$\Rightarrow \left(\frac{15}{100} \times 83.2 \right) + 83.2$$

$$\Rightarrow \left(\frac{1248}{100} \right) + 83.2$$

$$\Rightarrow (12.48 + 83.2)$$

$$\Rightarrow 95.68$$

Now,

$$\text{Discount} = MP - SP$$

$$\Rightarrow (100 - 95.68)$$

$$\Rightarrow 4.32$$

$$\text{Discount\%} = \frac{\text{Discount}}{\text{MP}} \times 100$$

$$\Rightarrow \left(\frac{4.32}{100} \times 100 \right)$$

$$\Rightarrow 4.32\%$$

$\therefore$ The required discount percentage is 4.32%

★ Shortcut Trick

Let the marked price be Rs.100

$$\text{SP of the article} = \left(100 \times \frac{80}{100} \right) = 80$$

$$\text{CP of the article} = \left(80 \times \frac{100}{125} \right) = 64$$

$$\text{New CP of the article} = \left(64 \times \frac{130}{100} \right) = \frac{416}{5}$$

$$\Rightarrow 83.2$$

$$\text{New SP of the article} = \left(83.2 \times \frac{115}{100} \right)$$

$$\Rightarrow \left(83.2 \times \frac{23}{20} \right)$$

$$\Rightarrow \left(\frac{1913.6}{20} \right)$$

$$\Rightarrow 95.68$$

$$\text{Discount} = (100 - 95.68) = 4.32$$

$$\text{Discount\%} = \left(\frac{4.32}{100} \times 100 \right)$$

$$\Rightarrow 4.32\%$$

$\therefore$ The required discount percentage is 4.32%

66. Answer: c

Explanation:

Given:

SP of the article = Rs. 355

Loss = 29%

Formula used:

$$CP = \frac{SP}{100 - Loss} \times 100$$

Calculation:

SP of the article = Rs. 355

Loss = 29%

$$CP = \frac{SP}{100 - Loss} \times 100$$

$$\Rightarrow \frac{355}{100 - 29} \times 100$$

$$\Rightarrow \left(\frac{355}{71} \times 100 \right)$$

$$\Rightarrow 500$$

CP = Rs. 500

Now,

For 31% gain

$$\Rightarrow SP = \left(500 \times \frac{131}{100} \right)$$

$$\Rightarrow 655$$

SP = Rs. 655

∴ The required SP is Rs. 655

★ Shortcut Trick

CP SP New SP

100 71 131

$\Rightarrow 71 \text{ unit} = 355$

$\Rightarrow 1 \text{ unit} = 5$

Then,

$\Rightarrow 131 \text{ unit} = (131 \times 5) = \text{Rs. } 655$

$\therefore$ The required SP is Rs. 655

67. Answer: a

Explanation:

Given:

$$\frac{3(\cot^2 47^\circ - \sec^2 43^\circ) - 2(\tan^2 23^\circ - \csc^2 67^\circ)}{\csc^2(68^\circ + \theta) - \tan(\theta + 61^\circ) - \tan^2(22^\circ - \theta) + \cot(29^\circ - \theta)}$$

Formula used:

$$\tan(90^\circ - \theta) = \cot \theta$$

$$\tan 2\theta - \sec 2\theta = 1$$

If $(a + b) = 90^\circ$ then, $\tan A = \cot B$

$$\csc 2\theta - \cot 2\theta = 1$$

Calculation:

$$\frac{3(\cot^2 47^\circ - \sec^2 43^\circ) - 2(\tan^2 23^\circ - \csc^2 67^\circ)}{\csc^2(68^\circ + \theta) - \tan(\theta + 61^\circ) - \tan^2(22^\circ - \theta) + \cot(29^\circ - \theta)}$$

$$\Rightarrow \frac{3(\tan^2 43^\circ - \sec^2 43^\circ) - 2(\tan^2 23^\circ - \csc^2 23^\circ)}{\csc^2(68^\circ + \theta) - \tan(\theta + 61^\circ) - \tan^2(22^\circ - \theta) + \cot(29^\circ - \theta)} \quad [\tan(90^\circ - \theta) = \cot \theta \text{ and } \tan^2 \theta - \sec^2 \theta = -1]$$

$$\Rightarrow \frac{3(\tan^2 43^\circ - \sec^2 43^\circ) - 2(\tan^2 23^\circ - \csc^2 23^\circ)}{\csc^2(68^\circ + \theta) - \tan(\theta + 61^\circ) - \cot^2(68^\circ + \theta) + \cot(29^\circ - \theta)} \quad [\text{If } (a + b) = 90^\circ \text{ then, } \tan A = \cot B]$$

$$\Rightarrow \frac{3(\tan^2 43^\circ - \sec^2 43^\circ) - 2(\tan^2 23^\circ - \sec^2 23^\circ)}{\cos^2(68^\circ + \theta) - \cot^2(68^\circ + \theta)}$$

Now, Taking minus common

$$\Rightarrow \frac{-3(-\tan^2 43^\circ + \sec^2 43^\circ) + 2(-\tan^2 23^\circ + \sec^2 23^\circ)}{\cos^2(68^\circ + \theta) - \cot^2(68^\circ + \theta)} [\operatorname{cosec} 2\theta - \cot 2\theta = 1]$$

$$\Rightarrow \frac{-3+2}{1}$$

$$\Rightarrow -1$$

$\therefore$ The required value is -1

68. Answer: a

Explanation:

Given:

$$2x - 3y + 6 = 0$$

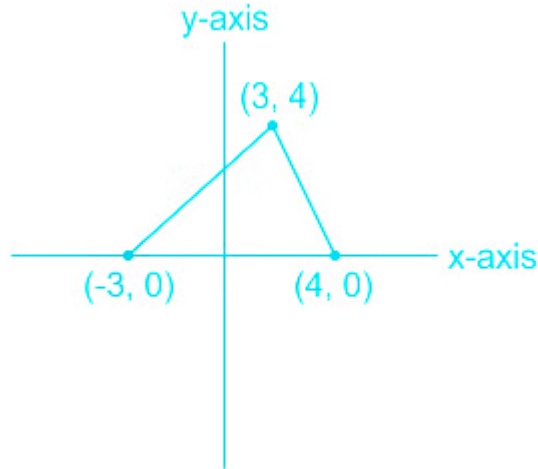
$$4x + y = 16$$

$$y = 0$$

Formula used:

$$\text{Area of triangle} = \frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$$

Calculation:



$$2x - 3y + 6 = 0$$

$$\Rightarrow 2x - 3y = -6 \dots(1)$$

$$4x + y = 16 \dots(2)$$

Multiplying equation (2) by 3

$$\Rightarrow 12x + 3y = 48 \dots(3)$$

Now,

Adding (1) and (3), we get

$$\Rightarrow (2x + 12x) = (48 - 6)$$

$$\Rightarrow 14x = 42$$

$$\Rightarrow x = 3$$

Now, Putting the value of x in equation (1)

$$\Rightarrow 2 \times 3 - 3y = -6$$

$$\Rightarrow 6 - 3y = -6$$

$$\Rightarrow -3y = -1$$

$$\Rightarrow y = (-1 - 3) = 4$$

$$\text{So, } (x_1, y_1) = (3, 4)$$

Now,

We put $y = 0$ in equation (2)

$$\Rightarrow 4x + 0 = 16$$

$$\Rightarrow 4x = 16$$

$$\Rightarrow x = 4$$

$$\text{So, } (x_2, y_2) = (4, 0)$$

Again,

We put $y = 0$ in equation (1)

$$\Rightarrow 2x - 0 = -6$$

$$\Rightarrow 2x = -6$$

$$\Rightarrow x = -3$$

$$\text{So, } (x_3, y_3) = (-3, 0)$$

Now,

$$\text{Area of triangle} = \frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$$

$$\Rightarrow \frac{1}{2} |3(0 - 0) + 4(0 - 4) + (-3)(4 - 0)|$$

$$\Rightarrow \frac{1}{2} |0 + (-16) + (-12)|$$

$$\Rightarrow \frac{1}{2} |-16 - 12|$$

$$\Rightarrow \frac{1}{2} |-28|$$

$$\Rightarrow 14 \text{ [Negative sign is always treated as positive in modulus]}$$

$\therefore$ The required value is 14

69. Answer: d

Explanation:

Given:

Time taken by A to fill the tank = $5\frac{1}{2}$ hours = $\frac{11}{2}$ hours

Because of leak, the tank filled in = $8\frac{1}{4}$ hours = $\frac{33}{4}$ hours

Formula used:

Work = Efficiency $\times$ Time

Calculation:

Per hour efficiency of tap = $\frac{2}{11}$

Let the per hour efficiency of the leak be x

According to the question

$$\Rightarrow \frac{2}{11} + x = \frac{4}{33}$$

$$\Rightarrow x = \left(\frac{4}{33} - \frac{2}{11} \right)$$

$$\Rightarrow x = \left(\frac{4-6}{33} \right)$$

$$\Rightarrow x = \frac{-2}{33} \quad [\text{The negative sign shows it is draining the tank}]$$

The total time taken by the leak to empty the 30% of the tank = $\left(1 / \frac{2}{33}\right) \times \frac{30}{100}$ hours

$$\Rightarrow \left(\frac{33}{2} \times \frac{30}{100} \right) \text{ hours}$$

$$\Rightarrow \frac{99}{20} \text{ hours}$$

$\therefore$ The required time taken by the leak to empty the 30% of the tank is $\frac{99}{20}$ hours

★ **Shortcut Trick**

Let the total capacity of the tank be 33 [LCM of 11 and 33]

Efficiency of A to fill the tank = $(33 \times \frac{2}{11}) = 6$

Combined Efficiency of (leak + A) = $33 \div (33/4) = 4$

Efficiency of Leak = $4 - 6 = -2$

30% of the tank = $33 \times \frac{30}{100}$

$\Rightarrow \frac{99}{10}$

Now, the Required time to empty = $(99/10) \div 2$

$\therefore$ The required time is $\frac{99}{20}$ hours

70. Answer: a

Explanation:

Given:

Saving of A = 35%

Income of A increases = 20.1%

Expenditure of A increases = 20%

Formula used:

Saving = (Income – Expenditure)

Calculation:

Let the income of A be 100

Then,

Expenditure of A = $(100 - 35) = 65$

Now,

Income of A increases = 20.1%

$$\Rightarrow (100 \times \frac{20.1}{100}) = 20.1$$

Expenditure of A increases = 20%

$$\Rightarrow (65 \times \frac{20}{100}) = 13$$

So, Saving = (Income – Expenditure)

$$\Rightarrow (20.1 - 13) = 7.1$$

The percentage of saving increased = $(\frac{7.1}{35} \times 100)$

$$\Rightarrow \frac{710}{35} = 20.3\%$$

$\therefore$ The required percentage is 20.3% of increase

71. Answer: b

Explanation:

Concept Used:

Follow the BODMAS rule according to the table given below:

B	Brackets in order {}, {}, []	ब्रैकेट {}, {}, [] क्रम में
O	of	का
D	Division (÷)	विभाजन (÷)
M	Multiplication (×)	गुणा (×)
A	Addition (+)	जोड़ (+)
S	Subtraction (–)	घटाव (–)

Calculation:

$$\left(2\frac{6}{7} \text{ of } 4\frac{1}{5} \div \frac{2}{3}\right) \times 5\frac{1}{9} \div \left(\frac{3}{4} \times 2\frac{2}{3} \text{ of } \frac{1}{2} \div \frac{1}{4}\right)$$

$$\Rightarrow \left(\frac{20}{7} \text{ of } \frac{21}{5} \div \frac{2}{3}\right) \times \frac{46}{9} \div \left(\frac{3}{4} \times \frac{8}{3} \text{ of } \frac{1}{2} \div \frac{1}{4}\right)$$

$$\Rightarrow \left(\frac{20}{7} \times \frac{21}{5} \times \frac{3}{2}\right) \times \frac{46}{9} \div \left(\frac{3}{4} \times \frac{8}{3} \text{ of } \frac{1}{2} \div \frac{1}{4}\right)$$

$$\Rightarrow (18) \times \frac{46}{9} \div \left(\frac{3}{4} \times \frac{8}{3} \times \frac{1}{2} \times \frac{4}{1}\right)$$

$$\Rightarrow (18) \times \frac{46}{9} \div (4)$$

$$\Rightarrow \left(18 \times \frac{46}{9} \times \frac{1}{4}\right)$$

$$\Rightarrow 23$$

$\therefore$ The required value is 23

72. Answer: c

Explanation:

Given:

The income of A = $\frac{2}{3}$ of B's income

The expenditure of A = $\frac{3}{4}$ of B's expenditure

Formula used:

Saving = Income – Expenditure

Calculation:

The income of A = $\frac{2}{3}$ of B's income

The income of A = 2x

The income of B = 3x

The ratio of income of A and B = (2x : 3x)

Now

The expenditure of A = $\frac{3}{4}$ of B's expenditure

The expenditure of A = $3x$

The expenditure of B = $4x$

The ratio of expenditure of A and B = $(3x : 4x)$

According to the question

$\frac{1}{3}$ of the income of B is equal to the expenditure of A

$\Rightarrow$ The ratio of new income of A and B = $(2x : 3x) \times 3$

$\Rightarrow (6x : 9x)$

Now,

The ratio of savings of A to B = $(6x - 3x) : (9x - 4x)$

$\Rightarrow (3x : 5x)$

$\Rightarrow 3 : 5$

$\therefore$ The required savings of A to B is $3 : 5$

73. Answer: c

Explanation:

Given:

$$(a^2 + b^2) : (b^2 + c^2) : (c^2 + a^2) = 34 : 61 : 45$$

Calculation:

$$(a^2 + b^2) : (b^2 + c^2) : (c^2 + a^2) = 34 : 61 : 45$$

$$\Rightarrow (a^2 + b^2) + (b^2 + c^2) + (c^2 + a^2) = 34 + 61 + 45$$

$$\Rightarrow 2(a^2 + b^2 + c^2) = 140$$

$$\Rightarrow (a^2 + b^2 + c^2) = \frac{140}{2}$$

$$\Rightarrow (a^2 + b^2 + c^2) = 70$$

Now,

$$\Rightarrow a^2 = (a^2 + b^2 + c^2) - (b^2 + c^2)$$

$$\Rightarrow a^2 = (70 - 61)$$

$$\Rightarrow a^2 = 9$$

$$\Rightarrow a = 3$$

Again,

$$\Rightarrow b^2 = (a^2 + b^2 + c^2) - (c^2 + a^2)$$

$$\Rightarrow b^2 = (70 - 45)$$

$$\Rightarrow b^2 = 25$$

$$\Rightarrow b = 5$$

Again,

$$\Rightarrow c^2 = (a^2 + b^2 + c^2) - (a^2 + b^2)$$

$$\Rightarrow c^2 = (70 - 34)$$

$$\Rightarrow c^2 = 36$$

$$\Rightarrow c = 6$$

Now,

The value of $b - a : c - b : c - a$

$$\Rightarrow (5 - 3) : (6 - 5) : (6 - 3)$$

$$\Rightarrow 2 : 1 : 3$$

$\therefore$ The required value is 2 : 1 : 3

74. Answer: c

Explanation:

Given:

$$x = (433)^{24} - (377)^{38} + (166)^{54}$$

Concept used:

- The unit digit of a power of a number repeats itself every 4th time for the base having the last digit as 3, 7.
- But the last digit for $(166)^{54}$ will always be 6 as the unit digit of a power of a number having the last digit 6 will always be 6

Calculation:

$$\text{Unit digit of } x = \text{Unit digit of } (433)^{24} - \text{Unit digit of } (377)^{38} + \text{Unit digit of } (166)^{54}$$

$$\Rightarrow \text{Unit digit of } (433)^{(4 \times 5) + 4} - \text{Unit digit of } (377)^{(4 \times 9) + 2} + 6 \text{ (as Unit digit of } (166)^{54} \text{)}$$

Now,

$$\Rightarrow \text{Unit digit of } (433)^4 = 1$$

$$\Rightarrow \text{Unit digit of } (377)^2 = 9$$

$$\Rightarrow \text{Unit digit of } (166)^2 = 6$$

$$\text{Hence, Unit digit of } x = (1 - 9 + 6)$$

$$\Rightarrow x = (7 - 9)$$

$$\Rightarrow \text{Or, } x = (17 - 9)$$

$$\Rightarrow x = 8$$

$\therefore$ The required unit digit of x is 8

75. Answer: b

Explanation:

Calculation:

Total Number of Students passed = 900

The number of students who passed the examination from institute C = 30%

$$\Rightarrow \left(\frac{30}{100} \times 900 \right)$$

$$\Rightarrow 270$$

Total Number of Students appeared = 1200

The number of students who appeared from institutes D = 105%

$$\Rightarrow \left(\frac{105}{360} \times 1200 \right)$$

$$\Rightarrow 350$$

The number of students who appeared from institutes E = 39%

$$\Rightarrow \left(\frac{39}{360} \times 1200 \right)$$

$$\Rightarrow 130$$

The total number of students who appeared from institutes D and E = $(350 + 130) = 480$

Now,

The number of students who passed the examination from institute C to the total number of students who appeared from institutes D and E

$$\Rightarrow \left(\frac{270}{480} \times 100 \right)$$

$$\Rightarrow 56.25\%$$

$\therefore$ The required percentage is 56.25%

76. Answer: d

Explanation:

Given:

The surface area of a sphere is 221.76 cm^2

Formula used:

$$\text{Surface area of sphere} = 4\pi r^2$$

$$\text{Volume of the sphere} = \frac{4}{3} \pi r^3$$

Calculation:

The surface area of a sphere is 221.76 cm^2

$$\Rightarrow 4 \times \frac{22}{7} \times r^2 = 221.76$$

$$\Rightarrow \frac{88r^2}{7} = 221.76$$

$$\Rightarrow 88r^2 = (221.76 \times 7)$$

$$\Rightarrow 88r^2 = 1552.32$$

$$\Rightarrow r^2 = 17.64$$

$$\Rightarrow r = 4.2 \text{ cm}$$

Now,

$$\text{Volume of the sphere} = \left(\frac{4}{3} \times \frac{22}{7} \times 4.2 \times 4.2 \times 4.2 \right) \text{ cm}^3$$

$$\Rightarrow (4 \times 22 \times 0.2 \times 4.2 \times 4.2) \text{ cm}^3$$

$$\Rightarrow 310.464 \text{ cm}^3 \sim 310.5 \text{ cm}^3$$

$\therefore$ The required volume is 310.5 cm^3

77. Answer: a

Explanation:

Given:

$$\frac{1}{4} + \frac{[(20.35)^2 - (8.35)^2] \times 0.0175}{(1.05)^2 + (1.05)(27.65)}$$

Formula Used:

$$a^2 - b^2 = (a + b)(a - b)$$

Calculation:

$$\frac{1}{4} + \frac{[(20.35)^2 - (8.35)^2] \times 0.0175}{(1.05)^2 + (1.05)(27.65)}$$

$$\Rightarrow \frac{1}{4} + \frac{(20.35 - 8.35)(20.35 + 8.35) \times 0.0175}{(1.05)[1.05 + 27.65]}$$

$$\Rightarrow \frac{1}{4} + \frac{(12) \times (28.70) \times 0.0175}{(1.05) \times [28.70]}$$

$$\Rightarrow \frac{1}{4} + \frac{12 \times 0.0175}{1.0500}$$

$$\Rightarrow \frac{1}{4} + \frac{12 \times 175}{10500}$$

$$\Rightarrow \frac{1}{4} + \frac{2100}{10500}$$

$$\Rightarrow \frac{1}{4} + \frac{1}{5}$$

$$\Rightarrow \left(\frac{5+4}{20} \right)$$

$$\Rightarrow \frac{9}{20}$$

$\therefore$ The required value is $\frac{9}{20}$.

78. Answer: b

Explanation:

Given:

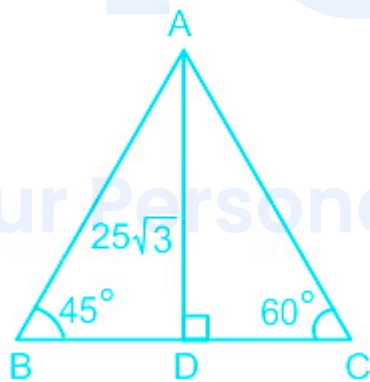
Height of the top of a tower = $25\sqrt{3}$ m

Formula used:

$$\tan 45^\circ = 1$$

$$\tan 60^\circ = \sqrt{3}$$

Calculation:



According to the question

In $\triangle ABD$

$$\Rightarrow \tan 45^\circ = \frac{AD}{BD}$$

$$\Rightarrow 1 = \frac{25\sqrt{3}}{BD}$$

$$\Rightarrow BD = 25\sqrt{3} = (25 \times 1.732)$$

$$\Rightarrow BD = 43.3 \text{ cm}$$

Now,

In $\triangle ADC$

Let DC be x

$$\Rightarrow \tan 60^\circ = \frac{AD}{DC}$$

$$\Rightarrow \sqrt{3} = \frac{25\sqrt{3}}{x}$$

$$\Rightarrow \sqrt{3}x = 25\sqrt{3}$$

$$\Rightarrow x = 25 \text{ cm}$$

Now,

The distance between the two points = (BD + DC)

$$\Rightarrow (43.3 + 25) \text{ cm}$$

$$\Rightarrow 68.3 \text{ cm}$$

$\therefore$ The required distance is 68.3 cm

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79. Answer: c

Explanation:

Given:

O is a point in the interior of $\triangle ABC$

$$OA = 12 \text{ cm}$$

$$OC = 9 \text{ cm}$$

$$\angle AOB = \angle BOC = \angle COA$$

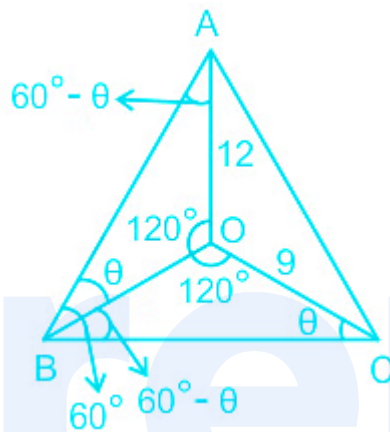
$$\angle ABC = 60^\circ$$

Concept used:

An angle around a point will always make a 360°

The sum of all the sides of triangle is 180°

Calculation:



According to the question

We know that an angle around a point will always make a 360°

So,

$$\Rightarrow \angle AOB = \angle BOC = \angle COA = \frac{360}{3}$$

$$\Rightarrow 120^\circ$$

Now,

$$\angle ABC = 60^\circ$$

We know that the sum of all the sides of triangle is 180°

In $\triangle AOB$

$$\text{Let } \angle OBA = \theta$$

$$\Rightarrow \angle OBA + \angle BAO + \angle AOB = 180^\circ$$

$$\Rightarrow \theta + \angle BAO + 120^\circ = 180^\circ$$

$$\Rightarrow \angle BAO = (180^\circ - 120^\circ - \theta)$$

$$\Rightarrow \angle BAO = 60^\circ - \theta$$

Now,

In $\triangle BOC$

$$\Rightarrow \angle OBC = (\angle ABC - \angle OBA)$$

$$\angle OBC = 60^\circ - \theta$$

$$\Rightarrow \angle OBC + \angle BOC + \angle OCB = 180^\circ$$

$$\Rightarrow (60^\circ - \theta + 120^\circ + \angle OCB = 180^\circ)$$

$$\Rightarrow \angle OCB = (180^\circ - 120^\circ - 60^\circ - \theta)$$

$$\Rightarrow \angle OCB = \theta$$

So,

$\angle AOB$ and $\angle BOC$

$$\Rightarrow \angle A = \angle B$$

$$\Rightarrow \angle O = \angle O$$

$$\Rightarrow \angle B = \angle C$$

$\triangle AOB \sim \triangle BOC$ [AAA similarity]

Now,

$$\Rightarrow \frac{OA}{OB} = \frac{OB}{OC}$$

$$\Rightarrow \frac{12}{OB} = \frac{OB}{9}$$

$$\Rightarrow OB^2 = 108$$

$$\Rightarrow OB = 6\sqrt{3} \text{ cm}$$

$\therefore$ The required value of OB is $6\sqrt{3} \text{ cm}$

80. Answer: c

Explanation:

Given:

$$\angle B = 78^\circ$$

AD is the bisector of $\angle A$ meeting BC at D

AE $\perp$ BC at E

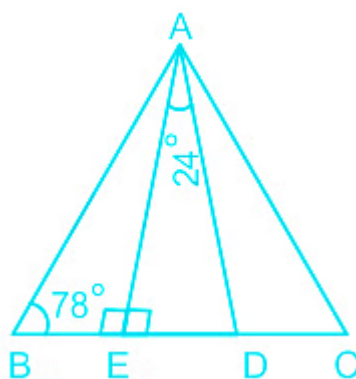
$$\angle DAE = 24^\circ$$

Concept used:

If AD is the angle bisector and AE is the perpendicular on-base BC, then

$$\angle DAE = \frac{1}{2} (\angle B - \angle C)$$

Calculation:



Let the value of $\angle C$ be x

$$\angle B = 78^\circ$$

$$\angle DAE = 24^\circ$$

Now, According to the concept used

$$\angle DAE = \frac{1}{2} (\angle B - \angle C)$$

$$\Rightarrow 24^\circ = \frac{1}{2} (78^\circ - x)$$

$$\Rightarrow 48^\circ = 78^\circ - x$$

$$\Rightarrow x = (78^\circ - 48^\circ)$$

$$\Rightarrow x = 30^\circ$$

$\therefore$ The value of $\angle ACB$ is 30° .

81. Answer: c

Explanation:

Given:

$$\left(\frac{\tan^3 \theta}{\sec^2 \theta} + \frac{\cot^3 \theta}{\cos^2 \theta} + 2 \sin \theta \cos \theta \right) \div (1 + \operatorname{cosec} 2\theta + \tan^2 \theta)$$

Formula used:

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\cot \theta = \frac{\cos \theta}{\sin \theta}$$

$$\sec^2 \theta = \frac{1}{\cos^2 \theta}$$

Calculation:

$$\left(\frac{\tan^3 \theta}{\sec^2 \theta} + \frac{\cot^3 \theta}{\cos^2 \theta} + 2 \sin \theta \cos \theta \right) \div (1 + \operatorname{cosec} 2\theta + \tan^2 \theta)$$

$$\Rightarrow \left(\frac{\sin^3 \theta}{\cos^3 \theta} \cdot \frac{1}{\cos^2 \theta} + \frac{\cos^3 \theta}{\sin^3 \theta} \cdot \frac{1}{\sin^2 \theta} + 2 \sin \theta \cos \theta \right) \div (\sec^2 \theta + \operatorname{cosec}^2 \theta)$$

$$\begin{aligned}
 &\Rightarrow \left(\frac{\sin^3 \theta}{\cos^3 \theta} \times \frac{\cos^2 \theta}{1} + \frac{\cos^3 \theta}{\sin^3 \theta} \times \frac{\sin^2 \theta}{1} + 2\sin \theta \cos \theta \right) \div \left(\frac{1}{\cos^2 \theta} + \frac{1}{\sin^2 \theta} \right) \\
 &\Rightarrow \left(\frac{\sin^3 \theta}{\cos \theta} + \frac{\cos^3 \theta}{\sin \theta} + 2\sin \theta \cos \theta \right) \div \left(\frac{\sin^2 \theta + \cos^2 \theta}{\cos^2 \theta \sin^2 \theta} \right) \\
 &\Rightarrow \frac{\sin^4 \theta + \cos^4 \theta}{\cos \theta \sin \theta} + 2\sin \theta \cos \theta \div \left(\frac{1}{\cos^2 \theta \sin^2 \theta} \right) \\
 &\Rightarrow \frac{(\sin^2 \theta + \cos^2 \theta)^2}{\cos \theta \sin \theta} \times \left(\frac{\cos^2 \theta \sin^2 \theta}{1} \right) \\
 &\Rightarrow \frac{(1)^2}{\cos \theta \sin \theta} \times \left(\frac{\cos^2 \theta \sin^2 \theta}{1} \right) \\
 &\Rightarrow \frac{1}{\cos \theta \sin \theta} \times \frac{\cos^2 \theta \sin^2 \theta}{1} \\
 &\Rightarrow \sin \theta \cos \theta
 \end{aligned}$$

∴ The required value is $\sin \theta \cos \theta$

82. Answer: d

Explanation:

★ Shortcut Trick

Take $\theta = 45^\circ$

$$\begin{aligned}
 &(1 + \cot 2 \cdot 45^\circ) (1 + \tan 2 \cdot 45^\circ) \times (\sin 45^\circ - \operatorname{cosec} 45^\circ) (\cos 45^\circ - \sec 45^\circ) \\
 &\Rightarrow (1 + 1) (1 + 1) \times \left(\frac{1}{\sqrt{2}} - \sqrt{2} \right) \left(\frac{1}{\sqrt{2}} - \sqrt{2} \right) \\
 &\Rightarrow 4 \times \left(-\frac{1}{\sqrt{2}} \right) \left(-\frac{1}{\sqrt{2}} \right) \\
 &\Rightarrow 4 \times 1/2 = 2
 \end{aligned}$$

Now, From options

- 1) $\sec 45^\circ + \operatorname{cosec} 45^\circ = \sqrt{2} + \sqrt{2} = 2\sqrt{2} \neq 2$
- 2) $\sin 45^\circ \cos 45^\circ = (1/\sqrt{2}) \times (1/\sqrt{2}) = 1/2 \neq 2$
- 3) $\sin 45^\circ + \cos 45^\circ = (1/\sqrt{2}) + (1/\sqrt{2}) = \sqrt{2} \neq 2$

$$4) \sec 45^\circ \operatorname{cosec} 45^\circ = \sqrt{2} \times \sqrt{2} = 2$$

∴ The correct option is option 4)

★ Alternate Method

Given:

$$(1 + \cot^2 \theta) (1 + \tan^2 \theta) \times (\sin \theta - \operatorname{cosec} \theta) (\cos \theta - \sec \theta)$$

Formula used:

$$\sec^2 \theta - \tan^2 \theta = 1$$

$$\Rightarrow \sec^2 \theta = 1 + \tan^2 \theta$$

$$\operatorname{Cosec}^2 \theta - \cot^2 \theta = 1$$

$$\Rightarrow \operatorname{cosec}^2 \theta = 1 + \cot^2 \theta$$

$$\tan^2 \theta = \sec^2 \theta - 1$$

$$\sin \theta = \frac{1}{\operatorname{cosec} \theta}$$

$$\cos \theta = \frac{1}{\sec \theta}$$

$$\tan^2 \theta = \frac{1}{\cot^2 \theta}$$

Calculation:

$$(1 + \cot^2 \theta) (1 + \tan^2 \theta) \times (\sin \theta - \operatorname{cosec} \theta) (\cos \theta - \sec \theta)$$

$$\Rightarrow (\operatorname{cosec}^2 \theta) (\sec^2 \theta) \times \left(\frac{1}{\operatorname{cosec} \theta} - \operatorname{cosec} \theta \right) \left(\frac{1}{\sec \theta} - \sec \theta \right)$$

$$\Rightarrow (\operatorname{cosec}^2 \theta) (\sec^2 \theta) \times \left(\frac{1 - \operatorname{cosec}^2 \theta}{\operatorname{cosec} \theta} \right) \left(\frac{1 - \sec^2 \theta}{\sec \theta} \right)$$

$$\Rightarrow (\operatorname{cosec} \theta) (\sec \theta) \times (1 - \operatorname{cosec}^2 \theta) (1 - \sec^2 \theta)$$

$$\Rightarrow (\operatorname{cosec} \theta) (\sec \theta) \times (-\cot^2 \theta) \times (-\tan^2 \theta)$$

$$\Rightarrow (\operatorname{cosec} \theta) (\sec \theta) \times (\cot^2 \theta \times \frac{1}{\cot^2 \theta})$$

$$\Rightarrow \sec \theta \operatorname{cosec} \theta$$

$\therefore$ The required value is $\sec \theta \operatorname{cosec} \theta$

83. Answer: a

Explanation:

Given:

Three fractions x , y and z are such that $x > y > z$.

When the smallest of them is divided by the greatest, the result is $\frac{9}{16}$, which exceeds y by 0.0625

$$x + y + z = 2\frac{3}{12}$$

Calculation:

$$\text{If } x > y > z$$

According to the question

$$\Rightarrow \frac{z}{x} = \frac{9}{16}$$

$$\Rightarrow y = \frac{9}{16} - 0.0625$$

$$\Rightarrow \frac{9}{16} - \frac{1}{16}$$

$$\Rightarrow \frac{1}{2}$$

Now,

$$\Rightarrow x + y + z = 2\frac{3}{12} = \frac{27}{12}$$

$$\Rightarrow x + \frac{1}{2} + z = \frac{27}{12}$$

$$\Rightarrow x + z = \left(\frac{27}{12} - \frac{1}{2} \right)$$

$$\Rightarrow x + z = \frac{27-6}{12}$$

$$\Rightarrow x + z = \frac{21}{12}$$

$$\Rightarrow x + z = \frac{7}{4}$$

$\therefore$ The required value is $\frac{7}{4}$

84. Answer: c

Explanation:

Given:

$$a + b = 8$$

$$ab = 10$$

Formula used:

$$(a + b)^2 = a^2 + b^2 + 2ab$$

$$(a^3 + b^3) = (a + b)(a^2 - ab + b^2)$$

Calculation:

$$a + b = 8, ab = 10$$

$$\Rightarrow (8)^2 = a^2 + b^2 + 2 \times 10$$

$$\Rightarrow 64 = a^2 + b^2 + 20$$

$$\Rightarrow a^2 + b^2 = (64 - 20)$$

$$\Rightarrow a^2 + b^2 = 44$$

Now,

$$(a^3 + b^3) = (a + b)(a^2 - ab + b^2)$$

$$\Rightarrow (a^3 + b^3) = (8)(44 - 10)$$

$$\Rightarrow (a^3 + b^3) = (8 \times 34)$$

$$\Rightarrow (a^3 + b^3) = 272$$

$\therefore$ The required value is 272

85. Answer: b

Explanation:

★ Shortcut Trick

$$\text{1st cup; Juice : water} = [5 : 2 \rightarrow 7] \times 11$$

$$\text{2nd cup; Juice : water} = [7 : 4 \rightarrow 11] \times 7$$

We have multiplied by 11 and 7 to make the quantity of cups equal

$$\text{1st cup; Juice : water} = 55 : 22$$

$$\text{2nd cup; Juice : water} = 49 : 28$$

-----On adding

$$\text{Vessel; Juice : water} = 104 : 50 = 52 : 25$$

So, The required ratio of water : juice = 25 : 52

★ Alternate Method

Given:

The ratio of one cup of juice and water = 5 : 2

The ratio of another cup of the same capacity has them = 7 : 4

Calculation:

$$\text{The juice in the one cup} = \frac{5}{7}$$

The water in the one cup = $\frac{2}{7}$

The juice in the another cup = $\frac{7}{11}$

The water in the another cup = $\frac{4}{11}$

Now,

When contents of both the cups are poured in a vessel

$$\Rightarrow \left(\frac{5}{7} + \frac{7}{11} \right) = \left(\frac{2}{7} + \frac{4}{11} \right)$$

$$\Rightarrow \left(\frac{55+49}{77} \right) = \left(\frac{22+28}{77} \right)$$

$$\Rightarrow \frac{104}{77} = \frac{50}{77}$$

$$\Rightarrow \left(\frac{104}{77} \times \frac{77}{50} \right)$$

$$\Rightarrow \frac{104}{50}$$

$$\Rightarrow \frac{52}{25}$$

Now,

The final ratio of water to juice in the vessel = (25 : 52)

$\therefore$ The required ratio is 25 : 52

86. Answer: a

Explanation:

Given:

The volume of a solid cylinder = 2002 cm^3

Height = 13 cm

Formula used:

The volume of the cylinder = Bh

Where B = Area of Base and h = height

Calculation:

According to the question

Volume of the cylinder = Bh

$$\Rightarrow 2002 = B \times 13$$

$$\Rightarrow B = \left(\frac{2002}{13} \right)$$

$$\Rightarrow B = 154 \text{ cm}^2$$

$\therefore$ The area of its base is 154 cm^2 .

87. Answer: a

Explanation:

Given:

$$\text{LCM} + \text{HCF} = 512 \quad \text{-----(i)}$$

$$\text{LCM} - \text{HCF} = 496 \quad \text{-----(ii)}$$

Formula used:

$$\text{LCM} \times \text{HCF} = \text{one number} \times \text{other number}$$

Calculation:

On solving (i) and (ii) we get

$$\text{HCF} = 8$$

$$\text{LCM} = 504$$

Now, According to the formula used

$\text{LCM} \times \text{HCF} = \text{one number} \times \text{other number}$

$504 \times 8 = 72 \times \text{other number}$

other number = 56

$\therefore$ The second number is 56.

★ Alternate Method

Given:

The sum of LCM and HCF = 512

The difference of LCM and HCF = 496

Formula used:

$\text{LCM} \times \text{HCF} = \text{one number} \times \text{other number}$

Calculation:

Let HCF of two numbers be h

Then, one number = hx and other number = hy

LCM of two numbers hx, hy will be hxy

Sum of LCM and HCF = $hxy + h = 512 \dots(1)$

According to the question

$$\frac{h(xy+1)}{h(xy-1)} = \frac{512}{496}$$

Now,

On applying componendo and dividendo

$$\Rightarrow \frac{xy+1+xy-1}{xy+1-xy-1} = \left(\frac{512+496}{512-496} \right)$$

$$\Rightarrow \frac{1008}{16}$$

$$\Rightarrow xy = 63$$

Now, put the value of xy in equation (1)

$$\Rightarrow h(63 + 1) = 512$$

$$\Rightarrow h64 = 512$$

$$\Rightarrow h = 8 = \text{HCF}$$

Now,

$$\text{Let } hx = 72$$

$$\Rightarrow 8 \times x = 72$$

$$\Rightarrow x = 9$$

Now,

$$x = 9 \text{ and } xy = 63$$

$$\Rightarrow 9y = 63$$

$$\Rightarrow y = 7$$

So,

$$\text{The other number} = hy = (8 \times 7)$$

$$\Rightarrow 56$$

$\therefore$ The required value is 56

88. Answer: a

Explanation:

Concept Used:

Follow the BODMAS rule according to the table given below:

B	Brackets in order {}, {}, []	ब्रैकेट {}, {}, [] क्रम में
O	of	का
D	Division (÷)	विभाजन (÷)
M	Multiplication (×)	गुणा (×)
A	Addition (+)	जोड़ (+)
S	Subtraction (−)	घटाव (−)

Calculation:

$$\left(1\frac{1}{3} \div 2\frac{6}{7} \text{ of } 5\frac{3}{5}\right) \times \left(6\frac{2}{5} \div 4\frac{1}{2} \text{ of } 5\frac{1}{3}\right) \div \left(\frac{3}{4} \times 2\frac{2}{3} \div \frac{5}{9} \text{ of } 1\frac{1}{5}\right) = k$$

$$\Rightarrow \left(\frac{4}{3} \div \frac{20}{7} \text{ of } \frac{28}{5}\right) \times \left(\frac{32}{5} \div \frac{9}{2} \text{ of } \frac{16}{3}\right) \div \left(\frac{3}{4} \times \frac{8}{3} \div \frac{5}{9} \text{ of } \frac{6}{5}\right) = k$$

$$\Rightarrow \left(\frac{4}{3} \div \frac{16}{1}\right) \times \left(\frac{32}{5} \div \frac{24}{1}\right) \div \left(\frac{3}{4} \times \frac{8}{3} \div \frac{2}{3}\right) = k$$

$$\Rightarrow \left(\frac{4}{3} \times \frac{1}{16}\right) \times \left(\frac{32}{5} \times \frac{1}{24}\right) \div \left(\frac{3}{4} \times \frac{8}{3} \times \frac{3}{2}\right) = k$$

$$\Rightarrow \left(\frac{1}{12} \times \frac{4}{15} \div 3\right) = k$$

$$\Rightarrow \left(\frac{1}{45} \times \frac{1}{3}\right) = k$$

$$\Rightarrow \frac{1}{135} = k$$

$$\Rightarrow 0.0074 = k$$

∴ The value of k lies between 0.007 and 0.008

89. Answer: c

Explanation:

Given:

$$LM = 5\sqrt{2} \text{ cm}$$

$$LN = 13 \text{ cm}$$

$$\angle LMN = 135^\circ$$

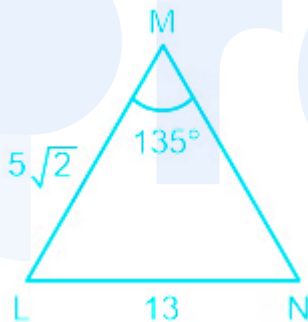
Formula used:

Cosine formula:

$$\cos 135^\circ = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\cos 135^\circ = \frac{-1}{\sqrt{2}}$$

Calculation:



Let $a = 13 \text{ cm}$, $b = 5\sqrt{2} \text{ cm}$ and $c = x \text{ cm}$

Now,

$$\cos 135^\circ = \frac{b^2 + c^2 - a^2}{2bc}$$

$$\Rightarrow \frac{-1}{\sqrt{2}} = \frac{(5\sqrt{2})^2 + x^2 - (13)^2}{2 \times 5\sqrt{2} \times x}$$

$$\Rightarrow \frac{-1}{\sqrt{2}} = \frac{50 + x^2 - 169}{10\sqrt{2}x}$$

$$\Rightarrow -1 = \frac{x^2 - 119}{10x}$$

$$\Rightarrow -10x = x^2 - 119$$

$$\Rightarrow x^2 + 10x - 119 = 0$$

$$\Rightarrow x^2 + 17x - 7x - 119 = 0$$

$$\Rightarrow x(x + 17) - 7(x + 17) = 0$$

$$\Rightarrow (x - 7)(x + 17) = 0$$

$$\Rightarrow x = 7, -17$$

So, $x = 7$ [not taking negative value]

$\therefore$ The length of MN is 7 cm

90. Answer: b

Explanation:

Given:

Time taken by A and B = $26\frac{2}{3}$ days = $\frac{80}{3}$ days

Time taken by B and C = 48 days

Time taken by A and C = 30 days

Formula used:

Work = Efficiency $\times$ Time

Calculation:

LCM of $\frac{80}{3}$, 48 and 30 is 720

Efficiency of A and B = $(720 \times \frac{3}{80}) = 27$

Efficiency of B and C = $(\frac{720}{48}) = 15$

Efficiency of A and C = $(\frac{720}{30}) = 24$

Total time taken by A, B and C to complete the work = $(\frac{27+15+24}{2})$

$$\Rightarrow A + B + C = 33 \text{ days}$$

Now,

$$\text{Time taken by A to complete the 60\% of the work} = \frac{\text{Total work}}{\text{Time}}$$

$$\Rightarrow \left(\frac{720}{(33-15)} \times \frac{60}{100} \right)$$

$$\Rightarrow \frac{720}{18} \times \frac{3}{5}$$

$$\Rightarrow (8 \times 3) \text{ days}$$

$$\Rightarrow 24 \text{ days}$$

$\therefore$ The required time taken by A to complete the 60% work is 24 days

★ Alternate Method

According to the question,

$$\frac{1}{A} + \frac{1}{B} = \frac{3}{80} \Rightarrow \frac{1}{B} = \frac{3}{80} - \frac{1}{A} \quad \text{----(1)}$$

$$\frac{1}{B} + \frac{1}{C} = \frac{1}{48} \quad \text{----(2)}$$

$$\frac{1}{C} + \frac{1}{A} = \frac{1}{30} \Rightarrow \frac{1}{C} = \frac{1}{30} - \frac{1}{A} \quad \text{----(3)}$$

Substituting the value in eqn (2)

$$\frac{1}{30} - \frac{1}{A} + \frac{3}{80} - \frac{1}{A} = \frac{1}{48}$$

$$\frac{17}{240} - \frac{2}{A} = \frac{1}{48}$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \quad -\frac{2}{A} = -\frac{1}{20}$$

$$A = 40 \text{ days}$$

$$\text{To complete 60\% of the work A will take} = 0.6 \times 40 = 24 \text{ days}$$

91. Answer: a

Explanation:

Given:

$$a + b + c = 1, ab + bc + ca = -22 \text{ and } abc = -40$$

Formula used:

$$a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$$

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$$

Calculation:

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ca)$$

$$\Rightarrow (1)^2 = a^2 + b^2 + c^2 + 2(-22)$$

$$\Rightarrow 1 = a^2 + b^2 + c^2 - 44$$

$$\Rightarrow a^2 + b^2 + c^2 = 45$$

Now,

$$a^3 + b^3 + c^3 - 3abc = (a + b + c)(a^2 + b^2 + c^2 - ab - bc - ca)$$

$$\Rightarrow a^3 + b^3 + c^3 - 3(-40) = (1)(45 + 22)$$

$$\Rightarrow a^3 + b^3 + c^3 - (-120) = 67$$

$$\Rightarrow a^3 + b^3 + c^3 = (67 - 120)$$

$$\Rightarrow a^3 + b^3 + c^3 = -53$$

$\therefore$ The required value is -53

92. Answer: d

Explanation:

Given:

The price of an item was reduced by 20%

If there is an increase of 25% in receipt of the revenue

Calculation:

Let the price of the item be x

According to the question

$$\Rightarrow x \times \left(\frac{80}{100} \right) \times \frac{(100+x)}{100} = x \times \left(\frac{125}{100} \right)$$

$$\Rightarrow x \times \left(\frac{4}{5} \right) \times \frac{(100+x)}{100} = x \times \frac{5}{4}$$

$$\Rightarrow \left(\frac{4x}{5} \right) \times \frac{(100+x)}{100} = \left(\frac{5x}{4} \right)$$

$$\Rightarrow \frac{(100+x)}{100} = \left(\frac{5x \times 5}{4x \times 4} \right)$$

$$\Rightarrow \frac{(100+x)}{100} = \frac{25}{16}$$

$$\Rightarrow 1600 + 16x = 2500$$

$$\Rightarrow 16x = (2500 - 1600)$$

$$\Rightarrow 16x = 900$$

$$\Rightarrow x = \frac{900}{16}$$

$$\Rightarrow x = 56.25$$

$\therefore$ The required value is 56.25

★ **Shortcut Trick**

$$\Rightarrow -20 + x - \frac{20x}{100} = 25$$

$$\Rightarrow -20 + x - \frac{x}{5} = 25$$

$$\Rightarrow x - \frac{x}{5} = (25 + 20)$$

$$\Rightarrow \frac{4x}{5} = 45$$

$$\Rightarrow 4x = 225$$

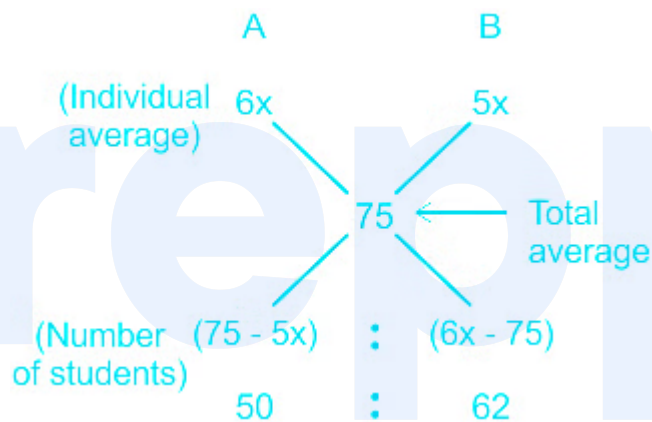
$$\Rightarrow x = 56.25$$

$\therefore$ The required value is 56.25

93. Answer: b

Explanation:

★ Shortcut Trick



$$\text{So, } \frac{75 - 5x}{6x - 75} = \frac{50}{62}$$

On solving we get

$$x = (75 \times 56)/305$$

$$\Rightarrow 6x = (6 \times 75 \times 56)/305 \approx 82.6$$

$\therefore$ The average score of students in section A is 82.6

★ Alternate Method

Given:

Total number of students in section A = 50

Total number of students in section B = 62

The average score in mathematics of all the students = 75

If the average score of students in section A is 20% more than that of students in section B

Formulae used:

Average = Sum of number/Total number

Total number of student = Student in section A + Student in section B

Calculation:

Total number of student = $(50 + 62) = 112$

Now,

$\Rightarrow 75 = \text{Total number of student}/112$

$\Rightarrow \text{Total number of student} = (112 \times 75) = 8400$

Now,

Let the average score of section B student be x

$\Rightarrow \text{Average score of section A student} = [x + (\frac{20}{100} \times x)]$

$\Rightarrow (x + \frac{x}{5})$

$\Rightarrow \frac{6x}{5}$

Now,

$\Rightarrow x = (\text{sum of score of mathematics in section B})/62$

Sum of score of mathematics in section B = $62x$

Now,

$\Rightarrow \frac{6x}{5} = \text{Sum of score of mathematics in section A}/50$

$\Rightarrow \text{Sum of score of mathematics in section A} = (\frac{6x}{5} \times 50)$

$$\Rightarrow 60x$$

Now,

Total score = sum of score of mathematics in section A + sum of score of section B in mathematics

$$\Rightarrow 8400 = 60x + 62x$$

$$\Rightarrow 8400 = 122x$$

$$\Rightarrow x = 68.85$$

Now,

$$\text{The average score of students in section A} = \frac{6x}{5} = \frac{(6 \times 68.85)}{5}$$

$$\Rightarrow \frac{413.5}{5}$$

$$\Rightarrow 82.6$$

$\therefore$ The average score of students in section A is 82.6

94. Answer: a

Explanation:

Given:

$$\frac{1+\cos\theta-\sin^2\theta}{\sin\theta(1+\cos\theta)} \times \frac{\sqrt{\sec^2\theta+\operatorname{cosec}^2\theta}}{\tan\theta+\cot\theta}$$

Formula used:

$$(1 - \sin^2\theta) = \cos^2\theta$$

$$\sec^2\theta = \frac{1}{\cos^2\theta}$$

$$\operatorname{cosec}^2\theta = \frac{1}{\sin^2\theta}$$

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$\cot\theta = \frac{\cos\theta}{\sin\theta}$$

Calculation:

$$\begin{aligned} & \frac{1+\cos\theta-\sin^2\theta}{\sin\theta(1+\cos\theta)} \times \frac{\sqrt{\sec^2\theta+\cos^2\theta}}{\tan\theta+\cot\theta} \\ \Rightarrow & \frac{\cos\theta+\cos^2\theta}{\sin\theta(1+\cos\theta)} \times \sqrt{\left(\frac{1}{\cos^2\theta} + \frac{1}{\sin^2\theta}\right) / \left(\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right)} \\ \Rightarrow & \frac{\cos\theta(1+\cos\theta)}{\sin\theta(1+\cos\theta)} \times \sqrt{\left(\frac{\sin^2\theta+\cos^2\theta}{\cos^2\theta\sin^2\theta}\right) / \left(\frac{\sin^2\theta+\cos^2\theta}{\cos\theta\sin\theta}\right)} \\ \Rightarrow & \frac{\cos\theta}{\sin\theta} \times \sqrt{\left(\frac{1}{\cos^2\theta\sin^2\theta}\right) / \left(\frac{1}{\cos\theta\sin\theta}\right)} \\ \Rightarrow & \cot\theta \times \left(\frac{1}{\cos\theta\sin\theta} / \frac{1}{\cos\theta\sin\theta}\right) \\ \Rightarrow & \cot\theta \times \left(\frac{1}{\cos\theta\sin\theta} \times \frac{\cos\theta\sin\theta}{1}\right) \\ \Rightarrow & \cot\theta \times 1 \\ \Rightarrow & \cot\theta \end{aligned}$$

∴ The required value is $\cot\theta$

95. Answer: b

Explanation:

★ Shortcut Trick

Let C.P = 100

M.P = $100 \times 136\% = 136$

S.P = $136 \times 70\% = 95.2$

Since, C.P > S.P

So, there will be a loss of $100 - 95.2 = 4.8$

∴ Loss% = $4.8/100 \times 100\% = 4.8$

★ Alternate Method

Given:

A person marks an article 36% above the cost price

Discount = 30% on the marked price

Formula used:

$$\text{Loss} = \text{CP} - \text{SP}$$

$$\text{Loss\%} = \frac{\text{Loss}}{\text{CP}} \times 100$$

Calculation:

Let the CP of the article be Rs. x

$$\text{MP of the article} = \text{Rs. } \left(x \times \frac{136}{100} \right) = 1.36x$$

Now,

$$\text{SP of the article} = \left(1.36x \times \frac{70}{100} \right)$$

$$\Rightarrow \frac{95.2x}{100} = 0.952x$$

$$\text{Loss} = (x - 0.952x) = 0.048x$$

$$\text{Loss\%} = \left(\frac{0.048x}{x} \times 100 \right)$$

$$\Rightarrow (0.048 \times 100)$$

$$\Rightarrow 4.8\%$$

∴ The Loss is 4.8%

96. Answer: d

Explanation:

Given:

Amount of each installment = Rs. 5,808

Rate of interest compound annually = 10%

Number of years = 2

Formula used:

$$P = A / \left(1 + \frac{R}{100}\right)^T$$

$$\text{Interest} = (2 \times \text{Installment} - P)$$

Calculation:

Let the loan amount be P.

$$P = 5808 / \left[1 + \left(\frac{10}{100}\right)\right] + 5808 / \left[1 + \left(\frac{10}{100}\right)\right]^2$$

$$\Rightarrow P = 5808 / \left[1 + \left(\frac{1}{10}\right)\right] + 5808 / \left[1 + \left(\frac{1}{10}\right)\right]^2$$

$$\Rightarrow P = 5808 / \left(\frac{11}{10}\right) + 5808 / \left(\frac{11}{10}\right)^2$$

$$\Rightarrow P = \left[5808 \times \frac{10}{11} + 5808 / \left(\frac{121}{100}\right)\right]$$

$$\Rightarrow P = \left(5280 + 5808 \times \frac{100}{121}\right)$$

$$\Rightarrow P = (5280 + 4800)$$

$$\Rightarrow P = \text{Rs. } 10080$$

Now,

$$\text{Interest} = (2 \times \text{Installment} - P)$$

$$\Rightarrow (2 \times 5808 - 10080)$$

$$\Rightarrow \text{Rs. } (11616 - 10080)$$

$$\Rightarrow \text{Rs. } 1536$$

Now,

60% of the total interest charged in this scheme = Rs. $(1536 \times \frac{60}{100})$

$\Rightarrow$ Rs. (307.2×3)

$\Rightarrow$ Rs. 921.6 ~ Rs. 922

$\therefore$ 60% of the total interest charged in this scheme is Rs. 922

97. Answer: d

Explanation:

★ Shortcut Trick

Let P_1 and P_2 be the principal investment by A and B in two schemes

According to the question

$$P_1 \times 130\% = P_2 \times 140\%$$

$$P_1 : P_2 = 14 : 13$$

According to the question

$$P_1 = 9100$$

$$\text{i.e 14 units} \rightarrow 9100$$

$$1 \text{ unit} \rightarrow 650$$

$$13 \text{ units } (P_2) \rightarrow 8450$$

$$\text{Now, } 90\% \text{ of } 8450 = 7605.$$

$\therefore$ The required result is 7605.

★ Alternate Method

Given:

Principal of A = Rs. 9100

Rate of A = 10%

Time of A = 3 years

Rate of B = 8%

Time of B = 5 years

Formula used:

$$SI = (P \times R \times T)/100$$

Amount = Principal + SI

Calculation:

According to the question

$$SI = (P \times R \times T)/100$$

$$\Rightarrow (9100 \times 10 \times 3)/100$$

$$\Rightarrow \text{Rs. } 2730$$

Amount = Principal + SI

$$\Rightarrow \text{Rs. } (9100 + 2730)$$

$$\Rightarrow \text{Rs. } 11,830$$

Now,

Let the Principal of B be P

Now,

$$SI = (P \times 8 \times 5)/100$$

$$\Rightarrow SI = \frac{2P}{5}$$

Amount = Principal + SI

$$\Rightarrow (P + \frac{2P}{5})$$

$$\Rightarrow \frac{7P}{5}$$

Now,

$$\Rightarrow \frac{7P}{5} = 11,830$$

$$\Rightarrow 7P = (11,830 \times 5)$$

$$\Rightarrow 7P = 59,150$$

$$\Rightarrow P = \frac{59,150}{7}$$

$$\Rightarrow P = \text{Rs. } 8,450$$

Now,

$$90\% \text{ of the sum invested by B} = (\frac{90}{100} \times 8,450)$$

$$\Rightarrow (845 \times 9)$$

$$\Rightarrow \text{Rs. } 7,605$$

$\therefore$ The required sum of B is Rs. 7,605

98. Answer: a

Explanation:

★ Shortcut Trick

Volume of sphere $\propto (\text{Radius})^3$

$$\text{So, } \frac{V_1}{V_2} = (\frac{3.5}{4.9})^3 = \frac{125}{343}$$

$$\% \text{ Increase in volume} = \frac{343-125}{125} \times 100\%$$

% Increase in volume = 174.4%

★ Alternate Method

Given:

Radius of the first spherical balloon = 3.5 cm

Radius of the second spherical balloon = 4.9 cm

Formula used:

Volume of the sphere = $\frac{4}{3} \pi r^3$

Calculation:

Radius of the first spherical balloon = 3.5 cm

$$\frac{\text{volume of the first spherical balloon}}{\text{volume of the second spherical balloon}} = \frac{\frac{4\pi \times (3.5)^3}{3}}{\frac{4\pi \times (4.9)^3}{3}}$$

$$\Rightarrow \frac{\text{volume of the first spherical balloon}}{\text{volume of the second spherical balloon}} = \frac{(3.5)^3}{(4.9)^3}$$

$$\Rightarrow \frac{\text{volume of the first spherical balloon}}{\text{volume of the second spherical balloon}} = \frac{42.875}{117.649}$$

Now,

$$\text{Percentage increase in the volume of the original balloon} = \left(\frac{117.649 - 42.875}{42.875} \times 100 \right)$$

$$\Rightarrow \left(\frac{74.774}{42.875} \times 100 \right)$$

$$\Rightarrow \frac{7477.4}{42.875}$$

$$\Rightarrow 174.4\%$$

∴ The required increase percentage in the volume of the original balloon is 174.4%

99. Answer: d

Explanation:

Given:

$$7 \sin 2\theta + 4 \cos 2\theta = 5$$

Formula used:

$$B^2 = H^2 - P^2$$

$$\sin\theta = \frac{P}{H}$$

$$\sec\theta = \frac{H}{B}$$

$$\tan\theta = \frac{P}{B}$$

$$\cot\theta = \frac{B}{P}$$

$$\cos\theta = \frac{B}{H}$$

Calculation:

$$7 \sin 2\theta + 4 \cos 2\theta = 5$$

$$\Rightarrow 7 \sin^2\theta + 4(1 - \sin^2\theta) = 5$$

$$\Rightarrow 7 \sin^2\theta + 4 - 4 \sin^2\theta = 5$$

$$\Rightarrow 3 \sin^2\theta = 1$$

$$\Rightarrow \sin^2\theta = \frac{1}{3}$$

$$\Rightarrow \sin\theta = \frac{1}{\sqrt{3}} = \frac{P}{H}$$

Now, By Pythagoras theorem

$$B^2 = H^2 - P^2$$

$$\Rightarrow B^2 = (\sqrt{3})^2 - (1)^2$$

$$\Rightarrow B^2 = (3 - 1)$$

$$\Rightarrow B^2 = 2$$

$$\Rightarrow B = \sqrt{2}$$

Now,

The value of $\frac{\sqrt{3} \sec \theta + \tan \theta}{\sqrt{2} \cot \theta - \sqrt{3} \cos \theta}$

$$\Rightarrow (\sqrt{3} \times \frac{\sqrt{3}}{\sqrt{2}} + \frac{1}{\sqrt{2}}) / (\sqrt{2} \times \sqrt{2} - \sqrt{3} \times \frac{\sqrt{2}}{\sqrt{3}})$$

$$\Rightarrow (\frac{3}{\sqrt{2}} + \frac{1}{\sqrt{2}}) / (2 - \sqrt{2})$$

$$\Rightarrow (\frac{4}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}) / (2 - \sqrt{2})$$

$$\Rightarrow (\frac{4\sqrt{2}}{2}) / (2 - \sqrt{2})$$

$$\Rightarrow \frac{2\sqrt{2}}{2 - \sqrt{2}}$$

Multiplying with conjugate $(2 + \sqrt{2})$

$$\Rightarrow (\frac{2\sqrt{2}}{2 - \sqrt{2}} \times \frac{2 + \sqrt{2}}{2 + \sqrt{2}})$$

$$\Rightarrow \frac{2\sqrt{2}(2 + \sqrt{2})}{2}$$

$$\Rightarrow \sqrt{2}(2 + \sqrt{2})$$

$$\Rightarrow 2\sqrt{2} + 2$$

$$\Rightarrow 2(1 + \sqrt{2})$$

$\therefore$ The required value is $2(1 + \sqrt{2})$

100. Answer: b

Explanation:

Given:

$$x = \sqrt{1 + \frac{\sqrt{3}}{2}} - \sqrt{1 - \frac{\sqrt{3}}{2}}$$

Formula used:

$$(a - b)^2 = a^2 + b^2 - 2ab$$

Calculation:

$$x = \sqrt{1 + \frac{\sqrt{3}}{2}} - \sqrt{1 - \frac{\sqrt{3}}{2}}$$

Squaring on both the sides

$$\Rightarrow x^2 = 1 + \frac{\sqrt{3}}{2} + 1 - \frac{\sqrt{3}}{2} - 2\sqrt{\left(1 - \frac{3}{4}\right)}$$

$$\Rightarrow x^2 = 2 - 2\sqrt{\frac{1}{4}}$$

$$\Rightarrow x^2 = 2 - 2\left(\frac{1}{2}\right)$$

$$\Rightarrow x^2 = 2 - 1$$

$$\Rightarrow x^2 = 1$$

$$\Rightarrow x = -1 \text{ or } +1$$

Taking $x = 1$

Now,

The value of $\frac{\sqrt{3-x}}{\sqrt{3+x}}$

$$\frac{\sqrt{3-1}}{\sqrt{3+1}}$$

Now, multiplying with the conjugate of $(\sqrt{3} - 1)$

$$\Rightarrow \frac{\sqrt{3-1}}{\sqrt{3+1}} \times \frac{\sqrt{3-1}}{\sqrt{3-1}}$$

$$\Rightarrow \frac{(\sqrt{3-1})^2}{3-1}$$

$$\Rightarrow \left(\frac{(\sqrt{3})^2 + (1)^2 - 2(\sqrt{3})(1)}{2} \right)$$

$$\Rightarrow \frac{4-2\sqrt{3}}{2}$$

$$\Rightarrow 2 - \sqrt{3}$$

$$\Rightarrow 2 - 1.73 \quad [\sqrt{3} = 1.73]$$

$$\Rightarrow 0.27$$

$\therefore$ The required value is 0.27

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