1. If the unit digit of $433 \times 456 \times 43N$ is $(N + 2)$, then what is the value of N?

a. 1 *b.* 8 *c.* 3 *d.* 6

✓ ***(d)*** Here, unit digit in $433 \times 456 \times 43N = (N + 2)$

$\Rightarrow$ Unit digit in $3 \times 6 \times N = (N + 2)$

Now, putting $N = 6$ from option (d).

$\Rightarrow$ unit digit in $3 \times 6 \times 6 = (6 + 2)$

$\Rightarrow$ unit digit in $108 = 8 \Rightarrow 8 = 8$

Hence, $N = 6$

2. If $N = (12345)^2 + 12345 + 12346$, then what is the value of $\sqrt{N}$?

a. 12346 *b.* 12345 *c.* 12344 *d.* 12347

✓ ***(a)*** Given,

$N = (12345)^2 + 12345 + 12346$

$\Rightarrow N = 12345\{12345 + 1\} + 12346$

$\Rightarrow N = 12345 \times 12346 + 12346$

$\Rightarrow N = 12346(12345 + 1)$

$\Rightarrow N = 12346 \times 12346$

Now, $\sqrt{N} = \sqrt{12346 \times 12346} = 12346$

3. Which of the following statement(s) is/are true?

I. $(0.03/0.2) + (0.003/0.02) + (0.0003/0.002) + (0.00003/0.0002) = 0.6$

II. $(0.01) + (0.01)^2 + (0.001)^2 = 0.010101$

a. Only I *b.* Only II

c. Neither I nor II *d.* Both I and II

✓ ***(d)*** **Statement I**

$$\frac{0.03}{0.2} + \frac{0.003}{0.02} + \frac{0.0003}{0.002} + \frac{0.00003}{0.0002} = 0.6$$

Now, taking LHS,

$$\frac{0.03}{0.2} + \frac{0.003}{0.02} + \frac{0.0003}{0.002} + \frac{0.00003}{0.0002}$$

$$= \frac{3}{20} + \frac{3}{20} + \frac{3}{20} + \frac{3}{20} = \frac{12}{20} = 0.6 = \text{RHS}$$

Statement II

$(0.01) + (0.01)^2 + (0.001)^2 = 0.010101$

Now, taking LHS,

$(0.01) + (0.01)^2 + (0.001)^2$

$= 0.01 + 0.0001 + 0.000001$

$= 0.010101 = \text{RHS}$

Hence, both the statements are true.

4. What is the value of $1/(0.1)^2 + 1/(0.01)^2 + 1/(0.5)^2 + 1/(0.05)^2$?

a. 10504 *b.* 10404 *c.* 10004 *d.* 11400

✓ ***(a)*** Here,

$$\frac{1}{(0.1)^2} + \frac{1}{(0.01)^2} + \frac{1}{(0.5)^2} + \frac{1}{(0.05)^2}$$

$$= \frac{1}{0.01} + \frac{1}{0.0001} + \frac{1}{0.25} + \frac{1}{0.0025}$$

$$= \frac{100}{1} + \frac{10000}{1} + \frac{100}{25} + \frac{10000}{25}$$

$= 100 + 10000 + 4 + 400 = 10504$

5. Which of the following statement(s) is/are true?

I. $\left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)\left(1 + \frac{1}{4}\right)\ldots\left(1 + \frac{1}{998}\right) > 497$

II. $14\frac{3}{4} + 5\frac{1}{4} - 2\frac{1}{2} > 11\frac{1}{8} + 12\frac{3}{8} - 7\frac{1}{4}$

a. Only I *b.* Only II

c. Neither I nor II *d.* Both I and II

✓ ***(d)*** **Statement I**

$$\left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)\left(1 + \frac{1}{4}\right)\ldots\left(1 + \frac{1}{998}\right) > 497$$

LHS

$$= \left(1 + \frac{1}{2}\right)\left(1 + \frac{1}{3}\right)\left(1 + \frac{1}{4}\right)\ldots\left(1 + \frac{1}{998}\right)$$

$$= \frac{2}{1} \times \frac{3}{2} \times \frac{4}{3} \times \frac{5}{4} \times \ldots\ldots \frac{999}{998}$$

$$= \frac{999}{2} = 499.5 > 497 \therefore \text{LHS} > \text{RHS}$$

Statement II

$$14\frac{3}{4} + 5\frac{1}{4} - 2\frac{1}{2} > 11\frac{1}{8} + 12\frac{3}{8} - 7\frac{1}{4}$$

Here, LHS

$$= 14\frac{3}{4} + 5\frac{1}{4} - 2\frac{1}{2} = \frac{59}{4} + \frac{21}{4} - \frac{5}{2}$$

$$= \frac{80}{4} - \frac{5}{2} = \frac{70}{4} = 17.5$$

and RHS

$$= 11\frac{1}{8} + 12\frac{3}{8} - 7\frac{1}{4} = \frac{89}{8} + \frac{99}{8} - \frac{29}{4}$$

$$= \frac{188}{8} - \frac{29}{4} = \frac{130}{8} = 16.25$$

$\therefore$ LHS > RHS

Hence, both the statements are true.

6. Which of the following statement(s) is/are true?

I. $\frac{3}{110} < \frac{9}{308} < \frac{7}{225}$

II. $99\frac{1}{7} + 99\frac{2}{7} + 99\frac{3}{7} + \ldots 99\frac{6}{7} = 279$

a. Only I *b.* Only II

c. Neither I nor II *d.* Both I and II

✓ ***(a)*** **Statement I** $\frac{3}{110} < \frac{9}{308} < \frac{7}{225}$

$= 0.02727 < 0.02922 < 0.03111$

Statement II

$$99\frac{1}{7} + 99\frac{2}{7} + 99\frac{3}{7} + \ldots + 99\frac{6}{7} = 279$$

$$\text{LHS} = 99\frac{1}{7} + 99\frac{2}{7} + 99\frac{3}{7} + \ldots + 99\frac{6}{7}$$

$= (99 + 99 + 99 + 99 + 99 + 99) +$

$$\left(\frac{1}{7}+\frac{2}{7}+\frac{3}{7}+\frac{4}{7}+\frac{5}{7}+\frac{6}{7}\right)$$

$$= 594 + \frac{21}{7} = 594 + 3 = 597$$

$\therefore$ LHS $\neq$ RHS

Hence, only statement I is true.

7. If $f(x) = \frac{1}{x} - \frac{1}{x+1}$, then what is the value of $f(1) + f(2) + f(3) + \ldots f(10)$?

a. 9/10 *b.* 10/11 *c.* 11/12 *d.* 12/13

✓ ***(b)*** Given, $f(x) = \frac{1}{x} - \frac{1}{x+1}$

Then, $f(1) = \frac{1}{1} - \frac{1}{1+1} = 1 - \frac{1}{2}$

$$f(2) = \frac{1}{2} - \frac{1}{2+1} = \frac{1}{2} - \frac{1}{3}$$

$$f(3) = \frac{1}{3} - \frac{1}{3+1} = \frac{1}{3} - \frac{1}{4}$$

$$f(10) = \frac{1}{10} - \frac{1}{10+1} = \frac{1}{10} - \frac{1}{11}$$

Now, $f(1) + f(2) + f(3) + \ldots + f(10)$

$$= 1 - \frac{1}{2} + \frac{1}{2} - \frac{1}{3} + \frac{1}{3} - \frac{1}{4} + \ldots + \frac{1}{10} - \frac{1}{11}$$

$$= 1 - \frac{1}{11} = \frac{11-1}{11} = \frac{10}{11}$$

8. If $N = 4^{11} + 4^{12} + 4^{13} + 4^{14}$, then how many positive factors of N are there?

a. 92 *b.* 48 *c.* 50 *d.* 51

✓ ***(a)*** Number of positive factors

$= (11 + 12 + 13 + 14) \times 2 - 4 \times 2$

$= 50 \times 2 - 4 \times 2$

$= 2(50 - 4) = 2 \times 46 = 92$

9. If $N = 9^9$, then N is divisible by how many positive perfect cubes?

a. 6 *b.* 7 *c.* 4 *d.* 5

✓ ***(b)*** Here, $N = 9^9 = (3^2)^9 = 3^{18}$

$\therefore$ Number of positive cubes

$$= \frac{18}{3} + 1 = 6 + 1 = 7$$

10. If $N = 3^{14} + 3^{13} - 12$, then what is the largest prime factor of N?

a. 11 *b.* 79 *c.* 13 *d.* 73

✓ ***(d)*** Greatest prime factor

$= (14 + 13) \times 3 - 8$

$= 27 \times 3 - 8 = 81 - 8 = 73$

11. Which of the following statement(s) is/are true?

I. $\sqrt{121} + \sqrt{12321} + \sqrt{1234321} = 1233$

II. $\sqrt{0.64} + \sqrt{64} + \sqrt{36} + \sqrt{0.36} > 15$

a. Only I *b.* Only II

c. Neither I nor II *d.* Both I and II

✓ ***(d)*** **Statement I**

$\sqrt{121} + \sqrt{12321} + \sqrt{1234321} = 1233$

LHS $= \sqrt{121} + \sqrt{12321} + \sqrt{1234321}$

$= 11 + 111 + 1111 = 1233 =$ RHS

Statement II

$\sqrt{0.64} + \sqrt{64} + \sqrt{36} + \sqrt{0.36} > 15$

LHS $= \sqrt{0.64} + \sqrt{64} + \sqrt{36} + \sqrt{0.36}$

$= 0.8 + 8 + 6 + 0.6 = 15.4 > 15$

$\therefore$ LHS > RHS

Hence, both the statement are true.

12. What is the value of

$$(2+\sqrt{2}) + \left(\frac{1}{2+\sqrt{2}}\right) + \left(\frac{1}{2-\sqrt{2}}\right) + (2-\sqrt{2})?$$

a. 2 *b.* 4 *c.* 8 *d.* 6

✓ ***(d)*** $(2+\sqrt{2}) + \left(\frac{1}{2+\sqrt{2}}\right) + \left(\frac{1}{2-\sqrt{2}}\right) + (2-\sqrt{2})$

$$= (2 + \sqrt{2} + 2 - \sqrt{2}) + \frac{(2-\sqrt{2})}{(2+\sqrt{2})(2-\sqrt{2})} + \frac{(2+\sqrt{2})}{(2-\sqrt{2})(2+\sqrt{2})}$$

$$= 4 + \frac{(2-\sqrt{2})}{4-2} + \frac{2+\sqrt{2}}{4-2}$$

$$= 4 + \frac{2-\sqrt{2}}{2} + \frac{2+\sqrt{2}}{2}$$

$$= \frac{8 + 2 - \sqrt{2} + 2 + \sqrt{2}}{2} = \frac{12}{2} = 6$$

13. The sum of two positive numbers is 14 and difference between their squares is 56. What is the sum of their squares?

a. 106 *b.* 196 *c.* 53 *d.* 68

✓ ***(a)*** Let, the numbers are x and y.

According to the question, $x + y = 14$ ...(i)

and $x^2 - y^2 = 56$

$\Rightarrow (x - y)(x + y) = 56$

$\Rightarrow (x - y) \times 14 = 56$ [From Eq. (i)]

$\Rightarrow x - y = 4$ ...(ii)

Now, solving Eq (i) and (ii), we have

$x = 9$ and $y = 5$

$\therefore$ Sum of their squares

$= (9)^2 + (5)^2 = 81 + 25 = 106$

14. What is the value of

$1006^2 - 1007 \times 1005 + 1008 \times 1004 - 1009 \times 1003$?

a. 6 *b.* 3 *c.* 12 *d.* 24

✓ ***(a)*** $1006^2 - 1007 \times 1005 + 1008 \times 1004 - 1009 \times 1003$

$= (1006)^2 - (1006 + 1)(1006 - 1) + (1009 - 1)(1003 + 1) - 1009 \times 1003$

$= (1006)^2 - [(1006)^2 - (1)^2] + [1009 \times 1003 + 1009 - 1003 - 1] - 1009 \times 1003$

$= (1006)^2 - (1006)^2 + (1)^2 + 1009 \times 1003 + 5 - 1009 \times 1003$

$= 1 + 5 = 6$

15. If $a^2 + b^2 = 4b + 6a - 13$, then what is the value of $a + b$?

a. 3 *b.* 2 *c.* 5 *d.* 10

✓ ***(c)*** Given, $a^2 + b^2 = 4b + 6a - 13$

$\Rightarrow a^2 - 6a = -b^2 + 4b - 13$

$\Rightarrow a^2 - 6a + 9 = -b^2 + 4b - 13 + 9$

$\Rightarrow a^2 - 6a + 9 = -b^2 + 4b - 4$

$\Rightarrow (a - 3)^2 = -(b - 2)^2$

$\Rightarrow a - 3 = -(b - 2)$

$\Rightarrow a - 3 = -b + 2$

$\Rightarrow a + b = 2 + 3$

$\Rightarrow a + b = 5$

16. x and y are positive integers, if $x^4 + y^4 + x^2 y^2 = 481$ and $xy = 12$, then what is the value of $x^2 - xy + y^2$?

a. 16 *b.* 13

c. 11 *d.* 15

✓ ***(b)*** Given, $x^4 + y^4 + x^2y^2 = 481$

and $xy = 12$

Now, $x^4 + y^4 + 2x^2y^2 - x^2y^2 = 481$

$\Rightarrow (x^2 + y^2)^2 - (xy)^2 = 481$

$\Rightarrow (x^2 + y^2)^2 - (12)^2 = 481$

$\Rightarrow (x^2 + y^2)^2 - 144 = 481$

$\Rightarrow (x^2 + y^2)^2 = 481 + 144 = 625$

$\Rightarrow x^2 + y^2 = 25$

$\therefore x^2 - xy + y^2 = x^2 + y^2 - xy$

$= 25 - 12 = 13$

$\Rightarrow x^2 - xy + y^2 = 13$

17. If $A = 1 + 2^P$ and $B = 1 + 2^{-P}$, then what is the value of B?

a. $(A + 1)/(A - 1)$ *b.* $(A + 2)/(A + 1)$

c. $A/(A - 1)$ *d.* $(A - 2)/(A + 1)$

✓ ***(c)*** Given, $A = 1 + 2^P$ and $B = 1 + 2^{-P}$

$\because A = 1 + 2^P$

$\Rightarrow 2^P = (A - 1)$

$\Rightarrow 2^{-P} = \frac{1}{(A-1)}$

$\therefore B = 1 + \frac{1}{(A-1)} = \frac{A - 1 + 1}{A - 1} = \frac{A}{A-1}$

$\Rightarrow B = \frac{A}{(A-1)}$

18. If a and b are roots of the equation $ax^2 + bx + c = 0$, then which equation will have roots $(ab + a + b)$ and $(ab - a - b)$?

a. $a^2x^2 + 2acx + c^2 + b^2 = 0$

b. $a^2x^2 + 2acx + c^2 - b^2 = 0$

c. $a^2x^2 - 2acx + c^2 + b^2 = 0$

d. $a^2x^2 + 2acx + c^2 - b^2 = 0$

✓ ***(*)*** Given, Roots of equation

$= (ab + a + b)$ and $(ab - a - b)$

$\therefore$ Equation $= x^2 -$ (Sum of Roots) $x +$ Multiplication of Roots

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

$x^2 - 2abx + (a^2b^2 - a^2b - ab^2 + a^2b - a^2 - ab + ab^2 - ab - b^2)$

$= x^2 - 2abx + a^2b^2 - a^2 - b^2 - 2ab$

19. If $\sqrt{(1-p^2)(1-q^2)} = \frac{\sqrt{3}}{2}$, then what is the value of $\sqrt{2p^2 + 2q^2 + 2pq} + \sqrt{2p^2 + 2q^2 - 2pq}$?

a. 2 b. $\sqrt{2}$
c. 1 d. None of these

✓ **(b)**

20. If $(a+b)^2 - 2(a+b) = 80$ and $ab = 16$ then what can be the value of $3a - 19b$?

a. −16 b. −14
c. −18 d. − 20

✓ **(b)**

21. If $x^{y+z} = 1$, $y^{x+z} = 1024$ and $z^{x+y} = 729$ (x, y and z are natural numbers), then what is the value of $(z+1)^{x+y+z}$?

a. 6561 b. 10000 c. 4096 d. 14641

✓ **(b)**

22. If $x + y + z = 1$, $x^2 + y^2 + z^2 = 2$ and $x^3 + y^3 + z^3 = 3$, then what is the value of xyz?

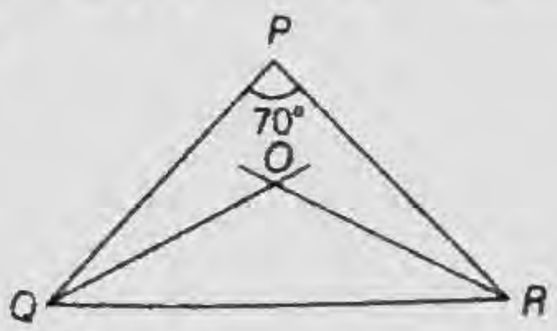
a. $\frac{1}{3}$ b. $\frac{1}{6}$ c. $\frac{1}{2}$ d. $\frac{1}{4}$

✓ **(b)**

23. In triangle PQR, the internal bisector of $\angle Q$ and $\angle R$ meets at O, If $\angle QPR = 70°$, then what is the value (in degrees) of $\angle QOR$?

a. 45 b. 125 c. 115 d. 110

✓ **(b)**



Here, $\angle QPR = 70°$

We know that

$\angle QPR + \angle PRQ + \angle RQP = 180°$

$\Rightarrow 70° + \angle PRQ + \angle RQP = 180°$

$\Rightarrow \angle PRQ + \angle RQP = 180° - 70° = 110°$

$\therefore \angle OQR + \angle ORQ = \frac{110°}{2} = 55°$ ...(i)

Because angle of internal bisector

Now, we also know that

$\angle QOR + \angle OQR + \angle RQO = 180°$

$\Rightarrow \angle QOR + 55° = 180°$ [From Eq (i)]

$\Rightarrow \angle QOR = 180° - 55° = 125°$

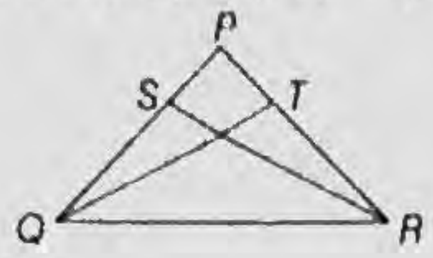
$\Rightarrow \angle QOR = 125°$

24. PQR is a triangle such that $PQ = PR$ and QT are the median to the sides PQ and PR respectively. If the medians RS and QR intersect at right, angle, then what is the value of $(PQ/QR)^2$?

a. $\frac{3}{2}$ b. $\frac{5}{2}$
c. 2 d. None of these

✓ **(b)** Given, $PQ = PR$

Now, In ΔPQT, $(PQ)^2 = (PT)^2 + (QT)^2$ ...(i)



And in ΔQRT

$(QR)^2 = (TR)^2 + (QT)^2$ ...(ii)

Now, from Eqs. (i) and (ii), we have

$$\frac{(PQ)^2}{(QR)^2} = \frac{(PT)^2 + (QT)^2}{(TR)^2 + (QT)^2}$$

$$= \frac{\left(\frac{PR}{2}\right)^2 + PR^2}{\left(\frac{PR}{2}\right)^2 + \left(\frac{PR}{2}\right)^2}$$

$$= \frac{\frac{PR^2}{4} + PR^2}{\frac{PR^2}{4} + \frac{PR^2}{4}} = \frac{\frac{5PR^2}{4}}{\frac{2PR^2}{4}}$$

$$= \frac{5PR^2}{2PR^2} = \frac{5}{2} \Rightarrow \left(\frac{PQ}{QR}\right)^2 = \frac{5}{2}$$

25. PQR is a triangle. S and T are the midpoints of the sides PQ and PR respectively. Which of the following is True?

1. Triangle PST is similar to triangle PQR
2. $ST = 1/2\,(QR)$
3. ST is parallel to QR.

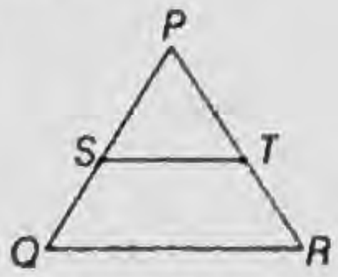
a. I and II b. II and III
c. I and III d. All of these

✓ **(d)** Here, from figure,

I. $\Delta PST \cong \Delta PQR$

II. $ST = \frac{1}{2}QR$

III. $ST \parallel QR$



Hence, given all the three statements are true.

26. ABC is a triangle in which $\angle ABC = 90°$, BD is perpendicular to AC, which of the following is true?

I. Triangle BAD is similar to triangle CBD.

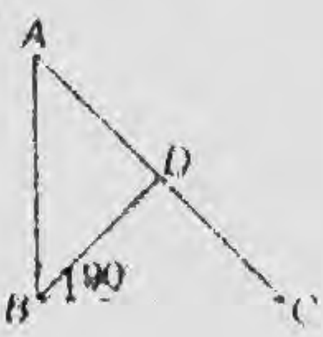
II. Triangle BAD is similar to triangle CAB.

III. Triangle CBD is similar to triangle CAB.

a. Only I b. II and III
c. I and III d. All of these

✓ **(d)** Here, given triangle is a right angled triangle Hence, all the triangle made by perpendicular BD is equal to the given triangle

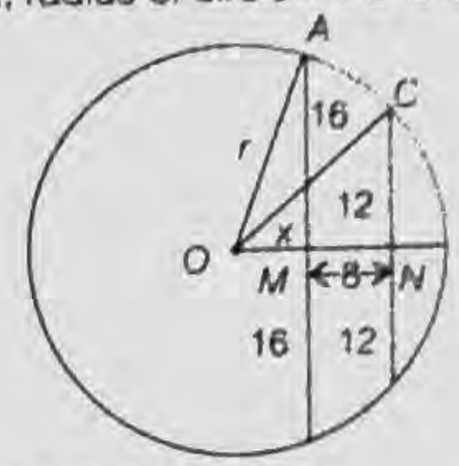
Hence, given all the statements are true



27. Two parallel chords are one the one side of the centre of a circle. The length of the two chords is 24 cm and 32 cm. If the distance between the two chords is 8 cm, then what is the area of the circle?

a. 724.14 cm^2 b. 832.86 cm^2
c. 924.12 cm^2 d. 988.32 cm^2

✓ **(b)** Let, radius of circle = r and $OM = x$



∴ In right angled ΔOMA,

$OA^2 = OM^2 + AM^2$

$\Rightarrow r^2 = x^2 + 16^2$

$\Rightarrow r^2 = x^2 + 256$ ...(i)

And in right angled ΔOCN,

$OC^2 = ON^2 + NC^2$

$\Rightarrow r^2 = (x+8)^2 + (12)^2$

$\Rightarrow r^2 = (x+8)^2 + 144$ ...(ii)

Now, from Eqs. (i) and (ii), we have

$x^2 + 256 = (x+8)^2 + 144$

$\Rightarrow x^2 + 256 = x^2 + 64 + 16x + 144$

$\Rightarrow 16x + 208 - 256 = 0$

$\Rightarrow 16x - 48 = 0$

$\Rightarrow 16x = 48 \Rightarrow x = 3$

Now, putting the value of x in Eq. (i), we have

$r^2 = (3)^2 + 256$

$\Rightarrow r^2 = 9 + 256 = 265$

$\Rightarrow r = \sqrt{265} \Rightarrow r = 16.28$ cm

Now, Area of circle

$= \pi r^2 = \frac{22}{7} \times 265$ [$\because r^2 = 265$]

$= \frac{5830}{7} = 832.86\ cm^2$

28. Two circles of radius 4 cm and 6 cm touch each other Internally. What is the length of the longest chord of the outer circle, which is also a tangent to inner circle?

a. $12\sqrt{2}$ cm b. $8\sqrt{2}$ cm
c. $6\sqrt{2}$ cm d. $4\sqrt{2}$ cm

✓ **(b)** Diameter of inner circle = OE = 8 cm

$DC = 2$ cm, $CC_1 = 2$ cm, $C_1E = 4$ cm

Here chord of outer circle is tangent to the inner circle which is represented by AB

$AC = BC = 6$ cm [Radius of inner circle]

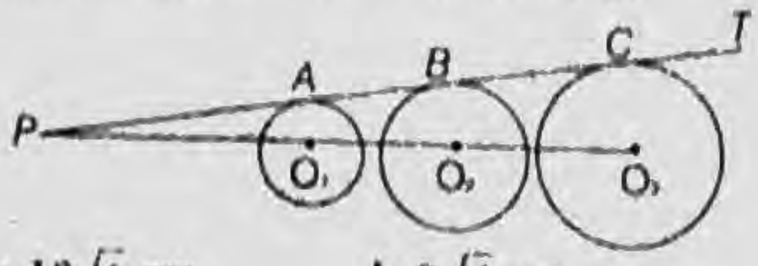
$AB = 2AD = 2\sqrt{AC^2 - CD^2} = 2\sqrt{6^2 - 2^2}$

$= 2\sqrt{36 - 4}$

$= 2\sqrt{32} = 2 \times 4\sqrt{2} = 8\sqrt{2}$ cm

Hence maximum length of chord will be $8\sqrt{2}$ cm

29. In the given figure, PT is a common tangent to three circles at points A, B and C respectively. The radius of the small, medium and large circles is 4 cm, 6 cm and 9 cm, O_1, O_2 and O_3 are the centre of the three circles. What is the value of PC?



a. $18\sqrt{6}$ cm b. $9\sqrt{6}$ cm
c. $24\sqrt{6}$ cm d. $15\sqrt{6}$ cm

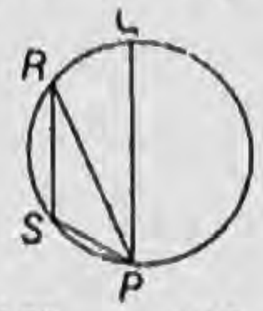
✓ **(a)**

30. $PQRS$ is a cyclic quadrilateral, PR and QS intersect at T. If $\angle SPR = 40°$ and $\angle PQS = 80°$, then what is the value of $\angle PSR$?

a. 60° b. 40°
c. 80° d. 100°

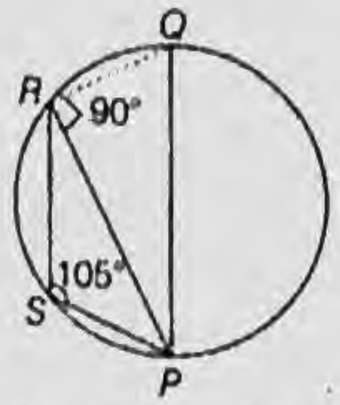
✓ **(a)**

31. In the given figure, $\angle PSR = 105°$ and PQ is the diameter of the circle. What is the valu of $\angle QPR$?



a. 75° b. 15° c. 30° d. 45°

✓ **(b)** Given $\angle PSR = 105°$ and $\angle PRQ = 90°$



Because angle in a semi-circle is right angle.

Now, $\angle QPR = \angle PSR - \angle PRQ$

$= 105° - 90° = 15°$

32. There are two identical circles of radius 10 cm each. If the length of the direct common tangent is 26 cm, then what is the length of the transverse common tangent?

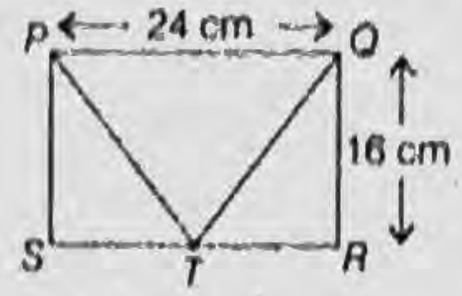
a. $2\sqrt{69}$ cm b. $4\sqrt{23}$ cm
c. $4\sqrt{46}$ cm d. $3\sqrt{46}$ cm

✓ **(a)**

33. $PQRS$ is a rectangle in which side of $PQ = 24$ cm and $QR = 16$ cm. T is a point on RS. What is the area of the triangle PTQ?

a. 192 cm²
b. 162 cm²
c. 148 cm²
d. Cannot be determined

✓ **(a)** Here, $PQ = 24$ cm and $QR = 16$ cm



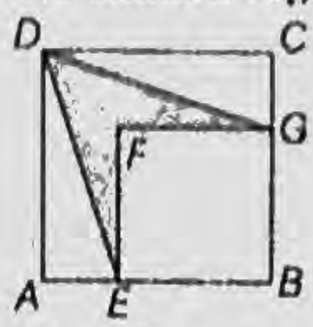
Now, Area of $\Delta PQT = \frac{1}{2} \times$ Base $\times$ Height

[$\because \Delta PQT$ is right angled triangle]

Base of $\Delta PQT = 24$ cm and Height $= 16$ cm

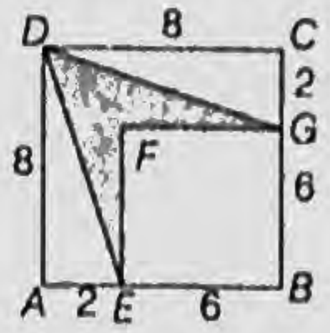
$\therefore$ Area of $\Delta PQT = \frac{1}{2} \times 24 \times 16 = 192$ cm²

34. In the given figure, $ABCD$ and $BEFG$ are squares of sides 8 cm and 6 cm respectively. What is the area (in cm²) of the shaded region?



a. 14 cm² b. 12 cm² c. 8 cm² d. 16 cm²

✓ **(b)** Here,



Area of square $ABCD = (8)^2 = 64$ cm²

and Area of square $BEFG = (6)^2 = 36$

$\therefore$ Area of shaded portion

$= 64 - 36 - (2 \times 2)^2$

$= 64 - 36 - 16 = 12$ cm²

35. $PQRS$ is a parallelogram and its area is 300 cm². Side PQ is extended to X such that $PQ = QX$. If XS intersects QR at Y, then what is the area of triangle SYR?

a. 75 cm² b. 50 cm²
c. 120 cm² d. 100 cm²

✓ **(a)** Here,

Area of Parallelogram $PQRS = 300$ cm²

Now, Area of

$\Delta SRY = \frac{1}{4} \times$ Area of parallelogram $PQRS$

$= \frac{1}{4} \times 300 = 75$ cm²

36. $PQRST$ is a regular pentagon. If PR and QT intersects each other at X, then what is the value of $\angle TXR$?

a. 98° b. 90°
c. 72° d. 108°

✓ **(d)**

37. In the given figure, $ABCDEF$ is a regular hexagon whose side is 12cm. What is the shaded area?

a. $54\sqrt{3}$ cm² b. $36\sqrt{3}$ cm²
c. $48\sqrt{3}$ cm² d. $52\sqrt{3}$ cm²

✓ **(a)**

38. $ABCD$ passes through the centres of the three circles as shown in the figure. $AB = 2$ cm and $CD = 1$. If the area of middle circle is the average of the areas of the other two circles, then what is the length of BC?

a. $(\sqrt{6}) - 1$ cm b. $(\sqrt{6}) + 1$ cm
c. $(\sqrt{6}) - 3$ cm d. $(\sqrt{6}) + 3$ cm

✓ **(a)**

39. A = Area of the largest circle drawn Inside a square of side 1 cm.

B = Sum of areas of 4 identical (largest possible) circles drawn inside a square of side 1 cm.

C = Sum of areas of 9 identical circle (largest possible) drawn inside a square of side 1 cm.

D = Sum of area of 16 identical circles (largest possible) drawn inside a square of side 1 cm.

Which of the following is true about A, B, C and D?

a. A > B > C > D
b. A < B < C < D
c. A > B = C > D
d. No option is correct.

✓ **(d)** No one statement is true from the given statements because in every statement, number of circle has been changed.

40. A prism has a square base whose side is 8 cm, The height of prism is 80 cm. The prism is cut into 10 identical parts by 9 cuts which are parallel to base of prism. What is the total surface area of all the 10 parts together?

a. 4260 cm² b. 2560 cm²
c. 3840 cm² d. 3220 cm²

✓ **(c)** Total surface area of prism = Lateral surface area + 2 × Area of base

= Perimeter of Base × Height + 2 × Area of base × 10

[$\because$ Prism has cut into 10 identical parts]

$= 32 \times 80 + 2 \times 64 \times 10$

$= 2560 + 1280 = 3840$ cm²

$AC = BC = 6$ cm [Radius of inner circle]

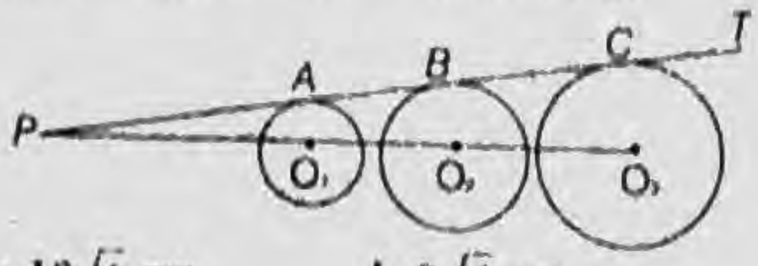
$AB = 2AD = 2\sqrt{AC^2 - CD^2} = 2\sqrt{6^2 - 2^2}$

$= 2\sqrt{36 - 4}$

$= 2\sqrt{32} = 2 \times 4\sqrt{2} = 8\sqrt{2}$ cm

Hence maximum length of chord will be $8\sqrt{2}$ cm

29. In the given figure, PT is a common tangent to three circles at points A, B and C respectively. The radius of the small, medium and large circles is 4 cm, 6 cm and 9 cm, O_1, O_2 and O_3 are the centre of the three circles. What is the value of PC?



a. $18\sqrt{6}$ cm b. $9\sqrt{6}$ cm
c. $24\sqrt{6}$ cm d. $15\sqrt{6}$ cm

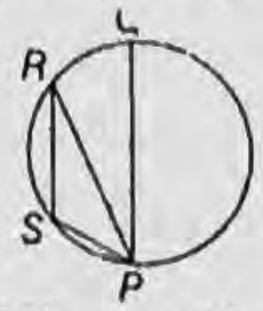
✓ **(a)**

30. $PQRS$ is a cyclic quadrilateral, PR and QS intersect at T. If $\angle SPR = 40°$ and $\angle PQS = 80°$, then what is the value of $\angle PSR$?

a. 60° b. 40°
c. 80° d. 100°

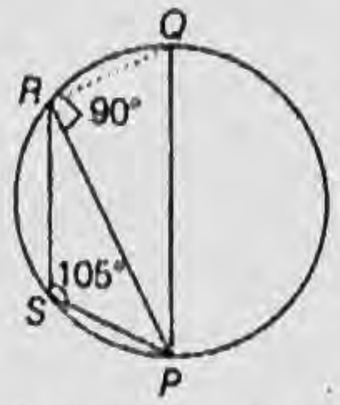
✓ **(a)**

31. In the given figure, $\angle PSR = 105°$ and PQ is the diameter of the circle. What is the valu of $\angle QPR$?



a. 75° b. 15° c. 30° d. 45°

✓ **(b)** Given $\angle PSR = 105°$ and $\angle PRQ = 90°$



Because angle in a semi-circle is right angle.

Now, $\angle QPR = \angle PSR - \angle PRQ$

$= 105° - 90° = 15°$

32. There are two identical circles of radius 10 cm each. If the length of the direct common tangent is 26 cm, then what is the length of the transverse common tangent?

a. $2\sqrt{69}$ cm b. $4\sqrt{23}$ cm
c. $4\sqrt{46}$ cm d. $3\sqrt{46}$ cm

✓ **(a)**

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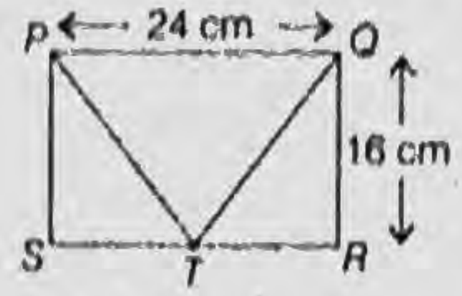

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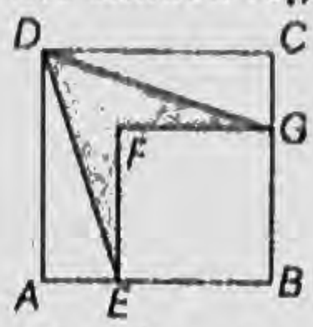

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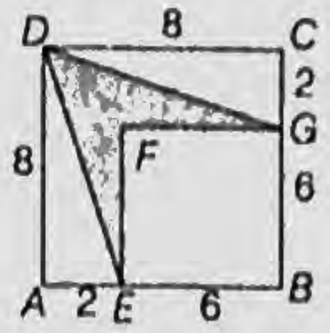

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✓ **(d)**

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✓ **(c)** Total surface area of prism = Lateral surface area + 2 × Area of base

= Perimeter of Base × Height + 2 × Area of base × 10

[$\because$ Prism has cut into 10 identical parts]

$= 32 \times 80 + 2 \times 64 \times 10$

$= 2560 + 1280 = 3840$ cm²

41. A cone of radius 90 cm and height 120 cm stands on its base. It is cut into 3 parts by 2 cuts parallel to its base such that the height of the three parts (from top to bottom) are in ratio of 1 : 2 : 3. What is the total surface area of the middle part?

a. 14600 cm^2 *b.* 16500 cm^2
c. 17800 cm^2 *d.* 18500 cm^2

✓ *(b)*

42. The curved surface area of a cylinder is 594 cm^2 and its volume is 1336.5 cm^3. What is the height of the cylinder?

a. 14 cm *b.* 21 cm
c. 24.5 cm *d.* 10.5 cm

✓ *(b)* Given, Curved surface area of cylinder = 594

$\Rightarrow 2\pi rh = 594$

$\Rightarrow \pi rh = 297$ ...(i)

and volume of cylinder = 1336.5

$\Rightarrow \pi r^2h = 1336.5$ ...(ii)

Now, Eq. (ii) is divided by Eq. (i) we have.

$$\frac{\pi r^2h}{\pi rh} = \frac{1336.5}{297}$$

$\Rightarrow r = 4.5$ cm

Now, putting the value of r in Eq. (i), we have $\pi rh = 297$

$$\Rightarrow \frac{22}{7} \times 4.5 \times h = 297$$

$$\Rightarrow h = \frac{7 \times 297}{22 \times 4.5}$$

$\Rightarrow h = 7 \times 297 = 7 \times 3$

$\Rightarrow h = 21$ cm

43. A hollow cylinder is made up of metal. The difference between outer and inner curved surface area of this cylinder is 352 cm^2. Height of the cylinder is 28 cm. If the total surface area of this hollow cylinder is 2640 cm^2, then what are the inner and outer radius (in cm)?

a. 4, 6 *b.* 10, 12 *c.* 8, 10 *d.* 6, 8

✓ *(d)* Given, height of cylinder (*h*) = 28 cm and difference between outer and inner curved surface area = 352 sq cm

According to the question,

$\Rightarrow 2\pi r_1h - 2\pi r_2h = 352$

$\Rightarrow 2\pi h(r_1 - r_2) = 352$

$\Rightarrow \pi h(r_1 - r_2) = 176$

$$\Rightarrow \frac{22}{7} \times 28(r_1 - r_2) = 176$$

$\Rightarrow 88(r_1 - r_2) = 176$

$\Rightarrow r_1 - r_2 = 2$ (i)

and total curved surface area of hollow cylinder = $2\pi(r_1 + r_2)(h + r_1 - r_2)$

$$\Rightarrow 2640 = 2 \times \frac{22}{7}(r_1 + r_2)(28 + 2)$$

$$\Rightarrow 2640 = \frac{44}{7} \times (r_1 + r_2) \times 30$$

$$\Rightarrow \frac{2640 \times 7}{44 \times 30} = (r_1 + r_2)$$

$$\Rightarrow r_1 + r_2 = \frac{264 \times 7}{132}$$

$\Rightarrow r_1 + r_2 = 14$ ...(ii)

Now, solving Eqs. (i) and (ii), we have, $r_1 = 8$ cm and $r_2 = 6$ cm

44. A solid metal sphere has radius 14 cm. It is melted to form small cones of radius 1.75 cm and height 3.5 cm. How many small cones will be obtained from the sphere?

a. 512 *b.* 256 *c.* 1024 *d.* 2048

✓ *(c)* Let, Number of cones made from sphere = *x*

According to the question,

x × volume of cone = Volume of sphere

$$\Rightarrow x \times \frac{1}{3}\pi r^2h = \frac{4}{3}\pi r^3$$

$\Rightarrow x \times (1.75)^2 \times 3.5 = 4 \times (14)^3$

$$\Rightarrow x = \frac{4 \times (14)^3}{1.75 \times 1.75 \times 3.5}$$

$$= \frac{4 \times 14 \times 14 \times 14}{1.75 \times 1.75 \times 3.5}$$

$\Rightarrow x = 4 \times 8 \times 8 \times 4 = 1024$

$\Rightarrow x = 1024$

Hence, 1024 cones can be obtained from sphere.

45. A metallic hemispherical bowl is made up of steel. The total steel used in making the bowl is 342n cm^3. The bowl can hold 144n cm^3 water. What is the thickness (in cm) of bowl and the curved surface area (in cm^2) of outer side?

a. 6, 162n *b.* 3, 162 n
c. 6, 81n *d.* 3, 81n

✓ *(b)*

46. There is a box of cuboid shape. The smallest side of the box is 20 cm and largest side is 40 cm. Which of the following can be volume of the box?

a. 18000 cm^3 *b.* 12000 cm^3
c. 36000 cm^3 *d.* 42000 cm^3

✓ *(a)*

47. A pyramid has a square base, whose side is 8 cm. If the height of pyramid is 16 cm, then what is the total surface area of the pyramid?

a. $64(\sqrt{17} + 1)$ cm^3 *b.* $32(\sqrt{13} + 1)$ cm^3
c. $64(\sqrt{3} + 1)$ cm^3 *d.* $32(\sqrt{5} + 1)$ cm^3

✓ *(a)*

48. What is the value of $\frac{2(1 - \sin^2\theta)\text{cosec}^2\theta}{\cot^2(1 + \tan^2\theta)} - 1$?

a. $\sin 2\theta$ *b.* $\sin^2\theta$
c. $\cos^2\theta$ *d.* $\cos 2\theta$

✓ *(d)* $\frac{2(1 - \sin^2\theta)\text{cosec}^2\theta}{\cot^2\theta(1 + \tan^2\theta)} - 1$

$$= \frac{2\cos^2\theta\,\text{cosec}^2\theta}{\cot^2\theta \cdot \sec^2\theta} - 1$$

$$= \frac{2 \times \cos^2\theta \times \frac{1}{\sin^2\theta}}{\frac{\cos^2\theta}{\sin^2\theta} \times \frac{1}{\cos^2\theta}} - 1$$

$$= \frac{2\cos^2\theta}{\sin^2\theta} \times \frac{\sin^2\theta}{1} - 1$$

$= 2\cos^2\theta - 1$

$= \cos 2\theta$

49. What is the value of $\frac{\cos 2A + 2\cos^2 A - 2\cos 2A \cos A}{\sin 2A - 2\sin^2 A \sin 2A}$

a. 2 cot *A* *b.* 2tan *A*
c. cot *A* *d.* tan *A*

✓ *(d)*

50. What is the value of cos15° − cos165°?

a. $\frac{\sqrt{3}}{\sqrt{2}}$ *b.* $\frac{2}{(\sqrt{3} - 1)}$
c. $\frac{(\sqrt{3} + 1)}{\sqrt{2}}$ *d.* $\frac{\sqrt{3} + 1}{2}$

✓ *(c)* cos15° − cos165°

= cos15° − cos(180° − 15°)

= cos15° − (− cos15°)

= cos15° + cos15°

= 2cos15° = 2cos(45° − 30°)

= 2 [cos 45° · cos 30° + sin 45° · sin 30°]

$$= 2\left[\frac{1}{\sqrt{2}} \times \frac{\sqrt{3}}{2} + \frac{1}{\sqrt{2}} \times \frac{1}{2}\right]$$

$$= 2\left[\frac{\sqrt{3}}{2\sqrt{2}} + \frac{1}{2\sqrt{2}}\right]$$

$$= 2 \times \frac{(\sqrt{3} + 1)}{2\sqrt{2}} = \frac{(\sqrt{3} + 1)}{\sqrt{2}}$$

51. If $P + Q + R = 60°$, then what is the value of $\cos Q \cos R(\cos P - \sin P) + \sin Q \sin R(\sin P - \cos P)$

a. $\frac{1}{2}$ *b.* $\frac{\sqrt{3}}{2}$
c. $\frac{1}{\sqrt{2}}$ *d.* $\sqrt{2}$

✓ *(a)* Given $P + Q + R = 60°$

Now, $\cos Q \cdot \cos R(\cos P - \sin P) + \sin Q \cdot \sin R(\sin P - \cos P)$

$\cos P \cdot \cos Q \cdot \cos R - \sin P \cdot \cos Q \cdot \cos R + \sin P \cdot \sin Q \cdot \sin R - \cos P \cdot \sin Q \cdot \sin R$

$= \cos(P + Q + R) = \cos 60° = \frac{1}{2}$

52. What is the value of $\frac{[1 - \tan(90 - \theta)]^2}{[\cos^2(90 - \theta)]} - 1$?

a. $-\sin 2\theta$ *b.* $-\cos 2\theta$
c. $\cos 2\theta$ *d.* $\sin 2\theta$

✓ *(a)* $\frac{[1-\tan(90°-\theta)]^2}{[\cos^2(90°-\theta)]}-1$

$=\frac{[1-\cot\theta]^2}{\sin^2\theta}-1$

$=\frac{\left(1-\frac{\cos\theta}{\sin\theta}\right)^2}{\sin^2\theta}-1$

$=\left(\frac{\sin\theta-\cos\theta}{\sin\theta}\right)^2\times\sin^2\theta-1$

$=(\sin\theta-\cos\theta)^2-1$

$=\sin^2\theta+\cos^2\theta-2\sin\theta\cdot\cos\theta-1$

$=1-2\sin\theta\cdot\cos\theta-1$

$=1-\sin2\theta-1=-\sin2\theta$

53. What is the value of

$$\frac{1+2\cot^2(90-x)-2\operatorname{cosec}(90-x)\cot(90-x)]}{[\operatorname{cosec}(90-x)-\cot(90-x)]}?$$

a. $\cos x+\sin x$ *b.* $\sin x-\cos x$

c. $\sec x+\tan x$ *d.* $\sec x-\tan x$

✓ *(d)* $\frac{[1+2\cot^2(90-x)-2\operatorname{cosec}(90-x)\cot(90-x)]}{\operatorname{cosec}(90-x)-\cot(90-x)}$

$=\frac{[1+2\tan^2 x-2\sec x\cdot\tan x]}{(\sec x-\tan x)}$

$=\frac{[1+\tan^2 x+\tan^2 x-2\sec x\tan x]}{(\sec x-\tan x)}$

$=\frac{(\sec^2 x+\tan^2 x-2\sec x\cdot\tan x)}{(\sec x-\tan x)}$

$=\frac{(\sec x-\tan x)^2}{(\sec x-\tan x)}=(\sec x-\tan x)$

54. What is the value of

$\sin(180-\theta)\sin(90-\theta)\div[\cot(90-\theta)/1+\tan^2\theta]$?

a. $\cos^2\theta\sin\theta$ *b.* $\frac{\cos\theta}{(1+\cot^2\theta)^2}$

c. $\frac{\tan\theta}{(1+\tan^2\theta)^2}$ *d.* $\sin^2\theta\cos\theta$

✓ *(*)* $\sin(180°-\theta)\cdot\sin(90°-\theta)-\left[\frac{\cot(90°-\theta)}{1+\tan^2\theta}\right]$

$=\sin\theta\cdot\cos\theta-\left[\frac{\tan\theta}{\sec^2\theta}\right]$

$=\sin\theta\cdot\cos\theta-\left[\frac{\sin\theta}{\cos\theta}\times\frac{\cos^2\theta}{1}\right]$

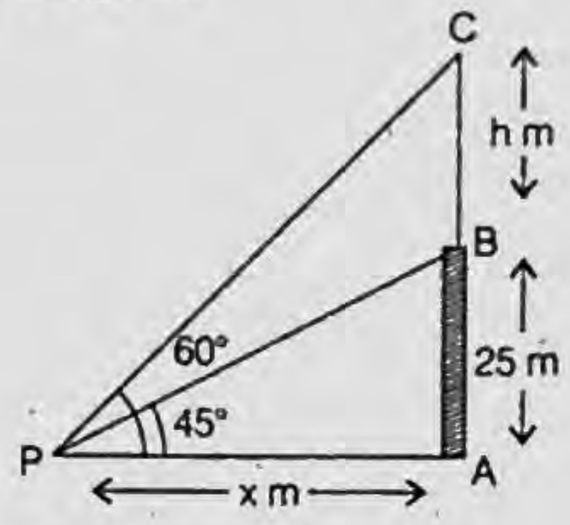
$=\sin\theta\cdot\cos\theta-\sin\theta\cdot\cos\theta=0$

55. A pole is standing on the top of a house. Height of house is 25 m. The angle of elevation of the top of house from point P is 45° and the angle of elevation of the top of pole from P is 60°. Point P is on the ground level. What is the height of pole?

a. $10(\sqrt{3}+1)$ m *b.* $15(\sqrt{3}+1)$ m

c. $25(\sqrt{3}-1)$ m *d.* $20(\sqrt{3}-1)$ m

✓ *(c)* Let, AB is a house and BC is a pole standing on it.



Here, AB = 25 m, BC = *h* m

AP = *x* m, AC = (*h* + 25) m

Now, in ΔPAB

$\tan45°=\frac{AB}{AP}=\frac{25}{x}$

$\Rightarrow\quad 1=\frac{25}{x}\quad\Rightarrow\quad x=25$ m

Now, in, ΔPAC

$\tan60°=\frac{AC}{AP}=\frac{(h+25)}{25}$

$\Rightarrow\quad\sqrt{3}=\frac{h+25}{25}$

$\Rightarrow h+25=25\sqrt{3}\quad\Rightarrow\quad h=25\sqrt{3}-25$

$\Rightarrow\quad h=25(\sqrt{3}-1)$ m

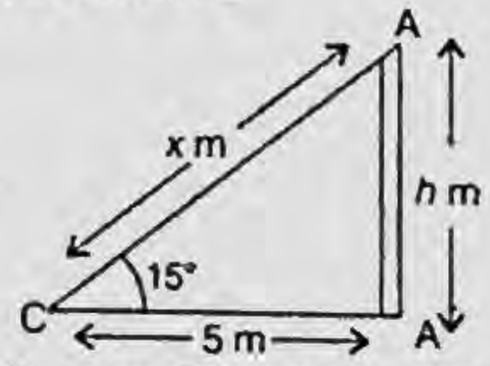
Hence, height of the pole is $25(\sqrt{3}-1)$ m.

56. A ladder is placed against a wall such that it just reaches the top of the wall. The foot of the ladder is at a distance of 5 m from the wall. The angle of elevation of the top of the wall from the base of the ladder is 45°. What is the length of the ladder?

a. $5\sqrt{6}-5\sqrt{3}$ m *b.* $5\sqrt{6}-5\sqrt{2}$ m

c. $5\sqrt{2}-1$ m *d.* $5\sqrt{3}+5\sqrt{2}$ m

✓ *(b)* Let, AC is a ladder which is connected to wall AB.



Here, AC = *x* m, BC = 5 m and AB = *h* m

Now, In ΔABC

$\cos15°=\frac{BC}{AC}=\frac{5}{x}$

$\Rightarrow\quad\frac{\sqrt{3}+1}{2\sqrt{2}}=\frac{5}{x}$

$\Rightarrow\quad 5\times2\sqrt{2}=x(\sqrt{3}+1)$

$\Rightarrow\quad x=\frac{10\sqrt{2}}{(\sqrt{3}+1)}$

$\Rightarrow\quad x=\frac{10\sqrt{2}\times(\sqrt{3}-1)}{(\sqrt{3}+1)\times(\sqrt{3}-1)}$

$\Rightarrow\quad x=\frac{10\sqrt{2}\,(\sqrt{3}-1)}{2}$

$\Rightarrow\quad x=5\sqrt{2}\,(\sqrt{3}-1)$

$\Rightarrow\quad x=(5\sqrt{6}-5\sqrt{2})$ m

57. An aeroplane is flying horizontally at a height of 1.8 km above the ground. The angle of elevation of plane from point X is 60° and after 20 seconds, its angle of elevation from X is become 30°. If point X is on ground, then what is the speed of aeroplane?

a. $216\sqrt{3}$ km/h *b.* $105\sqrt{3}$ km/h

c. $201\sqrt{3}$ km/h *d.* $305\sqrt{3}$ km/h

✓ *(a)*

Directions (Q.Nos. 58-62) The table given below shows the production of maize by 5 different States a percentage of total production. Each State produces only maize and rice. There are three types of rice – R_1, R_2 and R_3. The table also shows the R_1 type of rice produced as a percentage of total rice production and the ratio of R_2 and R_3 type of rice. Total production by each State is 625000.

State	Maize	R_1	$R_2 : R_3$
H	32%	60	6 : 11
R	62%	60	9 : 10
X	52%	60	3 : 5
S	52%	55	4 : 5
T	74%	80	3 : 10

58. What is the difference between the R_1 type of rice produced by State X and the R_2 type of rice produced by State H?

a. 115000 *b.* 120000

c. 55000 *d.* 65000

✓ *(b)* Quantity of the rice *R*1 type produced by state *X*

$=300000\times\frac{60}{100}=180000$

and quantity of the rice R_2 type produced by state H

$=425000\times\frac{40}{100}\times\frac{6}{(11+6)}$

$=170000\times\frac{6}{17}=60000$

∴ Required difference

$=180000-60000=120000$

59. What is the sum of the total production of maize by State X and T and total production of R_2 type of Rice by State S and R?

a. 868500 *b.* 1025000

c. 925000 *d.* 892500

✓ *(d)* Production of maize by State X

$=625000\times\frac{52}{100}=325000$

Production of maize by State T

$=625000\times\frac{74}{100}=462500$

Production of R_2 Type of rice by State S

$= 625000 \times \frac{48}{100} \times \frac{45}{100} \times \frac{4}{(4+5)}$

$= 135000 \times \frac{4}{9} = 60000$

Production of R_2 Type of rice by State R

$= 625000 \times \frac{38}{100} \times \frac{40}{100} \times \frac{9}{(9+10)} = 45000$

∴ Sum of production of all things

$= 325000 + 462500 + 60000 + 45000 = 892500$

60. Production of R_3 type of rice by State X is what percentage of production of R_1 type of rice by State S?

a. 45.45 *b.* 52.52 *c.* 42.5 *d.* 39.5

✓ **(a)** Production of R_3 type of rice by

State X $= 625000 \times \frac{48}{100} \times \frac{40}{100} \times \frac{5}{(3+5)}$

$= 75000$

and production of R_1 type of rice by

State S $= 625000 \times \frac{48}{100} \times \frac{44}{100} = 165000$

∴ Required percentage

$= \frac{75000}{165000} \times 100\% = 45.45\%$

61. A = Average of the R_3 type of rice produced by State H, R, S and X together.

B = Difference between the R_2 type of rice produced by State T and R_1 type of rice produced by State R.

What is the value of B – A ?

a. 54750 *b.* 56750

c. 57500 *d.* 57000

✓ **(c)** Here,

$A = \frac{1}{4}[10000 + 50000 + 75000 + 75000] = 77500$

and $B = 142500 - 7500 = 135000$

Now, $(B - A) = 135000 - 77500 = 57500$

62. F = Total production of R_2 types of rice by all the States.

K = Average of the total production of R_1 type of rice by all the States.

What is the value of K/F?

a. 0.875 *b.* 0.802

c. 0.08 *d.* 0.702

✓ **(b)** Here, $F = 60000 + 45000 + 45000 + 60000 + 7500 = 217500$

and $K = \frac{1}{5}[255000 + 142500 + 180000 + 165000 + 130000]$

$= \frac{872500}{5} = 174500$

∴ $\frac{K}{F} = \frac{174500}{217500} = 0.802$

63. If x beakers of 100 ml containing 1 : 4 acid-water solution are mixed with y beakers of 200 ml containing 3 : 17 acid-water solution then the ratio of acid to water in the resulting mixture becomes 19 : 91. Find $x : y$.

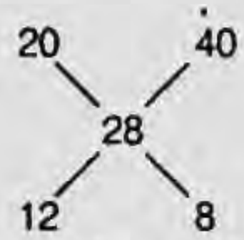
a. 5 : 3 *b.* 3 : 5 *c.* 7 : 13 *d.* 13 : 7

✓ **(a)**

64. In what ratio should 20% ethanol solution be mixed with 40% ethanol solution to obtain a 28% ethanol solution?

a. 2 : 3 *b.* 8 : 5 *c.* 3 : 2 *d.* 5 : 8

✓ **(c)** Here,



∴ Required ratio = 12 : 8 = 3 : 2

65. A and B start a business by investing equal amounts. Four months later, C joins them by investing ₹ 3.5 lakh. By withdrawing his investment in the business B leaves the business 4 months after C joined. At the end of the year the business makes ₹ 62400 profit out of which A collects ₹ 24000 as his share of profit. How much should be paid to C as his share of profit?

a. ₹ 16000 *b.* ₹ 32000

c. ₹ 22400 *d.* ₹ 27800

✓ **(c)**

66. A and B invest in a business in the ratio 3 : 7. The business makes a profit of ₹ 60000 in 1 year. They decide to distribute the profit remaning after reinvesting 40% of the profit. How much will A get?

a. ₹ 25200 *b.* ₹ 15600

c. ₹ 10800 *d.* ₹ 20400

✓ **(c)** Ratio of profit of A and B = 3 : 7

Total profit = ₹ 60000

∴ A's profit $= \frac{3}{(3+7)} \times 60000 =$ ₹ 18000

But 40% of profit is reinvest in business,

∴ After reinvestment profit of A

$= 18000 \times \frac{60}{100} =$ ₹ 10800

67. A can do a work in 72 days and B in 90 days. If they work on it together for 10 days, then what fraction of work is left?

a. 3/4 *b.* 1/4 *c.* 4/5 *d.* 5/6

✓ **(a)** One day work of A $= \frac{1}{72}$

One day work of B $= \frac{1}{90}$

One day work of (A + B) $= \frac{1}{72} + \frac{1}{90}$

$= \frac{5+4}{360} = \frac{9}{360} = \frac{1}{40}$

∴ 10 days work of (A + B) $= 10 \times \frac{1}{40} = \frac{1}{4}$

∴ Left work $= 1 - \frac{1}{4} = \frac{3}{4}$

68. A is thrice as a good a workman as B. C alone takes 48 days to paint a house. All three A, B and C working together take 16 days to paint the house. It will take how many days for B alone to paint the house?

a. 32 *b.* 64 *c.* 96 *d.* 72

✓ **(c)** Let, one day work of $A = \frac{1}{x}$

Then, one day work of $B = \frac{1}{3x}$

And one day work of $C = \frac{1}{48}$

Now, one day work of $(A + B + C) = \frac{1}{16}$

$\Rightarrow \frac{1}{x} + \frac{1}{3x} + \frac{1}{48} = \frac{1}{16}$

$\Rightarrow \frac{1}{x} + \frac{1}{3x} = \frac{1}{16} - \frac{1}{48}$

$\Rightarrow \frac{3+1}{3x} = \frac{3-1}{48}$

$\Rightarrow \frac{4}{3x} = \frac{2}{48}$

$\Rightarrow 3x \times 2 = 4 \times 48$

$\Rightarrow x = \frac{4 \times 48}{3 \times 2}$

$\Rightarrow x = 32$

∴ One day work of B $= \frac{1}{3 \times 32} = \frac{1}{96}$

∴ Time taken by B to complete the work = 96 days

69. C is 5 times as productive as B, A takes 60 days to complete a task. If A, B and C work together they can complete the task in 12 days. In how many days can B complete the task if the worked alone?

a. 18 *b.* 27 *c.* 90 *d.* 72

✓ **(c)** One day work of $C = \frac{1}{x}$

One day work of $B = \frac{1}{5x}$

One day work of $A = \frac{1}{60}$

And one day work of $(A + B + C) = \frac{1}{12}$

$\Rightarrow \frac{1}{60} + \frac{1}{5x} + \frac{1}{x} = \frac{1}{12}$

$\Rightarrow \frac{1}{5x} + \frac{1}{x} = \frac{1}{12} - \frac{1}{60}$

$\Rightarrow \frac{1+5}{5x} = \frac{5-1}{60}$

$$\Rightarrow \quad \frac{6}{5x} = \frac{4}{60}$$

$$\Rightarrow \quad 5x \times 4 = 6 \times 60$$

$$\Rightarrow \quad x = \frac{6 \times 60}{5 \times 4} = 18$$

$$\Rightarrow \quad x = 18$$

$\therefore$ One day work of $B = \frac{1}{5 \times 18} = \frac{1}{90}$

$\therefore$ Time taken by B to complete the work = 90 days

70. A can complete 50% of a job in 9 days and B can complete 25% of the job in 9 days if they worked alone. If they worked together how much of the job can they complete in 9 days?

a. 80% *b.* 90%
c. 75% *d.* 100%

✓ **(c)** Work done by A in 9 days $= 50\% = \frac{50}{100} = \frac{1}{2}$

$\therefore$ Work done by A in 1 day $= \frac{1}{2 \times 9} = \frac{1}{18}$

Work done by B in 9 days $= 25\% = \frac{25}{100} = \frac{1}{4}$

$\therefore$ Work done by B in 1 day $= \frac{1}{4 \times 9} = \frac{1}{36}$

$\therefore$ One day work of $(A + B) = \frac{1}{18} + \frac{1}{36}$

$$= \frac{2+1}{36} = \frac{3}{36} = \frac{1}{12}$$

Now, 9 days work of A and B

$$= 9 \times \frac{1}{12} = \frac{9}{12} = \frac{3}{4}$$

$\therefore$ Required percentage of work

$$= \frac{3}{4} \times 100\% = 75\%$$

71. Giving two successive discounts of 60% is equal to giving one discount of

a. 90% *b.* 72%
c. 96% *d.* 84%

✓ **(d)** Single discount

$$= \left[60 + 60 - \frac{60 \times 60}{100}\right]\%$$

$$= (120 - 6 \times 6)\%$$

$$= (120 - 36)\% = 84\%$$

72. If an item marked at ₹ 480 is being sold at ₹ 400, then what is the effective discount on the item?

a. 20%
b. 16.67%
c. 25%
d. 15%

✓ **(b)** Required discount percentage

$$= \frac{(480 - 400)}{480} \times 100\%$$

$$= \frac{80}{480} \times 100\% = 16.6666\%$$

$$= 16.67\%$$

73. On an item there is cash 5% discount on the marked price of ₹ 25000. After giving an additional season's discount the item is sold at ₹ 20900. How much was the season's discount?

a. 11% *b.* 10% *c.* 12% *d.* 9%

✓ **(c)** Price of article after cash discount

$$= 25000 \times \frac{95}{100} = ₹\ 23750$$

Now, Season's discount

$$= 23750 - 20900 = ₹\ 2850$$

$\therefore$ Required discount percentage

$$= \frac{2850}{23750} \times 100\% = 12\%$$

74. A retailer marks up his goods by 20% and then offers 25% discount. What will be the selling price on an item that he sells if its cost price is ₹ 2500?

a. ₹ 2400 *b.* ₹ 3000
c. ₹ 2750 *d.* ₹ 2250

✓ **(d)** Cost price of an article = ₹ 2500

Then, marked price of an article

$$= 2500 \times \frac{120}{100} = ₹\ 3000$$

and sale price of an article after discount

$$= 3000 \times \frac{(100 - 25)}{100}\%$$

$$= 3000 \times \frac{75}{100} = ₹\ 2250$$

75. Find two numbers such that their mean proportional is 18 and the third proportional to them is 144.

a. 6 and 42 *b.* 9 and 36
c. 3 and 18 *d.* 6 and 12

✓ **(b)** Let, two numbers are a and b which mean and third proportional is 18 and 144 respectively.

$$\sqrt{ab} = 18$$

$$\Rightarrow \quad ab = 324 \qquad \text{...(i)}$$

And $\frac{b^2}{a} = 144$

$$\Rightarrow \quad a = \frac{b^2}{144} \qquad \text{...(ii)}$$

Now, putting the value of a from Eq. (ii) in Eq. (i) we have

$$ab = 324$$

$$\Rightarrow \quad \frac{b^2}{144} \times b = 324$$

$$\Rightarrow \quad b^3 = 324 \times 144$$

$$\Rightarrow \quad b^3 = 46656$$

$$\Rightarrow \quad b^3 = 36 \times 36 \times 36 \Rightarrow b = 36$$

Now, potting the value of b in Eq. (ii), we have $a = \frac{(36)^2}{144}$

$$\Rightarrow \quad a = \frac{36 \times 36}{144} \Rightarrow \frac{36}{4} = 9$$

$$\Rightarrow \quad a = 9$$

Hence, number are 9 and 36

76. If $6A = 4B = 9C$; find $A : B : C$

a. 6 4 9 *b.* 6 9 4
c. 4 9 6 *d.* 9 6 4

✓ **(b)** Here $6A = 4B = 9C = K$ (Let)

Then, $6A = K$

$$\Rightarrow \quad A = \frac{K}{6}$$

Same as, $B = \frac{K}{4}$ and $C = \frac{K}{9}$

$$\therefore \quad A\ B\ C = \frac{K}{6}\ \frac{K}{4}\ \frac{K}{9} = \frac{1}{6}\ \frac{1}{4}\ \frac{1}{9}$$

$$= \frac{36}{6}\ \frac{36}{4}\ \frac{36}{9} = 6\ 9\ 4$$

77. Find the third proportional to 10 and 25.

a. 2.5 *b.* 62.5
c. 40 *d.* 100

✓ **(b)** Let, third proportional to 10 and 25 $= x$

Then, $a = 10$

and $b = 25$

$\therefore$ Third proportional $= x = \frac{b^2}{a} = \frac{(25)^2}{10}$

$$= \frac{25 \times 25}{10} = 62.5$$

78. A purse has ₹ 34.5 in the form of ₹ 1, 50 paise and 10 paise coins in the ratio of 6 : 9 : 10. Find the number of 10 paise coins.

a. 10 *b.* 30 *c.* 20 *d.* 40

✓ **(b)** Let, number of coins of ₹ 1, 50 paise and 10 paise are $6x$, $9x$ and $10x$ respectively in the purse.

and total value of coins

$$= 1 \times 6x + \frac{50}{100} \times 9x + \frac{10}{100} \times 10x$$

$$\Rightarrow \quad 34.5 = 6x + \frac{9x}{2} + x$$

$$\Rightarrow \quad \frac{23x}{2} = 34.5$$

$$\Rightarrow \quad x = \frac{2 \times 34.5}{23} = 3$$

$$\Rightarrow \quad x = 3$$

$\therefore$ Number of coins of 10 paise

$$= 10x = 10 \times 3 = 30$$

79. What number should be added to each of the numbers 103, 135, 110 and 144 so, that the resulting numbers are in proportion?

a. 12 *b.* 15
c. 9 *d.* 6

✓ **(c)** Let, number x should be added to make the given number proportional.

According to the question,

$$(103 + x) : (135 + x) :: (110 + x) : (144 + x)$$

$$\Rightarrow \quad \frac{103 + x}{135 + x} = \frac{(110 + x)}{(144 + x)}$$

$$\Rightarrow \quad 14832 + 103x + 144x + x^2 = 14850 + 135x + 110x + x^2$$

$\Rightarrow 14832 + 247x + x^2 = 14850 + 245x + x^2$

$\Rightarrow x^2 + 247x - 245x - x^2 = 14850 - 14832$

$\Rightarrow 2x = 18$

$\Rightarrow x = 9$

Hence, number 9 should be added to the given numbers to make it proportional.

80. When ticket prices to a water park are increased in the ratio 11 : 12 then the number of daily visitors to the park fall in the ratio 8 : 7. If the dally revenues before the increase in ticket price was ₹ 176000 then find the daily revenues after the increase in ticket price.

a. ₹ 264000 *b.* ₹ 112000
c. ₹ 192000 *d.* ₹ 168000

✓ *(d)*

81. The average weight of X, Y and Z is 74 kg. In the average weight of X and Y be 68 kg and that and Z be 78 kg, then the weight of Y is.

a. 72 kg *b.* 70 kg
c. 68 kg *d.* 66 kg

✓ *(b)* Given, $\frac{X + Y + Z}{3} = 74$

$\Rightarrow X + Y + Z = 222$ ...(i)

and $\frac{X + Y}{2} = 68$

$\Rightarrow X + Y = 136$ ...(ii)

and $\frac{Y + Z}{2} = 78$

$\Rightarrow Y + Z = 156$ ...(iii)

Now, adding Eqs. (ii) and (iii), we have

$X + 2Y + Z = 292$ ...(iv)

Now, subtracting Eqs. (i) from Eqs. (iv), we have

$$\begin{array}{r} Z + 2Y + Z = 292 \\ \underline{X + Y + Z = 222} \\ Y = 70 \end{array}$$

Hence, weight of y is 70 kg.

82. Of the 3 numbers whose average is 26, the first is 2/11 times the sum of other two. The first number is

a. 16 *b.* 13 *c.* 11 *d.* 12

✓ *(d)* Let, numbers are x, y and z.
According to the question,

$\frac{x + y + z}{3} = 26$

$\Rightarrow x + y + z = 78$ ...(i)

and $x = (y + z) \times \frac{2}{11}$

$\Rightarrow 11x = 2y + 2z$

$\Rightarrow \frac{11}{2}x = y + z$ ...(ii)

Now, from Eqs. (i) and (ii), we have

$x + \frac{11x}{2} = 78$

$\Rightarrow \frac{13x}{2} = 78$

$\Rightarrow x = \frac{2 \times 78}{13}$

$\Rightarrow x = 12$

Hence, first number is 12

83. The average weight of a class of 50 students is 48.6 kg. If the average weight of the 20 boys is 54 kg, then find the average weight of the girls in the class.

a. 40 kg *b.* 46 kg
c. 45 kg *d.* 42 kg

✓ *(c)* Here, Total weight of 50 students
$= 50 \times 48.6 = 2430$ kg
And total weight of 20 boys
$= 20 \times 54 = 1080$ kg
Now, number of girls in class
$= 50 - 20 = 30$
and total weight of 30 girls $= 2430 - 1080$
$= 1350$ kg
∴ Average weight of 30 girls of class
$= \frac{1350}{30} = 45$ kg

84. The average of all odd numbers from 113 to 159 is

a. 135 *b.* 134
c. 133 *d.* 136

✓ *(d)* Average of all odd numbers from 113 to 159 $= \frac{113 + 159}{2} = \frac{272}{2} = 136$

85. A trader buys jowar at ₹ 30 per kg. 20% of the grain gets wasted. He plans to sell the remaining grain so that he makes 40% overall profit. At what price should he shell the grain?

a. ₹ 48 per kg *b.* ₹ 50 per kg
c. ₹ 52.5 per kg *d.* ₹ 47.5 per kg

✓ *(c)* Let, trader buys 100 kg jowar.
Then, total cost price of jowar
$= 30 \times 100 =$ ₹ 3000
But 20% of jowar gets wasted.
∴ Quantity of rest jowar
$= 100 \times \frac{80}{100} = 80$ kg
∴ Cost of per kg of jowar
$= \frac{3000}{80} =$ ₹ 37.5 per kg
Now, to get 40% profit, Rate of jowar
$= 37.5 \times \frac{140}{100} =$ ₹ 52.5 per kg

86. If a vendor sells a watermelon at ₹ 69 he makes 8% loss. If he wants to make 16% profit then at what price should he sell?

a. ₹ 91
b. ₹ 83
c. ₹ 87
d. ₹ 79

✓ *(c)* Cost price of watermelon
$= 69 \times \frac{100}{(100 - 8)}$
$= \frac{69 \times 100}{92} =$ ₹ 75
Now, sale price of watermelon to get 16% profit
$= 75 \times \frac{116}{100} =$ ₹ 87

87. The cost of 25 items is the same as the revenue earned by selling x items. Find x, if the profit made in the transaction is 25%.

a. 25 *b.* 16.67 *c.* 20 *d.* 32

✓ *(c)* Here, profit percent = 25%, $a = 25$ and $b = x$
∴ Profit percentage $= \frac{a - b}{b} \times 100$
$\Rightarrow 25 = \left(\frac{25 - x}{x}\right) \times 100$
$\Rightarrow 25x = 2500 - 100x$
$\Rightarrow 25x + 100x = 2500$
$\Rightarrow 125x = 2500$
$\Rightarrow x = \frac{2500}{125} = 20$
$\Rightarrow x = 20$

88. An item is sold for ₹ 7130 making a 15% profit. What is the cost price of this item?

a. ₹ 6000 *b.* ₹ 6125
c. ₹ 6250 *d.* ₹ 6200

✓ *(d)* Here, Sale price = ₹ 7130,
Profit = 15%
∴ Cost price of an article = Sale price
$\times \left(\frac{100}{100 + \text{profit} + \%}\right)$
$= 7130 \times \left(\frac{100}{100 + 15}\right)$
$= 7130 \times \frac{100}{115} =$ ₹ 6200

89. 0.02% of 150% of 600 is

a. 0.18 *b.* 1.8 *c.* 18 *d.* 0.018

✓ *(a)* 0.02% of 150% of 600
$= \frac{0.02}{100} \times \frac{150}{100} \times 600 = 0.18$

90. When a number is increased by 40, it becomes 125% of itself, what is the number?

a. 200 *b.* 60 *c.* 160 *d.* 100

✓ *(c)* Let, number = x
According to the question,
$(x + 40) = x \times \frac{125}{100}$
$\Rightarrow (x + 40) = \frac{5x}{4}$
$\Rightarrow 4x + 160 = 5x$
$\Rightarrow 5x - 4x = 160$
$\Rightarrow x = 160$

91. In an exam of 300 marks a students gets 75 marks. If she had scored 6 more she would have attained passing percentage. What is the passing percentage?

a. 25% *b.* 30%
c. 35% *d.* 27%

✓ ***(d)*** Passing marks percentage

$$= \frac{(75 + 6)}{300} \times 100\%$$

$$= \frac{81}{300} \times 100\%$$

$$= \frac{81}{3} = 27\%$$

92. A man's annual income has increased by ₹ 7 lakh, but the tax on income that he has to pay has reduced from 20% to 16%. He now pays the same amount of tax as before. What is his increased income?

a. ₹ 8 lakh *b.* ₹ 10 lakh
c. ₹ 12 lakh *d.* ₹ 6 lakh

✓ ***(d)*** Let, Salary of man = ₹ x (in lakh)
According to the question,

$$x \times \frac{20}{100} = (x + 2) \times \frac{16}{100}$$

$$\Rightarrow \quad 20x = 16x + 32$$

$$\Rightarrow \quad 20x - 16x = 32$$

$$\Rightarrow \quad 4x = 32$$

$$\Rightarrow \quad x = 8$$

Hence, salary of man = ₹ 8 lakh
Now, increased salary of man

$$= ₹ (8 + 2)$$

$$= ₹ 10 \text{ lakh}$$

93. A car covers 630 km in 20 hours. Calculate its average speed in meters/second?

a. 8.25 *b.* 7.25
c. 8.75 *d.* 7.25

✓ ***(c)*** Speed of car $= \frac{630}{20} = 31.5$ km/h

Now convert this speed into the m/sec, we have to multiply it by $\frac{5}{18}$.

$\therefore$ Speed of car $= 31.5 \times \frac{5}{18}$ m/sec

$$= 8.75 \text{ m/sec}$$

94. A jet ski goes upstream at a speed of 48 km/h and comes back the same distance at 80 km/h. Find the average speed for the total journey.

a. 64 km/h *b.* 62 km/h
c. 66 km/h *d.* 60 km/h

✓ ***(d)*** Average speed of jet ski

$$= \frac{2 \times 48 \times 80}{(48 + 80)}$$

$$= \frac{2 \times 48 \times 80}{128}$$

$$= 60 \text{ km/h}$$

95. A bullet fired from a rifle travels at an average speed of 2520 km/hr. It hits the target after 0.2 seconds. How far is the target from the rifle?

a. 70 m *b.* 140 m
c. 100 m *d.* 200 m

✓ ***(b)*** Speed of bullet = 2520 km/h

$$= 2520 \times \frac{5}{18} \text{ m/sec}$$

$$= 700 \text{ m/sec}$$

Now, Distance of rifle from target

$$= 700 \times 0.2 \text{ m} = 140 \text{ m}$$

96. Train A and B start at the same time. Train A travels at 55 km/h from station X to station Y and train B travels at 80 km/h from station Y to station X. They cross each other after 1 hour and 36 minutes. What is the distance between station X and Y?

a. 196 km *b.* 232 km
c. 240 km *d.* 216 km

✓ ***(d)*** Relative speed of train A and B

$$= 55 + 80 = 135 \text{ km/h}$$

and Time = 1 h 36 min = (60 + 36) min

$$= 96 \text{ min} = \frac{96}{60} \text{ h}$$

$\therefore$ Distance between both the stations = Speed × Time

$$= 135 \times \frac{96}{60} = 216 \text{ km}$$

97. If in 2 years at simple interest the principal increases by 16%, what will be the compound interest earned on ₹ 25000 in 2 years at the same rate?

a. ₹ 4000 *b.* ₹ 2160
c. ₹ 2000 *d.* ₹ 4160

✓ ***(d)*** Compound Interest

$$= 25000\left[\left(1 + \frac{16}{100}\right)^2 - 1\right]$$

$$= 25000\left[\left(1 + \frac{2}{25}\right)^2 - 1\right]$$

$$= 25000\left[\left(\frac{27}{25}\right)^2 - 1\right]$$

$$= 25000\left[\frac{729}{625} - 1\right]$$

$$= 25000 \times \frac{104}{625} = ₹ 4160$$

98. If compound interest received on a certain amount in the 2nd year is ₹ 250. What will be the compound interest for the 3rd year on the same amount at 12% rate of interest?

a. ₹ 250 *b.* ₹ 300 *c.* ₹ 280 *d.* ₹ 270

✓ ***(c)*** Compound Interest

$$= 250 + 250 \times \frac{12}{100}$$

$$= 250 + 30 = ₹ 280$$

99. What is the difference between the compound interest on ₹ 12500 for 1 year at 8% per annum compounded yearly and half-yearly?

a. ₹ 16 *b.* ₹ 25
c. ₹ 20 *d.* ₹ 40

✓ ***(c)*** Here, $r = 8\%$, $P =$ ₹ 12500, $n = 1$ yr
Condition I When interest is compounded yearly

$$CI = \text{Principal}\left[\left(1 + \frac{r}{100}\right)^n - 1\right]$$

$$= 12500\left[\left(1 + \frac{8}{100}\right)^1 - 1\right]$$

$$= 12500\left[1 + \frac{8}{100} - 1\right]$$

$$= 12500 \times \frac{8}{100}$$

$$= ₹ 1000$$

Condition II When Interest is compound half yearly

$$CI = \text{Principal}\left[\left(1 + \frac{r}{100}\right)^n - 1\right]$$

$$= 12500\left[\left(1 + \frac{8}{2 \times 100}\right)^{2 \times 1} - 1\right]$$

$$= 12500\left[\left(\frac{26}{25}\right)^2 - 1\right]$$

$$= 12500\left[\frac{6760 - 625}{625}\right]$$

$$= 12500 \times \frac{51}{625} = ₹ 1020$$

$\therefore$ Required difference

$$= 1020 - 1000 = ₹ 20$$

100. The amount received at 8% per annum compound interest after 2 years is ₹ 72900. What was the principle?

a. ₹ 65000 *b.* ₹ 67500
c. ₹ 60000 *d.* ₹ 62500

✓ ***(d)*** Here, $r = 8\%$, $A =$ ₹ 72900,
$P = ?$, $n = 2$ yr
$\therefore$ Compound Amount

$$(A) = \text{Principal}\left(1 + \frac{r}{100}\right)^n$$

$$\Rightarrow 72900 = (P)\left(1 + \frac{8}{100}\right)^2$$

$$\Rightarrow 72900 = P\left(1 + \frac{2}{25}\right)^2$$

$$\Rightarrow 72900 + P\left(\frac{27}{25}\right)^2$$

$$\Rightarrow 72900 = P \times \frac{729}{625}$$

$$\Rightarrow \quad P = \frac{72900 \times 625}{729} = 100 \times 625$$

$$\Rightarrow \quad P = ₹ 62500$$