ORISSA BOARD
SUBJECT : MATHEMATICS

AR/AXR – 15 – MTH SET – B **CLASS : X**
MAXIMUM MARKS : 50 **TIME : 1 : 15 HOURS**

Question with Solutions

PART-A

1. For which value of p,(2, 2) is a solution of the equation 3x + 4y – 2p = 0 ?
(A) 3 (B) 5 (C) 7 (D) 9

Sol. (C) Given equation 3x + 4y – 2P = 0

If (2 , 2) is a solution of this equation then it staisfy this equation.

$3(2) + 4(2) - 2P = 0$

$2P = 14$

$P = 7$

2. If the equation 3x + y + 1 = 0 and rx + sy + 7 = 0 are inconsistent, then what is r : s ?
(A) 3 : 1 (B) 1 : 3 (C) 5 : 1 (D) 1 : 5

Sol. (A) $3x + y + 1 = 0$

$rx + sy + 7 = 0$

For in consistent $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$

$\frac{3}{r} = \frac{1}{s}$

$\frac{r}{s} = \frac{3}{1}$

3. What is the value of the determinant $\begin{vmatrix} 5 & 4 \\ 3 & 4 \end{vmatrix}$?

(A) 8 (B) 10 (C) 12 (D) 14

Sol. (A)

$\begin{vmatrix} 5 & 4 \\ 3 & 4 \end{vmatrix}$

$= 5 \times 4 - 3 \times 4$

$20 - 12 = 8$

4. Which of the following points does not lie on the graph of the equation 3x – 2y + 4 = 0 ?
(A) (2, 5) (B) (1, 2) (C) 4, 8) (D) (–2, – 1)

Sol. (B) Given equation is 3x – 2y + 4 = 0

For point (2 , 5)

$3(2) - 2(5) + 4$

$6 - 10 + 4$

= 0 (lie on the equation)

For point (1 , 2)

[redacted]

3(1) – 2(2) + 4

3 – 4 + 4 = 3 (does not lie)

For point (4 , 8)

3(4) – 2(8) + 4 = 0 (lie)

For point (– 2 , – 1)

3 (– 2) – 2 (– 1) + 4 = 0 (lie)

Answer is (1 , 2)

5. The graph of which of the following equations is parallel to the graph of 3x – y = 2 ?

(A) 3x + y = – 2 (B) 2x – 3y = 2 (C) 6x – 2y = 3 (D) 6x + 2y = – 4

Sol. (C) 3x – y = 2

Slope = $-\frac{3}{(-1)} = 3$

For option (A) slope = $\frac{-3}{1}$

For option (B) slope = $\frac{-2}{(-3)} = \frac{2}{3}$

For option (C) slope = $\frac{-6}{(-2)} = 3$

For option (D) slope = $-\frac{6}{2} = -3$

Hence option (C) is correct.

6. The sum of a number and its reciprocal is 3. If the number is x, then which of the following is the quadratic equation containing x ?

(A) $x^2 - 3x + 2 = 0$ (B) $x^2 + 3x + 1 = 0$

(C) $x^2 - 3x + 1 = 0$ (D) $x^2 + 3x + 2 = 0$

Sol. (C) ATQ

$x + \frac{1}{x} = 3$

$x^2 + 1 = 3x$

$x^2 - 3x + 1 = 0$

7. Which of the following being taken for p, the roots of the equation $x^2 + px + 1 = 0$ will be real and equal ?

(A) 2 (B) 2.5 (C) 4 (D) 8

Sol. (A) For real roots D = 0

$b^2 - 4ac = 0$

$p^2 - 4(1)(1) = 0$

$p^2 = 4$

$p = \pm 2$

Hence option (A) is correct.

8. If one of the roots of the quadratic equation $x^2 + x + k = 0$ is – 2, then what is the value of k ?

(A) 2 (B) – 2 (C) – 3 (D) 0

Sol. (B) If – 2 is a root of this equation then

$(-2)^2 + (-2) + k = 0$

$4 - 2 + k = 0$

$k = -2$

9. Which of the following quadratic equations has the sum of the roots as 2 and product of the roots as – 3 ?

(A) $x^2 - 2x - 3 = 0$ (B) $x^2 + 3x - 3 = 0$

(C) $x^2 - 3x - 3 = 0$ (D) $x^2 + 2x - 3 = 0$

Sol. (A) equation is

$x^2 - x$ (sum of roots) + (product of roots) = 0

$x^2 - x(2) + (-3) = 0$

$x^2 - 2x - 3 = 0$

10. In an AP, t_8 is more than t_3 by 25. What is the common difference of the AP ?

(A) 5 (B) 4 (C) 2 (D) 1

Sol. (A) $t_8 = t_3 + 25$

$a + 7d = a + 2d + 25$

$5d = 25$

$d = 5$

11. What is the common difference of an AP of which $t_n = 5n + 1$?

(A) 7 (B) 5 (C) 3 (D) 1

Sol. (B) $t_n = 5n + 1$

$t_1 = 6$

$t_2 = 11$

common difference = $t_2 - t_1 = 11 - 6 = 5$

12. Which of the following sequences is not an AP ?

(A) 1, 3, 5, 7, 9,............ (B) 0, – 2, – 4, – 6,........

(C) – 7, –5, – 2, – 1, 1, 3,.......... (D) – 6, – 4, – 2, 2, 3, 4,..........

Sol. (D) in option (D) – 6, – 4 , – 2 , 2 , 3 , 4 ...

Difference between consecutive terms is not same. so this is not an A.P.

13. In an AP, $S_n = n^2$, what is t_n ?

(A) 2n (B) 2n – 1 (C) 2n + 1 (D) 2n + 3

Sol. (B) $S_n = n^2$

$$\frac{n}{2}[2a + (n-1)d] = n^2$$

$2a + (n - 1)d = 2n$ ___(1)

If n = 1 then $S_1 = a = 1$ __(2)

$T_n = a + (n - 1)d$

from eq. (1) & (2)

$T_n = 2n - 1$

14. What is the middle of the scores in a data arranged in ascending or descending order known as ?

(A) Deviation (B) Mode (C) Mean (D) Median

Sol. (D) Median

15. If M is the mean of the scores x_1, x_2, x_3, ..., x_n, then what is the mean of the scores ax_1, ax_2, ax_3,..........., ax_n (When $a \neq 0$)

(A) M (B) M + a (C) aM (D) M – a

Sol. (C) $\frac{x_1 + x_2 + x_2 + x_3 + ...x_n}{n} = M$

$x_1 + x_2 + ...x_n = nM$ __(1)

required mean = $\frac{ax_1 + ax_2 + ...ax_n}{n} = \frac{a \times nM}{n} = aM$

16. What is the mean of the first 20 positive even numbers ?

(A) 20 (B) 21 (C) 22 (D) 24

Sol. (B) First 20 positive even integers 2 , 4 , 6 , ...40

Mean = $\frac{2+4+...40}{20} = \frac{2\times(1+2+...20)}{20} = \frac{2\times20\times21}{20\times2} = 21$

17. What is the median of the data given below ?

7, 12, 15, 6, 20

(A) 12 (B) 10 (C) 7 (D) 8

Sol. (A) Given observation 7 , 12 , 15 , 6 , 20

$\Rightarrow$ 6 , 7 , 12 , 15 , 20

number of observations = 5

Median = $\left(\frac{n+1}{2}\right)^{th}$ obs = $\left(\frac{5+1}{2}\right)^{th} = 3^{rd}$ obs

Median = 12

18. If a ludo-dice is rolled once, then what is the probability of getting 5 or less than that ?

(A) $\frac{3}{6}$ (B) $\frac{5}{6}$ (C) $\frac{6}{6}$ (D) $\frac{2}{3}$

Sol. (B) S = { 1 , 2 , 3 , 4 , 5, 6 }

required probability = $\frac{5}{6}$

19. Two coins are tossed once. What is the probability of getting at least two T's ?

(A) $\frac{1}{4}$ (B) $\frac{2}{4}$ (C) $\frac{3}{4}$ (D) $\frac{4}{4}$

Sol. (A) S = {HH ,HT , TH , TT}

For at least two T's = {TT}

required probability = $\frac{1}{4}$

[redacted]

20. A child is chosen at random from a group containing of 4 girls and 6 boys. What is the probability of the child being a girl ?

(A) $\frac{1}{4}$ (B) $\frac{2}{3}$ (C) $\frac{2}{5}$ (D) $\frac{3}{4}$

Sol. (C) Total girls = 4

Total boys = 6

Total children = 10

required probability = $\frac{4}{10} = \frac{2}{5}$

21. Rose flowers of equal size are contained in a bag and of those 5 are red, 3 are white and 2 are yellow. If one is taken out from the bag at random, what is the probability of getting a red rose ?

(A) $\frac{1}{3}$ (B) $\frac{1}{5}$ (C) $\frac{3}{10}$ (D) $\frac{1}{2}$

Sol. Red = 5

White = 3

Yellow = 2

Total flowers = 10

required probability = $\frac{5}{10} = \frac{1}{2}$

22. If the coordinates of three vertices of an triangle are (0, 0), (1, 0) and (0, 1), then what is the area of the triangle in square unit ?

(A) 1 (B) $\frac{1}{2}$ (C) $\frac{1}{3}$ (D) $\frac{1}{4}$

Sol. (B) Area of $\Delta = \frac{1}{2}|x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$

$= \frac{1}{2}|0(0-1) + 1(1-0) + 0(0-0)|$

$= \frac{1}{2}|1| = \frac{1}{2}$

23. The distance between two points M and N is 5 units. If the ordered pair of M is (3, 1) and N lies in the y-axis. What is the ordered pair of N ?

(A) (4, 0) (B) (0, 4) (C) (5, 0) (D) (0, 5)

Sol. (D) Let co-ordinate of point N is (0 , y)

ATQ $\sqrt{(0-3)^2 + (y-1)^2} = 5^2$

$9 + (y - 1)^2 = 25$

$(y - 1)^2 = 16$

$y - 1 = \pm 4$

$y = 5$ or -3

Hence point (0 , 5)

[redacted]

24. The origin is the mid point of a line segment and (2, 3) is one of its end point, then which of the following represents the ordered pair of the other end point ?

(A) $\left(\frac{1}{2}, \frac{3}{2}\right)$ (B) (– 2, 3) (C) (2, – 3) (D) (–2, – 3)

Sol. (D) Let another ordered pairs is (x , y)

(a , 0) is mid point hence

$\frac{x+2}{2} = 0$ & $\frac{y+3}{2} = 0$

x = – 2 y = – 3

point is (– 2 , – 3)

25. The coordinates of two points A and b are (a, b) and (a, – b) respectively. What is the distance between them ?

(A) 2a (B) 2b (C) $\sqrt{a^2+b^2}$ (D) $2\sqrt{a^2+b^2}$

Sol. (B) distance = $\sqrt{(x_1-x_2)^2+(y_1-y_2)^2}$

= $\sqrt{(a-a)^2+(b-(-b))^2}$ = $\sqrt{4b^2}$ = 2b

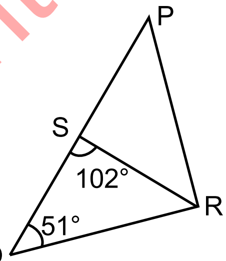
26. If the ratios of the areas of two equilateral triangles is 16 : 25, then what is the ratio of the lengths of the corresponding sides of the same two triangles ?

(A) 3 : 4 (B) 6 : 5 (C) 5 : 6 (D) 4 : 5

Sol. (D) $\frac{\text{Area of 1}^{st}\text{ triangle}}{\text{Area of 2}^{nd}\text{ triangle}} = \left(\frac{\text{side of 1}^{st}\text{ triangle}}{\text{side of 2}^{nd}\text{ triangle}}\right)^2$

ratio of sides of triangles = $\sqrt{\frac{16}{25}} = \frac{4}{5}$

27. In the given figure, m∠Q = 51°, m∠QSR = 102° and ΔSQR = ΔRQP. What is m∠PRS ?



(A) 65° (B) 70° (C) 75° (D) 80°

Sol. (C) Δ SQR ~ Δ RQP

∠ SQR = ∠ RQP = 51°

∠ QRS = ∠ QPR = 180° – (102 + 51°) = 27°

∠ RSQ = ∠ PRQ = 102°

Now ∠ PRS = ∠ PRQ – ∠ SRQ

= 102° – 27° = 75°

28. In ΔABC and ΔDEF if $m\angle A = m\angle D$. $m\angle B = m\angle E$. AB = 2 cm, BC = 3 cm and DE = 6 cm, then what is EF in cm ?

(A) 9 (B) 7 (C) 5 (D) 3

Sol. In ΔABC & ΔDEF

$\angle A = \angle D$

$\angle B = \angle E$

so by AA similarity

$\Delta ABC \sim \Delta DEF$

so $\frac{AB}{DE} = \frac{BC}{EF}$

$\frac{2}{6} = \frac{3}{EF}$

EF = 9 cm

29. In ΔDEF, DE = 3 cm, EF = 4 cm and in ΔPQR, PQ = 9 cm. If triangles ΔDEF and ΔPQR are similar, then what is QR in cm ?

(A) 13 (B) 14 (C) 12 (D) 16

Sol. (C) $\Delta DEF \sim \Delta PQD$

$\frac{DE}{PQ} = \frac{EF}{QR}$

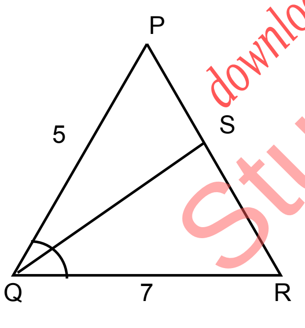
$\frac{3}{9} = \frac{4}{QR}$

QR = 12 cm

30. In ΔPQR, the bisector of $\angle PQR$ intersects PR at the point S. If PQ = 5 cm and QR = 7 cm, then what is PS : PR ?

(A) 5 : 12 (B) 12 : 5 (C) 8 : 12 (D) 12 : 8

Sol. (A)



by internal bisector theorem

$\frac{PQ}{QR} = \frac{PS}{SR}$

$\frac{5}{7} = \frac{PS}{SR}$ ——(1)

[redacted]

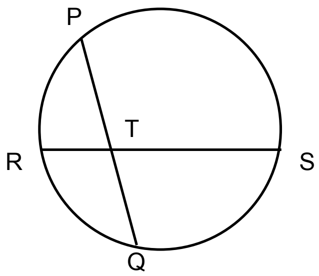
Now $\frac{PS}{PR} = \frac{PS}{PS + SR}$ from equ.(1)

$= \frac{PS}{PS + \frac{7}{5}PS} = \frac{5PS}{12PS} = \frac{5}{12}$

31. Two chords $\overline{PQ}$ and $\overline{RS}$ of a circle intersect each other at T. If RT = 4 cm, ST = 3 cm, QT = 6 cm, what is PT in cm ?

(A) 1 (B) 2 (C) 3 (D) 4

Sol. (B)

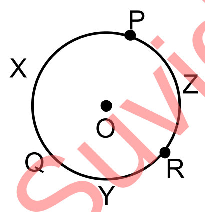


$\because$ RT × TS = TP × PQ

4 × 3 = PT × 6

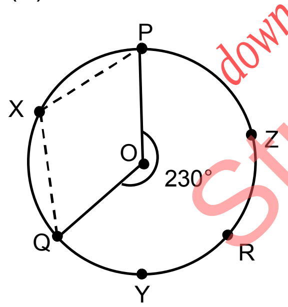
PT = 2 cm

32. In the given diagram 'O' is the centre the circle PQR. If $m\widehat{QRP}$ = 230°, how much is m∠PXQ ?



(A) 140° (B) 115° (C) 105° (D) 100°

Sol. (B)



$\angle P \times Q = \frac{1}{2} < \widehat{PRQ}$

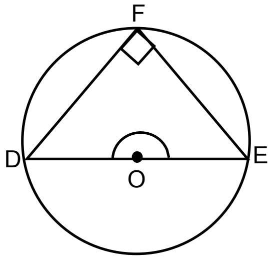
$= \frac{1}{2} \times 230° = 115°$

[redacted]

33. $\overline{DE}$ is a diameter in the circle DEF. How much is $m\overset{\frown}{DFE}$?

(A) 180° (B) 135° (C) 120° (D) 115°

Sol. (A)



DE is a diameter hevel

$\angle \overset{\frown}{DFE} = \angle DOE = 180°$

34. What is the relation between the degree unit and radian unit used for measuring an angle ?

(A) $\frac{\pi}{3}$ radian = 40° (B) $\frac{2\pi}{3}$ radian = 100°

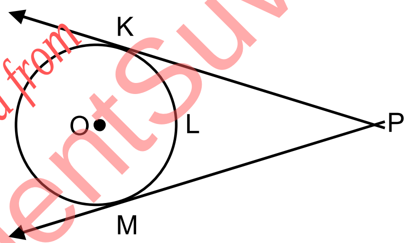
(C) $\frac{\pi}{2}$ radian = 90° (D) π radian = 120°

Sol. (C) in option (C)

$\frac{\pi}{2} \times \frac{180°}{\pi} = 90°$

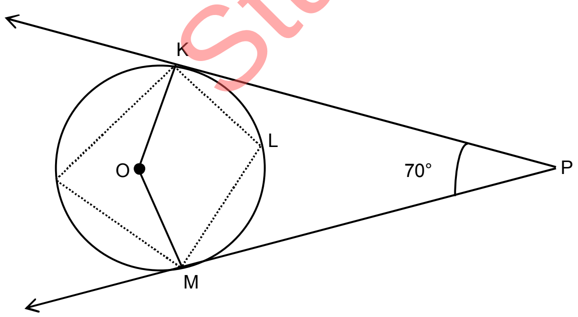
so option (C) is correct.

35. In the given diagram, O is the centre of the circle KLM and K, M are the points of contacts of the tangents drawn to the circle from P. If m∠KPM = 70°, what is $m\overset{\frown}{KLM}$ equal to ?



(A) 140° (B) 120° (C) 110° (D) 100°

Sol. (C)

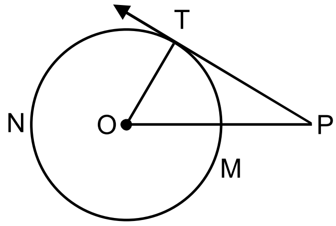


$\because \angle KOM + \angle KPM = 180°$

$\angle KOM = 180° - 70° = 110°$

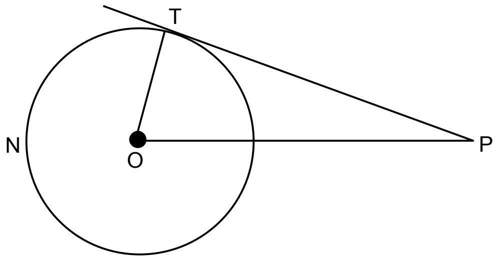
		[redacted]

36. In the given figure, 'O' is the centre of the circle NMT. $\overrightarrow{PT}$ is a tangent to the circle at T. If PT = 40 cm, OP = 41 cm, then what is the length of $\overrightarrow{OT}$ in cm ?



(A) 9 (B) 12 (C) 13 (D) 24.5

Sol. (A) Given : PT = 40 cm



OP = 41 cm

OT = ?

In Δ OTP

∠ OTP = 90°

$OT^2 + TP^2 = OP^2$

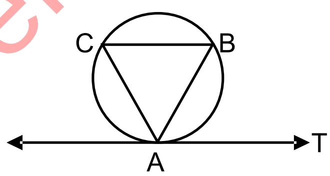
$\Rightarrow OT^2 + (40)^2 = (41)^2$

$\Rightarrow OT^2 = 41^2 - 40^2$

$OT^2 = 81$

OT = 9 cm

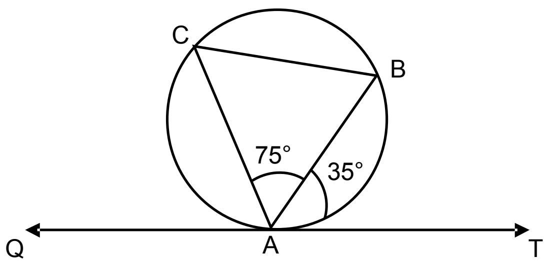
37. In the given figure $\overleftrightarrow{TA}$ is a tangent to the circle ABC at A. If m∠CAB = 75° and m∠TAB = 35°, then what is m∠ABC ?



(A) 55° (B) 60° (C) 70° (D) 50°

Sol. (C) Given : ∠ CAB = 75°

∠ TAB = 35°



[redacted]

$\angle$ CAQ + $\angle$ CAB + $\angle$ BAT = 180° (Linear pair)

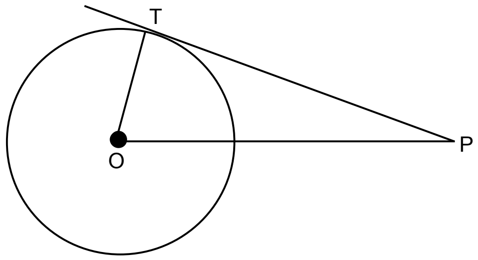
$\angle$ CAQ = 180° (75 + 35°) = 180° – 110° = 70°

$\angle$ CAQ = $\angle$ ABC = 70° (alternate interior angle segment theorem)

38. O is the centre of a circle and P is an exterior point in the plane of the circle. If $\overline{PT}$ is a tangent segment to the circle, then how much is m$\angle$TOP + m$\angle$TPO ?

(A) 30° (B) 45° (C) 60° (D) 90°

Sol. (D) $\because$ $\angle$ OTP = 90° (radius in perpendicular to tangent)



In $\angle$ OPT

$\angle$ OTP + $\angle$ TOP + $\angle$ TPO = 180° (Angle sum property)

$\because$ $\angle$ TOP + $\angle$ TPO = 180° – 90° = 90°

39. What is the number of direct common tangents of two internally tangent circles ?

(A) 4 (B) 2 (C) 1 (D) 3

Sol. (C) only one

40. The difference of the circumference of two concentric circles is 88 cm. What is the width of the concerned circular annulus ?

(A) 7 (B) 14 (D) 21 (D) 42

Sol. (B) Let the radii be r_1 & r_2 cm

then $2\pi r_1 - 2\pi r_2 = 28$

$2\pi (r_1 - r_2) = 88$

$r_1 - r_2 = \frac{88 \times 7}{2 \times 22} = 14$ cm

width = 14 cm

41. The area of a sector is $\frac{11}{20}$ th of the area of the corresponding circle, what is the degree measures of the arc of the sector ?

(A) 60° (B) 120° (D) 189° (D) 198°

Sol. (D) Let area of circle = πr^2

Area of sector = $\frac{\theta}{360}\pi r^2$

ATP

[redacted]

$$\frac{\theta}{360}\pi r^2 = \frac{11}{20}\pi r^2$$

$$\theta = \frac{360 \times 11}{20} = 18° \times 11 = 198°$$

42. The volume of a prism is $84\sqrt{3}$ cubic cm and the height of the prism is 7 cm. If the base of the prism is an equilateral triangle, then what is the length, in cm, of each side of its base ?

(A) $7\sqrt{3}$ (B) $6\sqrt{3}$ (C) $5\sqrt{3}$ (D) $4\sqrt{3}$

Sol. (D) Volume of prism = $84\sqrt{3}$ cm^3

height of prism = 7 cm

let side of base = a cm

Volume of prism = Area of triangular base × height

$$84\sqrt{3} = \frac{\sqrt{3}}{4} a^2 \times 7 \Rightarrow a = 4\sqrt{3}$$

43. What is the volume, in cubic cm, of a cone with 6 cm as radius of the base and 7 cm as height ?

(A) $\frac{240}{3}\pi$ (B) $\frac{250}{3}\pi$ (C) 84π (D) 87π

Sol. (C) Given radius of cone r = 6 cm

height h = 7 cm

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

$= \frac{1}{3} \times \pi \times 6 \times 6 \times 7$

$= \frac{1}{3} \times \pi \times 36 \times 7$

$= 84\pi$ cm^2

44. The inner radius and height of an open cylindrical vessel are $2\frac{1}{3}$ cm and 9 cm respectively. What is the greatest number of cubic cm of liquid it can hold ?

(A) 142 (B) 145 (C) 154 (D) 156

Sol. (C) Radius of cylinder = $2\frac{1}{3} = \frac{7}{3}$ cm

height of cylinder = 9 cm

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

$= \frac{22}{7} \times \frac{7}{3} \times \frac{7}{3} \times 9$

$= 154$ cm^3

45. What is the value of cos(A + B) + cos (A – B) ?

(A) 2 sin A cos B (B) 2 cos A sin B

(C) 2 cos A cos B (D) 2 sin A sin B.

Sol. (C) cos (A + B) + cos (A – B)

$\Rightarrow$ cosAcosB – sinAsinB + cosAcosB + sinAsinB

$\Rightarrow$ 2cosAcosB

46. Which of the following is equal to cot 80° × cot 70° × cot 60° × ....× cot10° ?

(A) 0 (B) 1 (C) $\sqrt{2}$ (D) $\sqrt{3}$

Sol. (B) cot80° × cot70° × cot60° ...× cot10°

cot80° × cot(90 – 80) × cot(70) cot (90 – 70)

cot80° × tan80° × cot70°tan70° × cot60°tan60° × cot50° × tan50°

$\because$ cotθ × tanθ = 1

= 1

47. In ΔLMN, sin (L + M) = 1. What is m∠N equal to ?

(A) 60° (B) 90° (C) 120° (D) 135°

Sol. (B) sin(L + M) = 1

sin(L + M) = sin90°

$\Rightarrow$ L + M = 90°

by angle sum property ∠ N = 180– 90° = 90°

48. If cot θ = $\frac{p}{q}$, then what is the value of $\text{cosec}^2\theta$?

(A) $\frac{p^2-q^2}{q^2}$ (B) $\frac{p^2+q^2}{q^2}$ (C) $\frac{q^2}{p^2-q^2}$ (D) $\frac{q^2}{p^2+q^2}$

Sol. (B) cotθ = $\frac{p}{q}$

$\because 1 + \cot^2\theta = \text{cosec}^2\theta$

$1 + \frac{p^2}{q^2} = \text{cosec}^2\theta$

$\Rightarrow \text{cosec}^2\theta = \frac{p^2+q^2}{q^2}$

49. If A + B + C = 90°, the what is the value of cos (A + C) ?

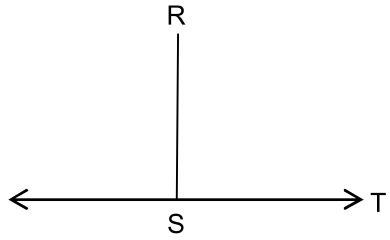
(A) – cos B (B) cos B (C) – sin B (D) sin B

Sol. (D) Given A + B + C = 90°

cos (A + C) $\Rightarrow$ cos (90 – B) {$\because$ cos (90 – θ) = sinθ}

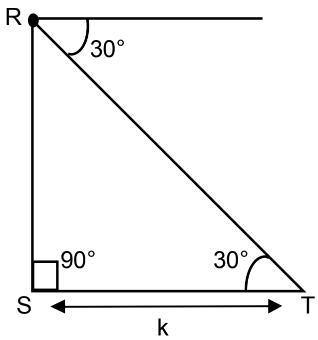
$\Rightarrow$ sinB

50. In the given diagram $\overline{RS} \perp \overleftrightarrow{ST}$ $\cdot\overleftrightarrow{ST}$ represents a horizontal plane and $\overline{RS}$ represents a pole. If the distance of T from S is K metre and a man at R sees the point T at an angle of depression of 30°, then what is the length of the pole $\overline{RS}$ in metre ?



(A) $\sqrt{3}$ K (B) $\frac{K}{\sqrt{3}}$ (C) $\sqrt{2}$ K (D) $\frac{K}{\sqrt{2}}$

Sol. In Δ RST



$$\tan 30° = \frac{RS}{ST}$$

$$\frac{1}{\sqrt{3}} = \frac{RS}{k}$$

$$\Rightarrow RS = \frac{k}{\sqrt{3}}$$

[redacted]