Plus One Higher Secondary Examination 2021

Mathematics

Answer key

Prepared by

Academic Council

*M*athematics *A*ssociation *K*ollam

1. **(i)** A = {1,2,3,4,5 }

(ii) A∩B = {1,2 }

(iii) A-B = { 3,4,5 }

2. t_1 = 105 , t_n = 995 , d = 5

n= $\frac{t_{n-t_1}}{d}$ + 1 = $\frac{995-105}{5}$ + 1 = 179

S_n = $\frac{n}{2}$(a+ t_n) = $\frac{179}{2}$(105 + 995) = 98450

3. $(2x + 3)^5$

= $5C_0 (2x)^5 + 5C_1(2x)^4.3 + 5C_2 (2x)^3 . 3^2 + 5C_3(2x)^2 . 3^3 + 5C_4 (2x) .3^4 + 5C_5 . 3^5$

$=32x^5 + 240x^4 + 720x^3 + 1080x^2 + 810x + 243$

4. LHL = $\lim_{x\to 0^-} 2x + 3$ = 2 .0 + 3 = 3

RHL = $\lim_{x\to 0^+} 3(x + 1)$ = 3(0+1) = 3

Since LHL = RHL , $\lim_{x\to 0}\begin{cases}2x + 3) \, ; x \le 0 \\ 3(x + 1); x \ge 0\end{cases}$ = 3

5. n(H) = 250 , n(E) = 200 , n(H∪E) = 400

No. people who speak Hindi and English = n (H∩E)

n(H∪E) = n(H) + n(E) – n (H∩E)

400 = 250 + 200 - n (H∩E)

n (H∩E) = 250 + 200 – 400 = 50

6. Given line is $2x + 3y - 6 = 0$

$A = 2, B = 3, C = -6$

Slope = $\frac{-A}{B} = \frac{-2}{3}$

y- intercept = $\frac{-C}{B} = 2$

7. Given Parabola is $y^2 = 12x$

$4a = 12$, $a = 3$

(i)Focus = $(a, 0) = (3, 0)$

(ii)Equation of Directrix is $x = -a$ or $x = -3$ or $x + 3 = 0$

(iii)Length of latus rectum = $4a = 12$

8. **(i)** YZ Plane

(ii) Distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2}$

$= \sqrt{(2 - (-3))^2 + (4 - 7)^2 + (-1 - 2)^2}$

$= \sqrt{25 + 9 + 9} = \sqrt{43}$

9. P(n) : $7^n - 3^n$ is divisible by 4

P(1): $7^1 - 3^1$ is divisible by 4

4 is divisible by 4

P(1) is true

P(k) : $7^k - 3^k$ is divisible by 4

Assume that P(k) is true

$7^k - 3^k = 4m$

$7^k = 4m+3^k$

P(k+1): $7^{k+1}-3^{k+1}$ is divisible by 4

We have to prove that p(k+1) is true

$7^{k+1}-3^{k+1} = 7^k.7^1 - 3^k.3^1$

$= 7(4m+3^k) - 3.3^k$

$= 28m + 7.3^k - 3.3^k$

$= 28m+ 4. 3^k$

$= 4(7m+ 3^k)$

$7^{k+1}-3^{k+1}$ is divisible by 4

P(k+1) is true.

Hence by P.M.I then result is true for all natural number n

10.(i) General Term $T_{r+1} = nC_r\ a^{n-r} b^r$

$= 12\ C_r\ x^{12-r} (-2y)^r$

(ii) Put r =3 , 4^{th} Term , $T_4 = 12C_3\ x^{12-3} (-2y)^3 = -1760\ x^9 y^3$

11. Let the ratio be k:1

The Z co-ordinate of XY plane =0

$$\frac{k(-8)+1(10)}{k+1} = 0$$

8k=10

$K=\frac{5}{4}$

Ratio=5:4

12. **(i)** It is false that every natural number is greater than zero

(ii) Converse : If a number n is even, then n^2 is even

Contra positive: If a number n is not even, then n^2 is not even

13. **(i)** 8

(ii) {1,2}, {2,3},{1,3}

(iii) $A' = \{4,5,6\}$

14. **(i)** x+1 = 3

x = 2

y-2 = 1

y = 3

(ii) $A \times B = \{(1,3),(1,4),(2,3),(2,4),(3,3),(3,4)\}$

15. **(i)** $\sin x = -\frac{\sqrt{3}}{2}$

$\tan x = \sqrt{3}$

(ii) $\sin^2\frac{\pi}{6} + \cos^2\frac{\pi}{3} = (\frac{1}{2})^2 + (\frac{1}{2})^2 = \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$

16. $1 + 3 + 3^2 + \ldots + 3^{n-1} = \frac{3^n - 1}{2}$

$P(n) : 1 + 3 + 3^2 + \ldots + 3^{n-1} = \frac{3^n - 1}{2}$

$P(1): 1 = \frac{3^1 - 1}{2}$

1 = 1

P(1) is true

P(k) : $1+ 3+ 3^2 + \ldots + 3^{k-1} = \frac{3^k-1}{2}$

Assume that p(k) is true

P(k+1) : $1+ 3+ 3^2 + \ldots + 3^{k+1-1} = \frac{3^{k+1}-1}{2}$

We have to prove that p(k+1) is true

L.H.S

$1+ 3+ 3^2 + \ldots + 3^k$

$= [1+ 3+ 3^2 + \ldots + 3^{k-1}] + 3^k$

$= \frac{3^k-1}{2} + 3^k$

$= \frac{3^k-1+2.3^k}{2}$

$= \frac{3.3^k-1}{2} = \frac{3^{k+1}-1}{2}$ = R H S

P(k+1) is true.

Hence by P.M.I then result is true for all natural number n

17. **(i)** i

(ii) 3(7+i7) + i(7+i7)

$= 21 + 21i + 7i + 7i^2$

$= 21 + 28i - 7$

$= 14 + 28i$

18. r = $\sqrt{1^2 + \sqrt{3}^2}$ = $\sqrt{1+3}$ = $\sqrt{4}$ = 2

tan$\propto$ = $|\frac{b}{a}|$ = $\sqrt{3}$

$\propto = \frac{\pi}{3}$

Complex number lies in first quadrant

$\theta = \frac{\pi}{3}$

1+i$\sqrt{3}$ = 2(cos$\frac{\pi}{3}$ + i sin $\frac{\pi}{3}$)

19. **(i)** 10

(ii) $^{21}C_2$ = 210

20. **(i)** Number of 3 digit numbers can be formed using 5 digits = 5 P_3

=5×4×3 =60

(ii) Required number of permutations =$\frac{9!}{4!\ 2!}$

= 7560

21. Slope of the line , m= $\frac{-A}{B}$ =$\frac{-1}{-7}$ = $\frac{1}{7}$

Slope of the perpendicular line = -7

Equation of the perpendicular line is $(y-y_1)= m(x-x_1)$

Ie, y-(-3)=(-7)(x-2)

y+3=-7x+14

7x+y=11

22. **(i)** a=5, c=4

$c^2 = a^2 - b^2$

$4^2 = 5^2 - b^2$

$16 = 25 - b^2$

b=3

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

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

(ii) $e = \frac{c}{a} = \frac{4}{5}$

23.(i) $y = x(x^2 + 2x + 1)$

$= x^3 + 2x^2 + x$

$\frac{dy}{dx} = 3x^2 + 4x + 1$

(ii) $y = \frac{x+1}{x}$

$$\frac{dy}{dx} = \frac{x \times \frac{d(x+1)}{dx} - (x+1) \times \frac{d(x)}{dx}}{(x)^2} = \frac{x.1-(x+1).1}{x^2} = \frac{-1}{x^2}$$

24. Assume that $\sqrt{5}$ is rational

$\sqrt{5} = \frac{p}{q}$, where p and q do not have a common factor

$P = \sqrt{5}\, q$

$P^2 = 5\, q^2$

P^2 is a multiple of 5

P is a multiple of 5

P = 5m

$(5m)^2 = 5\, q^2$

$25\ m^2 = 5\ q^2$

$q^2 = 5\ m^2$

q^2 is a multiple of 5

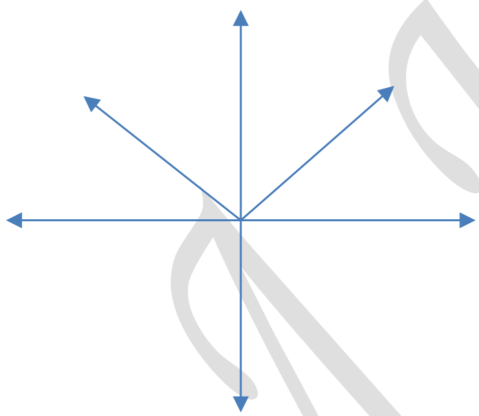
q is a multiple of 5

P and q have a common factor 5, which is a contradiction

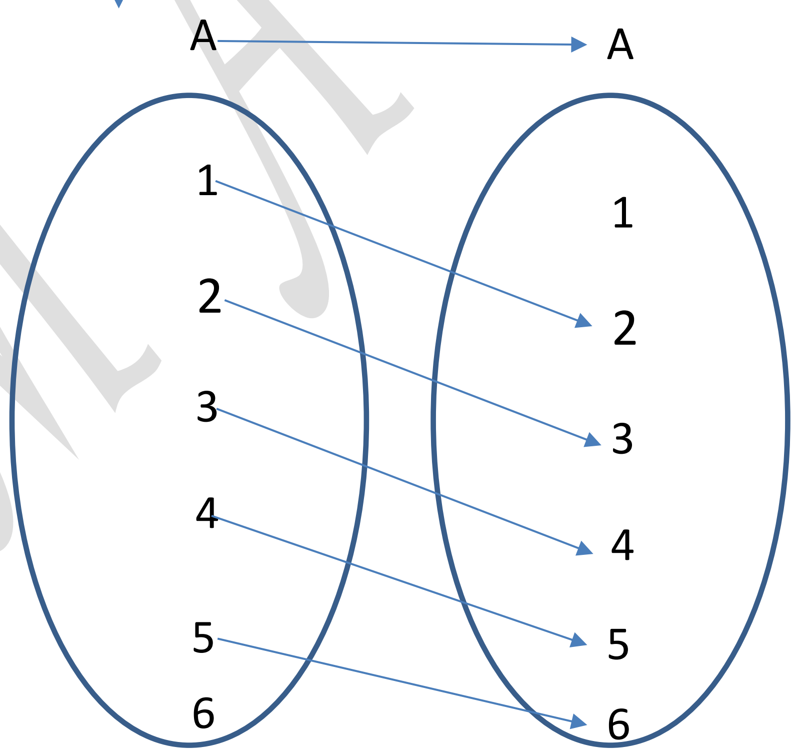
Our assumption is wrong

$\sqrt{5}$ is irrational

25. **(i)**



(ii) (a)



(b) domain = {1,2,3,4,5}

26. **(i)** sin 75^0

= sin (45^0+30^0)

= sin45^0 cos30^0 + cos45^0 sin30^0

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

$= \frac{\sqrt{3}}{2\sqrt{2}} + \frac{1}{2\sqrt{2}}$

$= \frac{\sqrt{3}+1}{2\sqrt{2}}$

(ii) $\frac{sin5x+sin3x}{cos5x+cos3x}$ = tan4x

$$\frac{sin5x+sin3x}{cos5x+cos3x} = \frac{2\ sin\frac{5x+3x}{2}\ cos\frac{5x-3x}{2}}{2\ cos\frac{5x+3x}{2}\ cos\frac{5x-3x}{2}}$$

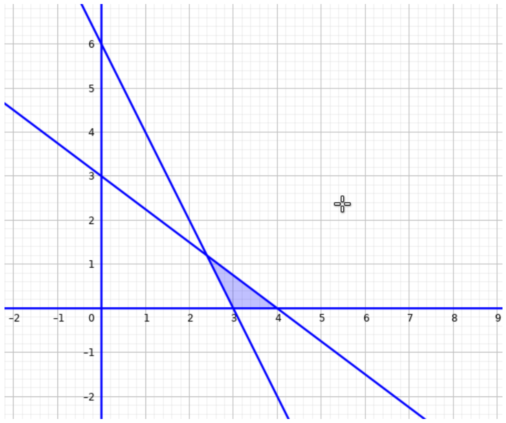
$$= \frac{sin4x\ cosx}{cos4x\ cosx} = \frac{sin4x}{cos4x} = \text{tan4x}$$

27. 2x + y =6

x	0	3
y	6	0

3x+4y = 12

x	0	4
y	3	0



28. **(i)** a = 5, r= 5

$a_{12} = a\ r^{11}$

$= 5.\ 5^{11}$

$= 5^{12}$

(ii) 8 + 88 + 888 + … to n terms

= 8[1 + 11 + 111 + … to n terms]

$= \frac{8}{9}$ [9 + 99 + 999 + … to n terms]

$= \frac{8}{9}$ [(10-1) + (100-1) + (1000-1) + … to n terms]

$= \frac{8}{9}$ [(10 + 100 + 1000 + … to nerms)-(1 + 1+ 1+ … to n terms)]

$= \frac{8}{9}\left[\, 10\left(\frac{10^n-1}{10-1}\right) - n\right]$

29.

x_i	f_i	$xifi$	$(x_i - \bar{x})^2$	$fi(x_i - \bar{x})^2$
35	3	105	729	2187
45	7	315	289	2023
55	12	660	49	588
65	15	975	9	135
75	8	600	169	1352
85	3	255	529	1587
95	2	190	1089	2178
	N=50	**3100**		**10050**

(i)Mean, $\overline{\boldsymbol{x}} = \frac{\Sigma x_i f_i}{N} = \frac{3100}{50} = \mathbf{62}$

(ii) **Variance =** $\frac{\Sigma fi(x_i - \bar{x})^2}{N} = \frac{10050}{50} = 201$

(iii)Standard deviation = $\sqrt{variance} = \sqrt{201}$

30. (i) Sample space, S={HH,HT,TH,TT}

The Event, E={HT,TH,TT}

P(E) $= \frac{3}{4}$

(ii) a) P(E U F) = P(E)+P(F)-P(E ∩ F)

$= \frac{1}{4} + \frac{1}{2} - \frac{1}{8} = \frac{5}{8}$

b) $P(E' \cap F') = P(E \cup F)'$

$= 1 - P(E \cup F)$

$= 1 - \frac{5}{8} = \frac{3}{8}$