Padasalai's Telegram Groups!

(தலைப்பிற்கு கீழே உள்ள லிங்கை கிளிக் செய்து குழுவில் இணையவும்!)

- Padasalai's NEWS - Group
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I – 75% EXAM – 2019

MATHS

Std : XI Marks : 90

Date: 04.11.2019 Time : 2½ hrs

I. Choose the correct answer: (20 x 1 = 20)

1. Let A and B be subsets of the universal set N, the set of natural numbers. Then $A' \cup [(A \cap B) \cup B']$ is
   a) A b) A' c) B d) N
2. If two sets A and B have 17 elements in common, then the number of elements common to the set $A \times B$ and $B \times A$ is
   a) 2^{17} b) 17^2 c) 34 d) insufficient data
3. The solution set of the following inequality $|x-1| \geq |x-3|$ is
   a) [0, 2] b) [2, ∞) c) (0, 2) d) (-∞, 2)
4. The number of solutions of $x^2 + |x-1| = 1$ is
   a) 1 b) 0 c) 2 d) 3
5. $\cos 1° + \cos 2° + \cos 3° + \cdots + \cos 179° =$
   a) 0 b) 1 c) -1 d) 89
6. A wheel is spinning at 2 radians/second. How many seconds will it take to make 10 complete rotations?
   a) 10 π seconds b) 20 π seconds c) 5 π seconds d) 15 π seconds
7. The number of 5 digit numbers all digits of which are odd is
   a) 25 b) 5^5 c) 5^6 d) 625
8. Number of sides of a polygon having 44 diagonals is ……
   a) 4 b) 4! c) 11 d) 22
9. The remainder when 38^{15} is divided by 13 is
   a) 12 b) 1 c) 11 d) 5
10. The coefficient of x^5 in the series e^{-2x} is
    a) $\frac{2}{3}$ b) $\frac{3}{2}$ c) $\frac{-4}{15}$ d) $\frac{4}{15}$
11. Equation of the straight line that forms an isosceles triangle with coordinate axes in the I-quadrant with perimeter $4 + 2\sqrt{2}$ is
    a) $x + y + 2 = 0$ b) $x + y - 2 = 0$ c) $x + y - \sqrt{2} = 0$ d) $x + y + \sqrt{2} = 0$
12. The image of the point (2,3) in the line $y = -x$ is
    a) (-3, -2) b) (-3, 2) c) (-2-3) d) (3,2)
13. What must be the matrix X, if $2X + \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} 3 & 8 \\ 7 & 2 \end{bmatrix}$?
    a) $\begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$ b) $\begin{bmatrix} 1 & -3 \\ 2 & -1 \end{bmatrix}$ c) $\begin{bmatrix} 2 & 6 \\ 4 & -2 \end{bmatrix}$ d) $\begin{bmatrix} 2 & -6 \\ 4 & -2 \end{bmatrix}$
14. If $A = \begin{bmatrix} a & x \\ y & a \end{bmatrix}$ and if $xy = 1$, then det $(A A^T)$ is equal to
    a) $(a-1)^2$ b) $(a^2+1)^2$ c) $a^2 - 1$ d) $(a^2-1)^2$
15. If $\vec{a} + \vec{2b}$ and $\vec{3a} + \vec{mb}$ are parallel, then the value of m is
    a) 3 b) $\frac{1}{3}$ c) 6 d) $\frac{1}{6}$

16. The true statements of the following are
    i) Every unit matrix is a scalar matrix but a scalar matrix need not be a unit matrix
    ii) Every scalar matrix is a diagonal matrix but a diagonal matrix need not be a scalar matrix
    iii) Every diagonal matrix is a square matrix but a square matrix need not be a diagonal matrix
    a) (i) (ii) (iii) b) (i) and (ii) c) (ii) and (iii) d) (i) (iii) and (i)
17. If G is the centroid of a triangle ABC and O is any other point then $\overrightarrow{OA} + \overrightarrow{OB} + \overrightarrow{OC}$ is equal to
    a) $\vec{O}$ b) $\overrightarrow{OG}$ c) 3 $\overrightarrow{OG}$ d) 4 $\overrightarrow{OG}$
18. Which of the following is a function which is not one-to-one?
    a) $f: R \to R; f(x) = x + 1$ b) $f: R \to R; f(x) = x^2 + 1$
    c) $f: R \to \{1, -1\}; f(x) = x - 1$ d) $f: R \to R; f(x) = -x$
19 The value of $\frac{\tan 70° - \tan 20°}{\tan 50°} =$
    a) 1 b) 2 c) 3 d) 0
20. Which of the given values of x and y make the following pair of matrices equal
    $\begin{bmatrix} 3x+7 & 5 \\ y+1 & 2-3x \end{bmatrix} = \begin{bmatrix} 0 & y-2 \\ 8 & 4 \end{bmatrix}$
    a) $x = \frac{-1}{3}, y = 7$ b) not possible c) $y = 7, x = \frac{-2}{3}$ d)) $x = \frac{-1}{3}, y = \frac{-2}{3}$

II. Answer any seven questions: (Question No. 30 is compulsory) (7 x 2 = 14)

21. Find the number of subsets of A if $A = \{x: x = 4n + 1, 2 \leq n \leq 5, n \in N\}$.
22. A girl A is reading a book having 446 pages and she has already finished reading 271 pages. She wants to finish reading this book within a week. What is the maximum number of pages she should read per day to complete reading the book within a week?
23. A food ball player can kick a football from ground level with an initial velocity if 80 ft /second. Find the maximum horizontal distance the foot ball travels and at what angle? (Take g = 32).
24. How many strings can be formed using the letters of the word LOTUS if the word.
    i) either starts with L or ends with S?
    ii) neither starts with L nor ends with S?
25. Find the middle term in the expansion of $(x + y)^6$.
26. Find the equation of the line, if the perpendicular drawn from the origin makes an angle 30° with x-axis and its length is 12.
27. Find the domain and range of the real function f defined by $f(x) = \sqrt{x - 1}$.
28. Solve for x if $\begin{bmatrix} x & 2 & -1 \end{bmatrix} \begin{bmatrix} 1 & 1 & 2 \\ -1 & -4 & 1 \\ -1 & -1 & -2 \end{bmatrix} \begin{bmatrix} x \\ 2 \\ 1 \end{bmatrix} = 0$.
29. Prove that the line segment joining the midpoints of two sides of a triangle is parallel to the third side whose length is half of the length of the third side.
30. Prove that : $\sin(n+1)x \sin(n+2)x + \cos(n+1)x \cos(n+2)x = \cos x$.

III. Answer any seven questions: (Question No. 40 is compulsory) (7 x 3 = 21)

31. In the set Z of integers, define mRn if m-n is divisible by 7. Prove that R is an equivalence relation.
32. Resolve into Partial fractions: $\frac{x}{(x+3)(x-4)}$.
33. Prove that: Projection formula $a = b\cos C + c\cos B$.
34. Prove that $n p_r = n-1\, p_r + r \times n-1\, p_{r-1}$.
35. Compare the sum of first n terms: $6 + 66 + 666 + \cdots$
36. Find the equation of the locus of the point such that the sum of the squares of the distance from the points (3, 5) , (1, -1) is equal to 20.
37. Find the value of $\begin{vmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 1 & \log_y z \\ \log_z x & \log_z y & 1 \end{vmatrix}$, If $x, y, z \neq 1$.
38. Solve $\begin{vmatrix} 4-x & 4+x & 4+x \\ 4+x & 4-x & 4+x \\ 4+x & 4+x & 4-x \end{vmatrix} = 0$.

39. If ABCD is a quadrilateral and E and F are the midpoints of AC and BD respectively, then Prove that $\overrightarrow{AB} + \overrightarrow{AD} + \overrightarrow{CB} + \overrightarrow{CD} = 4\,\overrightarrow{EF}$.

40. In how many ways can the letters of the word 'ASSASSINATION' be arranged so that all S's are together?

IV. Answer all the questions: **(7 x 5 = 35)**

41. a) Find the range of the function $f(x) = \frac{1}{1-3\cos x}$. **(OR)**

b) A quadrilateral is a Parallelogram if and only if its diagonals bisect each other.

42. a) Simplify : $\frac{1}{3-\sqrt{8}} - \frac{1}{\sqrt{8}-\sqrt{7}} + \frac{1}{\sqrt{7}-\sqrt{6}} - \frac{1}{\sqrt{6}-\sqrt{5}} + \frac{1}{\sqrt{5}-2}$.

(OR)

b) A manufacturer has 600 litres of a 12 percent solution of acid. How many litres of a 30 percent acid solution must be added to it so that the acid content in the resulting mixtures will be more than 15 percent but less than 18 percent?

43. a) If $\theta + \varphi = \alpha$, and $\tan\theta = k\,\tan\varphi$, then prove that $\sin(\theta - \varphi) = \frac{k-1}{k+1}\sin\alpha$.

(OR)

b) A man starts his morning walk at a point A reaches two points B and C and finally back to A such that $\angle A = 60°$ and $\angle B = 45°$, $AC = 4\,km$ in the ΔABC. Find the total distance he covered during his morning walk.

44. a) Find the number of strings of 5 letters that can be formed with the letters of the word PROPOSITION. **(OR)**

b) Use induction to prove that $5^{n+1} + 4 \times 6^n$ when divided by 20 leaves a remainder 9, for all natural numbers n.

45. a) In a race, 20 balls are placed in a line at intervals of 4 meters, with the first ball 24 meters away from the starting point. A contestant is required to bring the balls back to the starting place one at a time. How far would the contestant run to bring back all balls? **(OR)**

b) If p-q is small compared to either p or q. Then show that $\sqrt[n]{\frac{p}{q}} \simeq \frac{(n+1)p+(n-1)q}{(n-1)p+(n+1)q}$.

Hence find $\sqrt[8]{\frac{15}{16}}$.

46. a) In a shopping mall there is a hall of Cuboid shape with dimension $800 \times 800 \times 720$ units, which needs to be added the facility of an escalator in the path as shown by the dotted line in the figure.

Find i) the minimum total length of the escalator.
ii) the heights at which the escalator changes its direction.
iii) the slopes of the escalator at the turning points.

(OR)

b) The slope of one of the straight lines $ax^2 + 2hxy + by^2 = 0$ is twice that of the other, Show that $8h^2 = 9ab$.

47. a) If a, b, c are all positive, and are p^{th}, q^{th} and r^{th} terms of a G.P.

Show that $\begin{vmatrix} \log a & p & 1 \\ \log b & q & 1 \\ \log c & r & 1 \end{vmatrix} = 0$.

(OR)

b) Prove that $\begin{vmatrix} 1 & x & x \\ x & 1 & x \\ x & x & 1 \end{vmatrix}^2 = \begin{vmatrix} 1-2x^2 & -x^2 & -x^2 \\ -x^2 & -1 & x^2-2x \\ -x^2 & x^2-2x & -1 \end{vmatrix}$

XI - Maths - 75 %. Answer - key

21) $A = \{9, 13, 17, 21\} \Rightarrow n(A) = 4$

WKT $n[P(A)] = 2^{n(A)}$
$= 2^4$
$= 16$

22) $271 + 7x \geq 446$
$7x \geq 446 - 271 \geq 175$
$x \geq 25$

23) $u = 80$ ft/sec, $g = 32$
$R = \frac{u^2 \sin 2\theta}{g}$
$= \frac{80 \times 80 \times \sin 2\theta}{32}$
$= 200 \times \sin 2\theta$
$= 200 \times \sin 2(45^\circ)$
$= 200 \times \sin 90^\circ$
If R is 200 then,
$\theta = 45^\circ$

24) i) | L | 4 | 3 | 2 | 1 | $= 4\times3\times2\times1 = 24$
ii) | 4 | 3 | 2 | 1 | S | $= 4\times3\times2\times1 = 24$
iii) | L | 3 | 2 | 1 | S | $= 3\times2\times1 = 6$
The letter either starts with 'L' or ends with 'S' $= 24 + 24 - 6 = 42$
(iv) Neither with 'L' nor ends with 'S' $= 5\times4\times3\times2\times1 - 42 = 78$

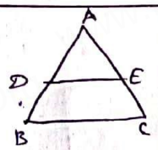
25) $(x+y)^6 \Rightarrow a = x, b = y, n = 6$
WKT $T_{\frac{n}{2}+1} = {}^nC_{\frac{n}{2}}\, a^{n-\frac{n}{2}}\, b^{\frac{n}{2}}$
$T_{\frac{6}{2}+1} = 6C_{\frac{6}{2}}\, x^{6-\frac{6}{2}}\, y^{\frac{6}{2}}$
$= 6C_3\, x^3 y^3 = 20x^3y^3$ (middle term)

26) $\theta = 30^\circ$, $p = 12$
WKT $x\cos\theta + y\sin\theta = p$
$\frac{\sqrt{3}}{2}x + \frac{y}{2} = 12$
$\times 2$ $\sqrt{3}x + y = 24$

27) put $\sqrt{x-1} = 0$
$x - 1 = 0$
$x = \pm 1$
$x < -1$ - Img
$x > 1$ - Real value
$x > -1$ - Real v
$x < 1$ - Imaginary
$\therefore$ Range $= (0, \infty)$
Domain $= (-\infty, \infty)$

28) $x^2 + 3x - 6 = 0$
$(x+5)(x-2) = 0$
$\therefore x = -5, 2$

29) $\vec{DE} = \vec{OE} - \vec{OD} = \frac{\vec{a}+\vec{c}}{2} - \frac{\vec{a}+\vec{b}}{2}$
$= \frac{\vec{c}+\vec{b}}{2} = \frac{\vec{a}+\vec{OB}}{2}$
$|\vec{DE}| = \frac{1}{2}|\vec{BC}| \Rightarrow DE = \frac{1}{2}BC \Rightarrow DE \parallel BC$



31) mRn if m-n is ÷ by 7
i) Ref mRn
$m = m$, $m - m = 0$
$\frac{m-n}{7} = 0/7 \rightarrow (1)$
$\therefore$ mRm is ÷ by 7 ⇒ It is Ref
ii) Sym: mRn & nRm
$\frac{m-n}{7} = k \Rightarrow \frac{n-m}{7} = -k$ ÷ by 7
Hence, sym.
iii) Trans
mRn, nRp
mRp
$m - n = 7k \rightarrow (1)$
$n - p = 7l \rightarrow (2)$
(1)+(2) ⇒ $m - p = 7(k+l)$ ÷ by 7
$\therefore$ It is transitive
From (1), (2), (3) → equivalence Relation

32) $\frac{x}{(x+3)(x-4)} = \frac{A}{x+3} + \frac{B}{x-4} \rightarrow (1)$
$\Rightarrow x = A(x-4) + B(x+3)$
Put $x = 4 \Rightarrow B = 4/7$
Put $x = -3 \Rightarrow A = 3/7$
(1) ⇒ $\frac{x}{(x+3)(x-4)} = \frac{3}{7(x+3)} + \frac{4}{7(x-4)}$

33) $a = b\cos C + c\cos B$

R.H.S $= b\cos C + c\cos B$
from law of sines $= 2R\sin B \cdot \cos C + 2R\sin C \cdot \cos B$
$= 2R\sin(B+C)$
$= 2R\sin(180 - A)$
$= 2R\sin A = a \rightarrow (1)$
From law of cosines:
R.H.S $= b\cos C + c\cos B$
$= b\left(\frac{a^2+b^2-c^2}{2ab}\right) + c\left(\frac{a^2+c^2-b^2}{2ac}\right)$
$= \frac{a^2+b^2-c^2}{2a} + \frac{a^2+c^2-b^2}{2a}$
$= a \rightarrow (2)$
from (1), (2) $a = b\cos C + c\cos B$

34) ${}^nP_r = (n-1)P_r + r \times (n-1)P_{r-1}$
R.H.S $= (n-1)P_r + r \times (n-1)P_{r-1}$
$= \frac{(n-1)!}{(n-1-r)!} + r\frac{(n-1)!}{[(n-1)-(r-1)]!}$
$= \frac{(n-1)!}{(n-r-1)!} + r\frac{(n-1)!}{(n-r)!}$
$= \frac{(n-1)!(n-r) + r(n-1)!}{(n-r)(n-r-1)!}$
$= \frac{(n-1)!\,[n-r+r]}{(n-r)(n-r-1)!} = \frac{(n-1)!\,n}{(n-r)!}$
$= \frac{n!}{(n-r)!} = {}^nP_r$ = R.H.S
H.P

35) $S_n = 6 + 66 + 666 + \dots = 6[1 + 11 + 111 + \dots]$
$= \frac{6}{9}[9 + 99 + 999 + \dots]$
$= \frac{6}{9}[(10-1) + (10^2-1) + \dots]$
$= \frac{6}{9}[(10 + 10^2 + 10^3 + \dots) - n]$
$= \frac{6}{9}\left[\frac{10(10^n-1)}{10-1} - n\right]$
$= \frac{60}{81}(10^n - 1) - \frac{6}{9}n$
$= \frac{20}{27}(10^n-1) - \frac{2}{3}n$

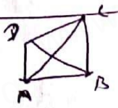
(In G.P: if $r > 1$, $S_n = \frac{a(r^n-1)}{r-1}$)

36) $P(h,k)$, $A(3,5)$, $B(1,-1)$
Given, $PA^2 + PB^2 = 20$
$\therefore x^2 + y^2 - 4x - 4y + 8 = 0$ (18)

37) $1[1 - \log_z y \cdot \log_y z] - \log_x y[\log_y x - \log_z x \cdot \log_y z] + \log_x z[\log_y x \cdot \log_z y - \log_z x]$
$= 1 - \log_z y \cdot \log_y z - \log_x y \cdot \log_y x + \log_x y \cdot \log_z x \cdot \log_y z + \log_x z \cdot \log_y x \cdot \log_z y - \log_x z \cdot \log_z x$
$= (1-1) - \log_y y - \log_y y + \log_z z + \log_x x = 0 - 1 - 1 + 1 + 1 = 0$

38) Put $x = 0 \Rightarrow x^2$ is a factor [$\because R_1 \equiv R_2 \equiv R_3$]
$C_1 \rightarrow C_1 + C_2 + C_3$
put $x = -12 \Rightarrow (x+12)$ is a factor [$\because C_1 = 0$]
$\therefore$ $x = 0, 0, -12$

39) $\vec{AB} + \vec{AD} + \vec{CB} + \vec{CD}$



L.H.S $= \vec{OB} - \vec{OA} + \vec{OD} - \vec{OA} + \vec{OB} - \vec{OC} + \vec{OD} - \vec{OC}$
$= 2\vec{b} + 2\vec{d} - 2\vec{a} - 2\vec{c}$
$= 2(\vec{b} + \vec{d}) - 2(\vec{a} + \vec{c})$
$= 2(2\vec{OF}) - 2(2\vec{OE})$
$= 4(\vec{OF} - \vec{OE}) = 4\vec{EF}$
[$\because \vec{OE} = \frac{\vec{a}+\vec{c}}{2}$, $\vec{OF} = \frac{\vec{b}+\vec{d}}{2}$]

30) $\sin(n+1)x \cdot \sin(n+2)x + \cos(n+1)x \cdot \cos(n+2)x$

$= \cos(nx+x)\cdot\cos(nx+2x) + \sin(nx+x)\cdot\sin(nx+2x)$

$= \cos(nx+x-nx-2x)$ [$\because \cos(A-B) =$]

$= \cos(-x)$

$= \cos x$.

40) (3SSS), A, A, I, N, A, TT, O, N

No. of ways $= \frac{10!}{3! \times 2! \times 2!}$

$= 1,51,200$

41) a $-1 \le \cos x \le 1$

×3) $-3 \le 3\cos x \le 3$

$3 \ge -3\cos x \ge -3$

$-3 \le -3\cos x \le 3$

$1-3 \le 1-3\cos x \le 1+3$

$-2 \le 1-3\cos x \le 4$

$-\frac{1}{2} \ge \frac{1}{1-3\cos x} \ge \frac{1}{4}$

$\therefore$ Range: $(-\infty, -\frac{1}{2}] \cup [\frac{1}{4}, \infty)$

b AB ∥ DC

$\vec{AB} \parallel \vec{DC}$ & $\vec{AB} = \vec{DC}$

$\vec{OB}-\vec{OA} = \vec{OC}-\vec{OD}$

$\vec{b}-\vec{a} = \vec{c}-\vec{d}$

$\vec{b}+\vec{d} = \vec{c}+\vec{a}$

$\frac{\vec{b}+\vec{d}}{2} = \frac{\vec{c}+\vec{a}}{2}$

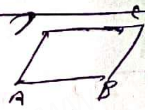
$\frac{\vec{b}+\vec{d}}{2} = \frac{\vec{c}+\vec{a}}{2}$

$\vec{b}+\vec{d} = \vec{c}+\vec{a}$

$\vec{b}-\vec{a} = \vec{c}-\vec{d}$

$\vec{OB}-\vec{OA} = \vec{OC}-\vec{OD}$

$\vec{AB} = \vec{DC} \Rightarrow AB \parallel DC$.



42) a $\frac{1}{3-\sqrt{8}} = 3+\sqrt{8} \to ①$

$\frac{1}{\sqrt{8}-\sqrt{7}} = \sqrt{8}+\sqrt{7} \to ②$

$\frac{1}{\sqrt{7}-\sqrt{6}} = \sqrt{7}+\sqrt{6} \to ③$

$\frac{1}{\sqrt{6}-\sqrt{5}} = \sqrt{6}+\sqrt{5} \to ④$

$\frac{1}{\sqrt{5}-2} = \sqrt{5}+2 \to ⑤$

① − ② + ③ − ④ + ⑤ ⇒

L.H.S $= 3+2$

$= 5$

$\therefore$ L.H.S = R.H.S

b $\frac{(600+x)15}{100} < 72 + \frac{30x}{100}$

$(600+x)15 < 7200+30x$

$9000+15x < 7200+30x$

$1800 < 15x$

$x > 120$

$\frac{(600+x)18}{100} > 72 + \frac{30x}{100}$

$10800+18x > 7200+30x$

$3600 > 12x$

$\therefore x < 300$

$\therefore 120 < x < 300$

43) a $\theta + \phi = \alpha$

$\tan\theta = k\tan\phi$

$\Rightarrow k = \frac{\tan\theta}{\tan\phi}$

$\frac{k-1}{k+1} = \frac{\tan\theta/\tan\phi - 1}{\tan\theta/\tan\phi + 1}$

$= \frac{\tan\theta - \tan\phi}{\tan\theta + \tan\phi}$

$= \frac{\sin\theta\cos\phi - \sin\phi\cos\theta}{\sin\theta\cos\phi + \sin\phi\cos\theta}$

$= \frac{\sin(\theta-\phi)}{\sin(\theta+\phi)} = \frac{\sin(\theta-\phi)}{\sin\alpha}$

$\Rightarrow \sin(\theta-\phi) = \frac{k-1}{k+1}\sin\alpha$

b $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$BC = 2\sqrt{6}$

$AB = 2\sqrt{3}+2$

$AC = 4\sqrt{2}$

Total distance

$= 2\sqrt{6}+2\sqrt{3}+2+4\sqrt{2}$ km.

44) a R, A, N, P, I, O ⇒ $7C_5 \Rightarrow 7C_5 \times 5! = 2520$

3 alike (O, O, O), 2 alike (P, I, I) ⇒ $1C_1 \times 2C_1 \Rightarrow \frac{1C_1 \times 2C_1 \times 5!}{3! \times 2!} = 10$

2 alike (R, A, N, P, I), (P, I, I) $= 3C_1 \times 6C_3$

3 alike (O, O, O), (R, A, N, P, I) ⇒ $1C_1 \times 6C_2 \Rightarrow \frac{1C_1 \times 6C_2 \times 5!}{3!} = 300$

$= 3C_1 \times 6C_3 \times \frac{5!}{2!} = 3600$

2 alike (P, I, O), (R, A, N) ⇒ $3C_2 \times 5C_1 \Rightarrow \frac{3C_2 \times 5C_1 \times 5!}{2! \times 2!} = 450$

Total $= 6880$

b $P(1) = 49$ it is true

$P(k) = 5^{2k+1} + 4 \times 6^k$

$\Rightarrow 5^{2k+1} = 20\lambda + 9 - 4 \times 6^k$

$P(k+1) = 20[5\lambda + 2] + 5 + 4 \times 6^k$

$= 20[5\lambda + 2 + (k+1)] + 9$

$P(k+1) = 20[5\lambda + 6k + 1] + 9$

$= 20[5\lambda + (k+1)] + 9$

$= 20[5\lambda + k + 1] + 9$

$5 + 4 \times 6^k = 20[(k+1)] + 9$ ∴ It is divided by 20 leaving a rem 9

45) a $\frac{p-q}{p+q} = x$

$p(1-x) = q(1+x)$

$\frac{1-x}{1+x} = \frac{q}{p} \Rightarrow \frac{1+x}{1-x} = \frac{p}{q}$

$\left(\frac{p}{q}\right)^{1/n} = \left[\frac{1+x}{1-x}\right]^{1/n} = \frac{1+\frac{1}{n}x+\cdots}{1-\frac{1}{n}x+\cdots}$

$= \frac{1+\frac{x}{n}}{1-\frac{x}{n}} = \frac{n+x}{n-x}$

$= \frac{n + \frac{p-q}{p+q}}{n - \frac{p-q}{p+q}} = \frac{(n+1)p + (n-1)q}{(n-1)p + (n+1)q}$

$p = 15$, $q = 16$, $n = 8$

$= \frac{9(15)+7(16)}{7(15)+9(16)} = \frac{247}{249}$

b 2(24), 2(2), 2(3), … 20 times. Hip.

It is an A.P $d = 2(4)$

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

$S_{20} = \frac{20}{2}[2(48)+19(8)]$

$= 10(96+152)$

$= 10(248)$

$= 2480$ m

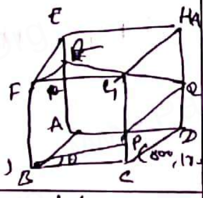
46) a

BR = 820

i) Total min. length $= 820 \times 4 = 3280$

ii) The height at each turn $= 180, 360, 540$

iii) The slope $= \frac{y_2-y_1}{x_2-x_1} = \frac{9}{40}$



b $ax^2+2hxy+by^2=0$

$m_1 = 2m_2$

$m_1+m_2 = -\frac{2h}{b}$

$m_1+2m_1 = -\frac{2h}{b}$

$3m_1 = -\frac{2h}{b} \Rightarrow m_1 = \frac{-2h}{3b}$

$m_1 \times m_2 = \frac{a}{b}$

$m_1(2m_1) = \frac{a}{b}$

$2m_1^2 = \frac{a}{b} \Rightarrow m_1^2 = \frac{a}{2b}$

$\frac{4h^2}{9b^2} = \frac{a}{2b} \Rightarrow 9ab = 8h^2$

47) a $t_p \Rightarrow AR^{p-1} = a$

$t_q = AR^{q-1} = b$

$t_r = AR^{r-1} = c$

$\Rightarrow \log a = (p-1)\log AR$

$\log b = (q-1)\log AR$

$\log c = (r-1)\log AR$

$\begin{vmatrix} \log a & p & 1 \\ \log b & q & 1 \\ \log c & r & 1 \end{vmatrix}$

$= 0$ [$C_1 \equiv C_3$]

b L.H.S $= \begin{vmatrix} 1 & x & x \\ x & 1 & x \\ x & x & 1 \end{vmatrix} \times \begin{vmatrix} 1 & x & x \\ -x & -1 & -x \\ -x & -x & -1 \end{vmatrix}$

In 2nd Δ ×R_2, R_3 by (−) using R×C multip. rule.

$\therefore$ L.H.S $= \begin{vmatrix} 1-2x^2 & -x^2 & -x^2 \\ -x^2 & -1 & x^2-2x \\ -x^2 & x^2-2x & -1 \end{vmatrix} = $ R.H.S

1 Marks key

(1) d b b c a | a b c a c

(11) b a a d c | a c b b b

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