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CBSE Class XI Mathematics
Sample Paper 04
As per pattern issued by CBSE for (2023-24)

Maximum Marks : 80 **Time : 3 hrs.**

General Instructions :

1. This Question Paper has 5 Sections A-E.
2. Section A has 20 MCQs carrying 1 mark each
3. Section B has 5 questions carrying 02 marks each.
4. Section C has 6 questions carrying 03 marks each.
5. Section D has 3 case based integrated units of assessment (04 marks each) with subparts of the values of 1, 1 and 2 marks each respectively.
6. Section E has 4 questions carrying 05 marks each.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION A
(Question 1 to 20 carry 1 mark)

Q1.If P(A) = ({1,2}) where P denotes the power set, then which one of the following is correct?

a){1,2}⊂A	b)1 ϵA
c) $\phi \notin A$	d)$\{1,2\} \in A$

Q2.If $\tan\theta = \frac{1}{2}$ and $\tan\phi = \frac{1}{3}$ then the value of $\theta + \phi$ is

a)$\frac{\pi}{6}$	b) π
c)0	d)$\frac{\pi}{4}$

Q3.If A = {1, 2, 6} and R be the relation defined on A by R={(a,b):$a, b \in A$ and a divides b}, then range of R is equal to

a){1,2}	b) {2,6}
c){1,2,6}	d)none of these

Q4.For each non-zero real number x, let $f(x)\frac{x}{|x|}$

a)a null set	b) a set containing only one element
c) a set containing only two element	d) a set containing infinite element

Q5.If $\sin\theta + \cos\theta = 1$, then the value of $\sin 2\theta$ is equal to

a)1	b) 1/2
c)0	d)2

Q6.Everybody in the room shakes hands with everybody else.The total number of handshakes is 66.Find the total number of person in the room

a)11	b) 10
c)66	d)12

Q7.If $m_{C_1} = \eta_{C_2}$ then

a)2m=n	b) 2m=n(n+1)
c)2m=n(n-1)	d)2n=m(m-1)

Q8.If $z_1 = 2 - i \; and \; z_2 = -2 + i$ such that $\frac{z_1 z_2}{\overline{z_1}} = a + ib$ then a is equal to

a)2/5	b) 3/5
c)11/5	d)-2/5

Q9.The equation of a line perpendicular to the line x-2y+3= 0 and passing through the point (1, – 2) is

a)y=2x	b) x=2y
c)x=-2y	d)y=-2x

Q10.Domain of $f(x) = \frac{1}{\sqrt{x+|x|}}$

a)$(-\infty, \infty)$	b)$(2, \infty)$
c)$(-\infty, 2)$	d)$(0, \infty)$

Q11.$If \; \frac{(x-3)}{x-5} > 0$ then x belongs to

a) $(-\infty, 3) \cup (5, \infty)$	b) $(-\infty, 3) \cup (-5, \infty)$
c)$(-\infty, 3] \cup [5, \infty)$	d)(3,5)

Q12.Find the geometric mean between 1 and 4

a)2	b) 0
c)4	d)-2

Q13.Value of $\lim_{x \to 1}: \frac{2}{1-x^2} + \frac{1}{x-1}$ is

a)1/2	b) 1/3
c)1/4	d)1

Q14.If nth term of GP is 2^n,then sum of first 6 terms is

a)126	b) 124
c)190	d)154

Q15.The equation of straight line passing through the point (1, 2) and parallel to the line y = 3x + 1 is

a) y+2=x+1	b) y-2=3(x+1)
c) y-2=3(x-1)	d) y-2=x-1

Q16. If n is a positive integer, then $(\sqrt{3}+1)^{2n+1} + (\sqrt{3}-1)^{2n+1}$ is

a) an even positive integer	b) a rational number
c) an odd positive integer	d) an irrational number

Q17.If repetition of the digits is allowed, then the number of even natural numbers having three digits is

a)250	b) 350
c)450	d)550

Q18.The centre of the circle $x^2 + y^2 - 6x + 4y - 12 = 0$ is (a, b) then (2a + 3 b) is

a)0	b) 2
c)3	d) 5

Q19. Assertion (A) If $\left(\frac{x}{3} + 1, y - \frac{2}{3}\right) = \left(\frac{5}{3}, \frac{1}{3}\right)$ then the values of x and y are 2 and 1, respectively.

Reason (R) If the set A has 3 elements and the set B = {3,4,5} then the number of elements in A X B is 6.

a)Both assertion and reason are true and reason is the correct explanation of assertion	b)Both assertion and reason are true but reason is not the correct explanation of assertion
c)Assertion is true but reason is false.	d) Assertion is false but reason is true.

Q20. Assertion (A) Three sets A ,B , C are such that A = B ∩ C and B = C ∩ A, then A = B .

Reason (R) If A = {x,y }, then A ∩ p(A) = A

a)Both assertion and reason are true and reason is the correct explanation of assertion	b)Both assertion and reason are true but reason is not the correct explanation of assertion
c)Assertion is true but reason is false.	d) Assertion is false but reason is true.

SECTION B
(Question 21 to 25 carry 2 mark)

Q21. Find the equation of the parabola with vertex at the origin and focus on positive x axis and passes through point (2,2).

Q22. Prove that cos 50° cos 10° - sin 50° sin 10° = 1/2

OR

Express as the product of sines and cosines: sin 15x – sinx.

Q23.Find the derivative of the function : $\frac{x^n}{\cos ax}$

Q24.How many different words can be formed from the letters of the word 'GANESHPURI'? In how many of these words: the vowels are always together?

OR

How many four digit different numbers, greater than 5000 can be formed with the digits 1, 2, 5, 9, 0 when repetition of digits is not allowed?

Q25. The number lock of a suitcase has 4 wheels with 10 digits, i.e. from 0 to 9. The lock open with a sequence of 4 digits with repeats allowed. What is the probability of a person getting the right sequence to open the suit case?

SECTION C
(Question 26 to 31 carry 3 mark

Q26. Draw the graph of the function $f(x) = \begin{cases} 1+2x, x < 0 \\ 3+5x, x \geq 0 \end{cases}$ also find its range.

Q27. Find the equation of a line with slope –1 and whose perpendicular distance from the origin is equal to 5.

Or

The line 2x – 3y = 4 is the perpendicular bisector of the line segment AB. If coordinates of A are (–3, 1) find coordinates of B.

Q28. The sum of two numbers is 6 times their geometric mean, show that numbers are in the ratio (3+2√2) : (3– 2√2)

Q29. If A is the set of all divisors of the number 15. B is the set of prime numbers smaller than 10 and C is the set of even number smaller than 9, then find the value of (A ∪ C) ∩ B.

Or

If $x = \{4^n - 3n - 1, n \in N\}$, $y = \{9(n-1), n \in N\}$ .Find the value of X ∪ Y

Q30. Find the coordinates of the points which trisect the line segment joining the points P(4,2,6) and Q(10, 16,6).

Q31. Prove that $\frac{\sin\theta + \sin 2\theta}{1+\cos\theta+\cos 2\theta} = \tan\theta$

SECTION D
(Question 32 to 35 carry 4 mark)

Q32. Anita is doing an experiment in which she has to arrange letters of word HARYANA given in puzzle in order to form words with or without meaning using all letters

(i)How many words start and end with letter A?

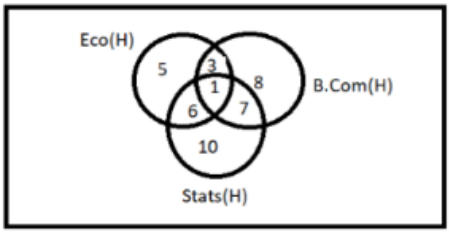
(ii) How many words containing all A's together?

(iii) How many words have exactly 4 letters in between H and Y ?

Or

In how many words are there in which all A's are not together.

Q33. Saksham is planning to take admission in a college after appearing for CUET exams .He is interested in applying three courses ,economics (hons.) , B .com (Hons.) and statistics (Hons.) .Some colleges are shortlisted by him from 50 colleges .He created a Venn diagram to understand his choices as shown below :

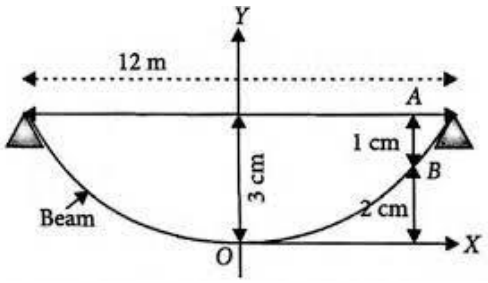


(i) How many colleges Saksham has Shortlisted only for economics (Hons.)
(ii) How many colleges he has not shortlisted .
(iii) How many colleges he has shortlisted for B.com(Hons.) or statistics (Hons.)

Or

How many colleges he has shortlisted for statistics (Hons.) but not for economics (Hons.)

Q34. A beam is supported at its ends by supports which are 12m apart. Since the load is concentrated at its centre, there is a deflection of 3 cm at the centre and the deflected beam is in the shape of a parabola.



(i)What will be the equation of parabola?
(ii) How for from the centre is deflection of 1cm?
(iii) At a distance of 2m from the centre, what will be the deflection of the beam?

Or

What is the difference of deflection of beam at a distance of 1m and 2m from the centre?

SECTION E
(Question 35 to 32 carry 5 mark)

Q35.Find real value of x and y if $\frac{(1+i)x-2i}{3+i}+\frac{(2-3i)y+i}{3-i}=i$

Q36.Evaluate$\left(1+cos\frac{\pi}{8}\right)\left(1+cos\frac{3\pi}{8}\right)\left(1+cos\frac{5\pi}{8}\right)\left(1+cos\frac{7\pi}{8}\right)$

Or

Prove that $4\,sin\,\alpha\,sin\left(\alpha+\frac{\pi}{3}\right)sin\left(\alpha+\frac{2\pi}{3}\right)=sin\,3\alpha$

Q37.Find the equation of the circle which passes through the points (20,3), (19, 8) and (2, -9). Find its centre and radius.

Or

Find the equation of the ellipse whose centre is at the origin, foci are (1, 0) and (-1, 0) and eccentricity is 1

Q38.Calculate the mean deviation about mean for the following data.

X	2	4	6	8	10	12	14	16
f	2	2	4	5	3	2	1	1

CBSE Class XI Mathematics Sample Paper 04 Answer key

SECTION – A

(Question number **1 to 20** carry **1 marks** each)

Q1.	**D**
Q2.	**D**
Q3.	**C**
Q4.	**C**
Q5.	**C**
Q6.	**A**
Q7.	**C**
Q8.	**D**
Q9.	**D**
Q10.	**D**
Q11.	**A**
Q12.	**A**
Q13.	**A**
Q14.	**A**
Q15.	**B**
Q16.	**D**
Q17.	**C**
Q18.	**A**
Q19.	**D**
Q20.	**A**

SECTION – B

(Question number **21 to 25** carry **2 marks** each)

Q21. Find the equation of the parabola with vertex at the origin and focus on positive x axis and passes through point (2,2).

Ans.) Equation of the parabola, $y^2=4ax$.
Since, it passes through (2,2), a=1/2
∴ Equation of the parabola,
$y^2=4(1/2)x$
$\Rightarrow y^2=2x$

Q22. Prove that cos 50° cos 10° - sin 50° sin 10° = 1/2

Ans.) $\cos 50^0 \cos 10^0 - \sin 50^0 \sin 10^0$
$=\cos(50^0+10^0)$ .....[Using $\cos A \cos B - \sin A \sin B = \cos(A+B)$].
$=\cos 60^0 = 1/2$

OR

Express as the product of sines and cosines: sin 15x – sinx.

Ans.) sin 15x -sin x

Sin A - Sin B = 2 Sin{(A - B)/2} Cos {(A + B)/2}

A = 15x

B = x

= 2 Sin { (15x - x)/2} cos {)15x + x)/2}

= 2 Sin (14x/2)cos(16x/2)

= 2Sin7x Cos8x

sin 15x -sin x = 2Sin7x Cos8x

Q23. Find the derivative of the function : $\frac{x^n}{\cos ax}$

Ans.) $f'(x) = \frac{(\cos ax)nx^{n-1} + x^n \sin ax \cdot a}{\cos^2(ax)}$ (Using $\frac{u}{v} = \frac{vu' - uv'}{v^2}$)

$= \frac{x^{n-1}[n\cos ax + ax \sin ax]}{\cos^2 ax}$

Q24. How many different words can be formed from the letters of the word 'GANESHPURI'? In how many of these words: the vowels are always together?

Ans.)

The word GANESHPURI consists of 10 distinct letters.

Number of letters = 10!

The word GANESHPURI consists of 4 vowels. If we keep all the vowels together, we have to consider them as a single entity.

So, we are left with the remaining 6 consonants and all the vowels that are taken together as a single entity. This gives us a total of 7 entities that can be arranged in 7! ways.

Also, the 4 vowels can be arranged in 4! ways amongst themselves.

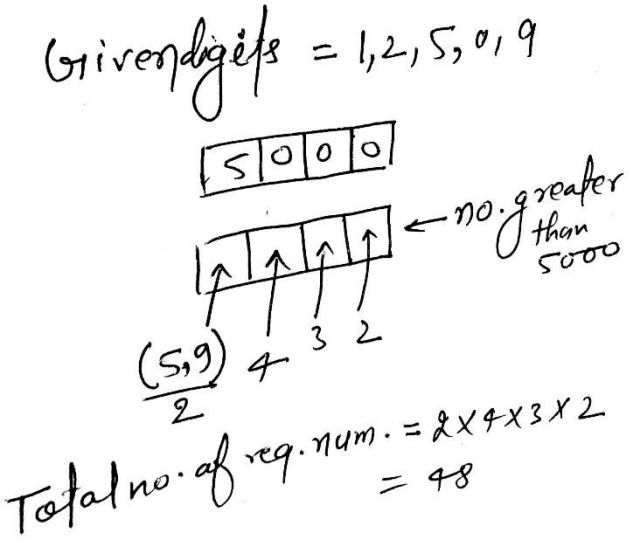
By fundamental principle of counting:

Total number of arrangements = $7! \times 4!$ words.

OR

How many four digit different numbers, greater than 5000 can be formed with the digits 1, 2, 5, 9, 0 when repetition of digits is not allowed?

Ans.)



Q25.The number lock of a suitcase has 4 wheels with 10 digits, i.e. from 0 to 9. The lock open with a sequence of 4 digits with repeats allowed. What is the probability of a person getting the right sequence to open the suit case?

Ans.) Number of wheels in number lock of suitcase =4. –o–o–o–o

Now, first wheel can have any one of the tens digits from 0 to 9.

Since, repetition is not allowed, so second wheel can have any of the remaining 8 digits.

Similarly, third wheel can have any of the remaining 7 digits.

And fourth wheel can have any of the remaining 6 digits

So, number of four digit lock code that can be formed without repetition of digits =10×9×8×7=5040

So, total four digit numbers formed =5040

But since, the lock can open with only one of the all four digit numbers.

Hence, required probability =1/5040

SECTION – C

(Question number **26 to 31** carry **3 marks** each)

Q26.Draw the graph of the function $f(x) = \begin{cases} 1 + 2x, x < 0 \\ 3 + 5x, x \geq 0 \end{cases}$ also find its range.

Ans.) Here, f(x) = 1 + 2x, x <0,

this given f (– 4) = 1 + 2(– 4) = – 7

f(– 3) = – 1 + 2(–3) = – 5

f(–2) = 1 + 2(– 2) = – 3

f(–1) = 1 + 2(–1) = – 1

and f(x) = 3 + 5x, x ≥ 0

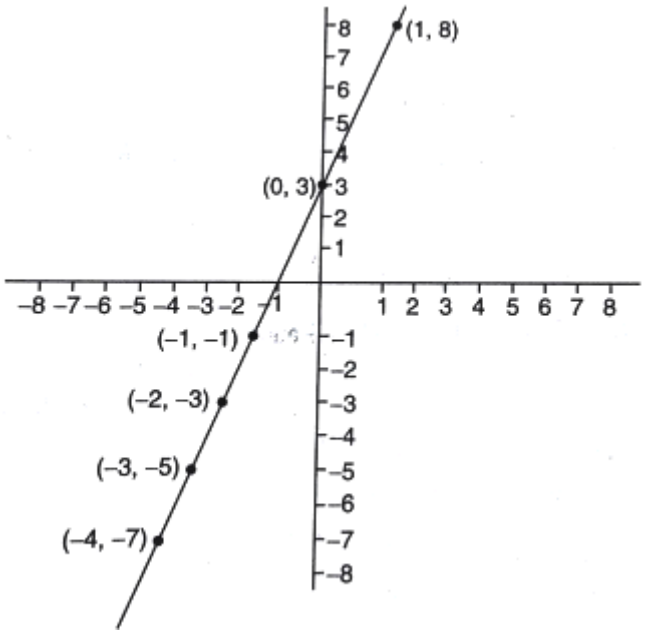
f(0) = 3 + 5(0) = 3

f(1) = 3 + 5(1) = 8

f(2) = 3 + 5(2) = 13

f(3) = 3 + 5(3) = 18

f(4) = 3 + 5(4) = 23



Range Let y, f (x), x < 0 ∴ y1 = 1 + 2x, x < 0

∴ x = (y 1 – 1)/ 2

As x < 0

⇒ y1 – 1 < 0 ⇒ y1 < 1

Let y2 = f (x), x ≥ 0

⇒ y2 = 3 + 5x, x ≥ 0

⇒ x = (y 2 – 3)/5, x ≥ 0

∵ x ≥ 0 ⇒ y2 – 3 ≥ 0 ⇒ y2 ≥ 3

Therefore, range of f (–∞, 1), ∪ [3, ∞)

Q27.Find the equation of a line with slope –1 and whose perpendicular distance from the origin is equal to 5.

Ans.)

Let c be the intercept on the y-axis.

Then, the equation of the line is

$y = -x + c\,[\because m = -1]$

$\Rightarrow x + y = c$

$\Rightarrow \frac{x}{\sqrt{1^2+1^2}} + \frac{y}{\sqrt{1^2+1^2}} = \frac{c}{\sqrt{1^2+1^2}}$ [Dividing both sides by $\sqrt{(\text{ coefficient of x })^2 + (\text{ coefficient of y })^2}$]

$\Rightarrow \frac{x}{\sqrt{2}} + \frac{y}{\sqrt{2}} = \frac{c}{\sqrt{2}}$

This is the normal form of the given line.

Therefore,

$\frac{c}{\sqrt{2}}$ denotes the length of the perpendicular from the origin.

B

$\therefore \left|\frac{c}{\sqrt{2}}\right| = 5$

$\Rightarrow c = \pm 5\sqrt{2}$

Thus, substituting

$c = \pm 5\sqrt{2}$ in $y = -x + c$,we get the equation of line to be $y = -x + 5\sqrt{2}$ or, $x + y - 5\sqrt{2} = 0$

OR The line 2x – 3y = 4 is the perpendicular bisector of the line segment AB. If coordinates of A are (–3, 1) find coordinates of B.

Ans.) **Let the co-ordinates of B are (p, q).**

Then, slope of line AB, $m_1 = \frac{q-1}{p+3}$.

And, slope of line $2x - 3y = 4$ is $\frac{2}{3} = mL$.

Since the lines are perpendicular, so $m_1 m_2 = -1$

$\Rightarrow \frac{q-1}{p+3} \times \frac{2}{3} = -1$

$\Rightarrow 2q - 2 = -3p - 9$

$\Rightarrow 3p + 2q + 7 = 0$ ...(1)

The midpoint of AB is $\left(\frac{p-3}{2}, \frac{q+1}{2}\right)$, which lies on the line AB.

$\therefore 2\left(\frac{p-3}{2}\right) - 3.\left(\frac{q+1}{2}\right) = 4$

$\Rightarrow 2p - 6 - 3q - 3 = 8$

$\Rightarrow 2p - 3q - 17 = 0$ ...(2)

Solving (1) and (2), we get $p = 1, q = -5$.

Q28 The sum of two numbers is 6 times their geometric mean, show that numbers are in the ratio (3+2√2) : (3– 2√2)

Ans.) Let the two numbers be *a* and *b*.

G.M. = $\sqrt{ab}$

According to the given condition,

$a + b = 6\sqrt{ab}$ ...(1)

$\Rightarrow (a + b)^2 = 36(ab)$

$(a-b)^2 = (a+b)^2 - 4ab = 36ab - 4ab = 32ab$

$\Rightarrow a - b = \sqrt{32}\sqrt{ab}$

$= 4\sqrt{2}\sqrt{ab}$ ...(2)

Adding (1) and (2), we obtain

$2a = (6 + 4\sqrt{2})\sqrt{ab}$

$\Rightarrow a = (3 + 2\sqrt{2})\sqrt{ab}$

Substituting the value of *a* in (1), we obtain

$b = 6\sqrt{ab} - (3+2\sqrt{2})\sqrt{ab}$

$\Rightarrow b = (3 - 2\sqrt{2})\sqrt{ab}$

$\frac{a}{b} = \frac{(3+2\sqrt{2})\sqrt{ab}}{(3-2\sqrt{2})\sqrt{ab}} = \frac{3 + 2\sqrt{2}}{3 - 2\sqrt{2}}$

Thus, the required ratio is (3+2√2) : (3– 2√2) .

Q29.If A is the set of all divisors of the number 15. B is the set of prime numbers smaller than 10 and C is the set of even number smaller than 9, then find the value of (A ∪ C) ∩ B.

Ans.) As mentioned in the question, set A is the set of the divisors of the number 15.
And we know that A divisor, also called a factor, of a number is a number which divides. For integers, only positive divisors are usually considered, though obviously the negative of any positive divisor is itself a divisor.A={1,3,5,15}
As mentioned in the question, B is the set of prime numbers smaller than 10.B={2,3,5,7}
As mentioned in the question, C is the set of even numbers smaller than 9.C={2,4,6,8}
Thus, (A∪C)∩B={2,3,5}

Or

If $x = \{4^n - 3n - 1, n \in N\}$
$y = \{9(n-1), n \in N\}$ **,Find the value of X ∪ Y**

Ans.) X={0,9,54...} Y={0,9,18,27...}
Hence X is a subset of Y
Therefore X∪Y=Y

Q30. Find the coordinates of the points which trisect the line segment joining the points P (4, 2, 6) and Q (10 , 16 , 6).

Ans.) Let A and B be the points that trisect the line segment joining points P (4, 2, –6) and Q (10, –16, 6)

Point A divides PQ in the ratio 1:2. Therefore, by section formula, the coordinates of point A are given by

$$\left(\frac{1(10)+2(4)}{1+2}, \frac{1(-16)+2(2)}{1+2}, \frac{1(6)+2(-6)}{1+2}\right) = (6, -4, -2)$$

Point B divides PQ in the ratio 2:1. Therefore, by section formula, the coordinates of point B are given by

$$\left(\frac{2(10)+1(4)}{2+1}, \frac{2(-16)+1(2)}{2+1}, \frac{2(6)-1(6)}{2+1}\right) = (8, -10, 2)$$

Thus, (6, –4, –2) and (8, –10, 2) are the points that trisect the line segment joining points P (4, 2, –6) and Q (10, –16, 6).

Q31. Prove that $\frac{\sin\theta+\sin 2\theta}{1+\cos\theta+\cos 2\theta} = \tan\theta$

Ans.) $\sin(2\theta)=2\sin\theta\cos\theta$

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

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

Therefore,

$LHS=(\sin\theta+\sin2\theta)/(1+\cos\theta+\cos2\theta)$

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

$=\sin\theta(1+2\cos\theta)/\cos\theta(1+2\cos\theta)$

$=\tan\theta$

$=RHS$

SECTION – D

(Question number **32 to 34** carry **4 marks** each **Q32.**

Q 32. The given word, 'HARYANA' consists of 7 letters, out of which there are 1 H, 3 A's, 1 R, 1 Y and 1 N. Total number of words formed by all the letters of the given word =7!3!=840.=7!3!=840.
How many words start and end with letter A?

Ans.)A H,R,Y,A,N ,A
5! =120

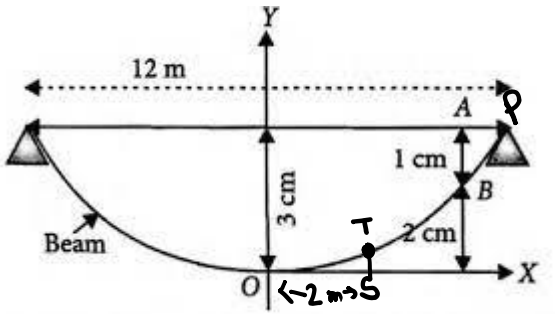
a) **How many words containing all A's together?**
Ans.) H,R,Y,N,A,A ,A
5! =120

b) **How many words have exactly 4 letters in between H and Y ?**
Ans .)For H and Y there are 4 ways
For remaining 5, there are 5!/3! =20
Total ways are 20X4=80
Or
In how many words are there in which all A's are not together.
Ans.)840-120=720

Q33.

Q34. A beam is supported at its ends by supports which are 12m apart. Since the load is concentrated at its centre, there is a deflection of 3 cm at the centre and the deflected beam is in the shape of a parabola.

a) **What will be the equation of parabola?**
Ans.) The beam takes the shape of a parabola, whose equation is of the form $x^2=4ay$ ...(i)



Since the point P(6,3/100) lie on it, we have

$(4\times a\times 3/100)=36$
$\Rightarrow a=36\times 12/12$
$\Rightarrow a=300$ m.

Required equation is $x^2=1200y$

b) **How for from the centre is deflection of 1cm?**
Ans.) Let AB be the deflection. Then,

AB =1/100m and Q is B(x,2/100)

$\therefore$ $x^2=4\times 300\times 2/100 \Leftrightarrow x=2\sqrt{6}$ m is the required distance.

c) **At a distance of 2m from the centre, what will be the deflection of the beam?**
Ans.).) Let TS be the deflection. Then,

OS =2 m and T is T(2,y)

$\therefore$ $2^2=4\times 300\times y \Leftrightarrow x=1/300$ m is the required deflection.

SECTION – E

(Question number **35 to 38** carry **5 marks** each)

Q35.Find real value of x and y if $\frac{(1+i)x-2i}{3+i}+\frac{(2-3i)y+i}{3-i}=i$

Ans.)

$$\frac{(1+i)x-2i}{3+i}+\frac{(2-3i)y+i}{3-i}=i$$
$$=\frac{[x+i(x-2)][3-i]+[3+i][2y+i(1-3y)]}{10}$$
$$=\frac{[3x+x-2+i(3x-6-x)]+[6y+3y-1+i(2y+3-9y)}{10}$$
$$=\frac{4x-2+i(2x-6)+(9y-1)+i(-7y+3)}{10}$$
$$=\frac{4x+9y-3+i(2x-7y-3)}{10}=i$$

Q36.Evaluate $\left(1+cos\frac{\pi}{8}\right)\left(1+cos\frac{3\pi}{8}\right)\left(1+cos\frac{5\pi}{8}\right)\left(1+cos\frac{7\pi}{8}\right)$

Ans.)

Ques :- Find the value of $\left(1+\cos\frac{\pi}{8}\right)\left(1+\cos\frac{3\pi}{8}\right)\left(1+\cos\frac{5\pi}{8}\right)\left(1+\cos\frac{7\pi}{8}\right)$ =

$\Rightarrow \left(1+\cos\frac{\pi}{8}\right)\left(1+\sin\left(\frac{\pi}{2}-\frac{3\pi}{8}\right)\right)\left(1+\sin\left(\frac{\pi}{2}-\frac{5\pi}{8}\right)\right)\left(1+\cos\left(\pi-\frac{\pi}{8}\right)\right)$

$\Rightarrow \left(1+\cos\frac{\pi}{8}\right)\left(1+\sin\frac{\pi}{8}\right)\left(1-\sin\frac{\pi}{8}\right)\left(1-\cos\frac{\pi}{8}\right)$.

Apply identity $(a+b)(a-b)=a^2-b^2$

$\Rightarrow \left(1-\cos^2\frac{\pi}{8}\right)\left(1-\sin^2\frac{\pi}{8}\right) \Rightarrow \sin^2\left(\frac{\pi}{8}\right)\times\cos^2\frac{\pi}{8}$

$\Rightarrow \frac{1}{4}\times 4\sin^2\frac{\pi}{8}\times\cos^2\frac{\pi}{8} \Rightarrow \frac{1}{4}\times\left(2\sin\frac{\pi}{8}\cdot\cos\frac{\pi}{8}\right)^2$.

Using formula $\sin 2\theta = 2\sin\theta\cdot\cos\theta$

$\Rightarrow \sin\frac{2\times\pi}{8_4} = 2\sin\frac{\pi}{8}\cdot\cos\frac{\pi}{8}$

$\Rightarrow \frac{1}{\sqrt{2}} = 2\sin\frac{\pi}{8}\cdot\cos\frac{\pi}{8}$.

$\Rightarrow \frac{1}{4}\times\left(\frac{1}{\sqrt{2}}\right)^2 = \frac{1}{8}$ Ans.

Or

Prove that $4\sin\alpha\sin\left(\alpha+\frac{\pi}{3}\right)\sin\left(\alpha+\frac{2\pi}{3}\right)=\sin 3\alpha$

Ans.) LHS = 4sin α sin(α + π/3) sin(α +2π/3)

= 2{ 2sin α.sin(α +π/3).sin(α +2π/3)

=2{cos(α - α -π/3) - cos(2 α +π/3) }sin(α +2π/3)

=2×1/2sin(α +2π/3) - 2sin(α +2π/3).cos(2 α +π/3)

=sin(α + 2π/3) - sin(3 α + π) -sin(α +2π/3)
=sin3 α =RHS

Q37.

By substitution of coordinates in the general equation of the

circle given by $x^2 + y^2 + 2gx + 2fy + c = 0$

We have $40g + 6f + c = -409$

$38g + 16f + c = -425$

$4g - 18f + c = -85$

From these three equations, we get

$g = -7$

$f = -3$

And $c = -111$

Hence, the equation of the circle is

$x^2 + y^2 - 14x - 6y - 111 = 0$

or $(x - 7)^2 + (y - 3)^2 = 13^2$

Therefore, the centre of the circle is (7, 3) and radius is 13.

Or

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

Given:

Coordinates of foci = (±1, 0) …(i)

We know that,

Coordinates of foci = (±c, 0) …(ii)

∴ From eq. (i) and (ii), we get

c = 1

It is also given that

$$\text{Eccentricity} = \frac{1}{2}$$

we know that,

$$\text{Eccentricity}, e = \frac{c}{a}$$

$\Rightarrow \frac{1}{2} = \frac{1}{a}$ [$\because c = 1$]

$\Rightarrow a = 2$

Now, we know that,

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

$\Rightarrow (1)^2 = (2)^2 - b^2$

$\Rightarrow 1 = 4 - b^2$

$\Rightarrow b^2 = 4 - 1$

$\Rightarrow b^2 = 3$

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

$$\Rightarrow \frac{x^2}{4} + \frac{y^2}{3} = 1$$

Q38.Calculate the mean deviation about mean for the following data.

X	2	4	6	8	10	12	14	16
f	2	2	4	5	3	2	1	1

Ans.)Mean=10.2

Mean deviation about Mean =2.44