# COMMON QUARTERLY EXAMINATION 2022

Date : 28-Sep-22

11th Standard

Maths

Reg.No. : | | | | | | |

Exam Time : 03:00:00 Hrs

Total Marks : 90

## I CHOOSE THE CORRECT ANSWER

20 x 1 = 20

1) The function f:R→R is defined by $f(x)=\frac{\left(x^{2}+\cos x\right)\left(1+x^{4}\right)}{\left(x-\sin x\right)\left(2x-x^{3}\right)}+e^{-\left|x\right|}$ is

(a) an odd function (b) neither an odd function nor an even function (c) an even function

(d) both odd function and even function.

2) If A = {(x,y) : y = $e^x$, x∈R} and B = {(x,y) : y = $e^{-x}$, x ∈ R} then n(A∩B) is

(a) Infinity (b) 0 (c) 1 (d) 2

3) The rule f(x) = $x^2$ is a bijection if the domain and the co-domain are given by

(a) R, R (b) R, (0, ∞) (c) (0, ∞); R (d) [0, ∞); [0,∞)

4) The number of solution of $x^2 + |x - 1| = 1$ is

(a) 1 (b) 0 (c) 2 (d) 3

5) If a and b are the roots of the equation $x^2-kx+c = 0$ then the distance between the points (a, 0) and (b, 0)

(a) $\sqrt{4k^{2}-c}$ (b) $\sqrt{k^{2}-4c}$ (c) $\sqrt{4c-k^{2}}$ (d) $\sqrt{k-8c}$

6) If $\frac{kx}{(x+2)(x-1)}=\frac{2}{x+2}+\frac{1}{x-2}$ ,then the value of k is

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

7) The maximum value of $4\sin^2x + 3\cos^2x + \sin\frac{x}{2}+\cos\frac{x}{2}$ is

(a) $4 + \sqrt{2}$ (b) $3+ \sqrt{2}$ (c) 9 (d) 4

8) $\cos1^0 + \cos2^0 + \cos3^0 + : : : + \cos179^0 =$

(a) 0 (b) 1 (c) -1 (d) 89

9) In a ΔABC, if

(i) $\sin\frac{A}{2}\sin\frac{B}{2}\sin\frac{C}{2} > 0$

(ii) sinA sinB sinC > 0, Then

(a) Both (i) and (ii) are true (b) Only (i) is true (c) Only (ii) is true (d) Neither (i) nor (ii) is true

10) In 3 fingers, the number of ways four rings can be worn is ways.

(a) $4^3-1$ (b) $3^4$ (c) 68 (d) 64

11) The number of ways in which a host lady invite 8 people for a party of 8 out of 12 people of whom two do not want to attend the party together is

(a) $2 \times {}^{11}C_7+{}^{10}C_8$ (b) ${}^{11}C_7+{}^{10}C_8$ (c) ${}^{12}C_8-{}^{10}C_6$ (d) ${}^{10}C_6+2!$

12) ${}^{(n-1)}C_r + {}^{(n-1)}C_{(r-1)}$ is

(a) $(n+1)C_r$ (b) $(n-1)C_r$ (c) $nC_r$ (d) $nC_{r-1}$

13) The number of ways of choosing 5 cards out of a deck of 52 cards which include at least one king is

(a) ${}^{52}C_5$ (b) ${}^{48}C_5$ (c) ${}^{52}C_5 + {}^{48}C_5$ (d) ${}^{52}C_5 - {}^{48}C_5$

14) If ${}^nC_4, {}^nC_5, {}^nC_6$ are in AP the value of n can be

(a) 14 (b) 11 (c) 9 (d) 5

15) The HM of two positive numbers whose AM and GM are 16, 8 respectively is

(a) 10 (b) 6 (c) 5 (d) 4

16) The value of $\frac{1}{2!}+\frac{1}{4!}+\frac{1}{6!}+\ldots$ is

(a) $\frac{e^{2}+1}{2e}$ (b) $\frac{(e+1)^{2}}{2e}$ (c) $\frac{(e-1)^{2}}{2e}$

(d) $\frac{e^{2}+1}{2e}$



17) The line (p + 2q)x + (p - 3q)y = p - q for different values of p and q passes through the point

(a) $\left(\frac{3}{5},\frac{5}{2}\right)$ (b) $\left(\frac{2}{5},\frac{2}{5}\right)$

(c) $\left(\frac{3}{5},\frac{3}{5}\right)$ (d) $\left(\frac{2}{5},\frac{3}{5}\right)$

18) If one of the lines given by $6x^2 - xy + 4cy^2 = 0$ is $3x + 4y = 0$, then c equals to

(a) -3 (b) -1 (c) 3 (d) 1

19) $\theta$ is acute angle between the lines $x^2 - xy - 6y^2 = 0$, then $\frac{2\cos\theta+3\sin\theta}{4\sin\theta+5\cos\theta}$ is

(a) 1 (b) $-\frac{1}{9}$ (c) $\frac{5}{9}$ (d) $\frac{1}{9}$

20) The remainder when $38^{15}$ is divided by 13 is

(a) 12 (b) 1 (c) 11 (d) 5

**ANSWER ANY 7 QUESTION Q.NO 30 COMPLUSARY** 7 x 2 = 14

21) Discuss the following relations for reflexivity, symmetricity and transitivity :
The relation R defined on the set of all positive integers by "mRn if m divided n".

22) Evaluate $\left( \left[ (256)^{ \frac { -1 }{ 4 } } \right] ^{ \frac { -1 }{ 4 } } \right) ^{ 3 }$

23) Without sketching the graphs, find whether the graphs of the following functions will intersect the x-axis and if so in how many points. $y = x^2 + x + 2$

24) Identify the Quadrant in which a given measure lies; $-230^0$

25) Find the values of other five trigonometric functions for the following
Cos $\theta = -\frac { 1 }{ 2 }$ $\theta$ lies in the III quadrant

26) In how many ways 10 pigeons can be placed in 3 different pigeon holes?

27) Find the value of 4!+5!

28) Write the first 6 terms of the sequences whose nth terms are given below and classify them as arithmetic progression, geometric progression, arithmetic -geometric progression, harmonic progression and none of them $\frac { 2n+3 }{ 3n+4 }$

29) Write the $n^{th}$ term of the following sequences
$\frac { 1 }{ 2 } ,\frac { 3 }{ 4 } ,\frac { 5 }{ 6 } ,\frac { 7 }{ 8 } ,\frac { 9 }{ 10 }$

30) If the equation $12x^2 - 10xy + 2y^2 + 14x - 5y + k = 0$ represents a pair of straight lines, find k, find separate equation and also angle between them.

**ANSWER ANY 7 QUESTION Q.NO 40 COMPLUSARY** 7 x 3 = 21

31) Let A={1,2,3,4} and B = {a,b,c,d}. Give a function from $A\rightarrow B$ for each of the following: one-to-one and onto.

32) If A and B are two sets so that n(B - A) = 2n(A - B) = 4n($A\cap B$) and if n($A\cup B$)=14, then find n(P (A)).

33) Classify each element of $\left\{ \sqrt { 7 } ,\frac { -1 }{ 4 } ,0,3.14,4,\frac { 22 }{ 7 } \right\}$ as a member of N, Q, R, -Q or Z.

34) If $a^2+b^2 = 7ab$. Show that $\log \frac { a+b }{ 3 } =\frac { 1 }{ 2 } (\log a + \log b)$

35) In $\triangle ABC$, if $a = \sqrt { 3 } -1$, $b =\sqrt { 3 } +1$ and 0. Find the other side and the other two angles

36) How many 'letter strings' together can be formed with the letters of the word "VOWELS" so that
(i) the strings begin with E
(ii) the strings begin with E and end with W.

37) Find the general terms and sum to n terms of the sequence 1, $\frac{4}{3},\frac{7}{9},\frac{10}{27}$,....

38) Expand ${\left( 2x-{1\over 2x} \right)}^{4}$.

39) Area of the triangle formed by a line with the coordinate axes, is 36 square units. Find the equation of the line if the perpendicular drawn from the origin to the line makes an angle of 45° with positive the x-axis.

40) A polygon has 90 diagonals. Find the number of its sides?



**ANSWER ALL THE QUESTION** 7 x 5 = 35

41) a) Find the largest possible domain of the real valued function $f(x) =\frac { \sqrt { 4-{ x }^{ 2 } } }{ \sqrt { { x }^{ 2 }-9 } }$

**(OR)**

b) A box contains two white balls, three black balls and four red balls. In how many ways can three balls be drawn from the box, if atleast one black ball is to be included in the draw?

42) a) Solve the equation $\sin 9\theta = \sin \theta$.

**(OR)**

b) How many three-digit odd numbers can be formed using the digits 0, 1, 2, 3, 4, 5? if

**The repetition of digits is allowed**

43) a) Prove that for any a and b, $-\sqrt{a^2+b^2} \le a \sin \theta+ b \cos \theta \le \sqrt{a^2+b^2}$

**(OR)**

b) If P and $p^1$ be the perpendicular from the original upon the straight lines $x\sec\theta+y \text{cosec}\theta=a$ and $x\cos\theta-y\sin\theta=a\cos2\theta$ , prove that $4p^2 +p^1 = a^2$

44) a) Prove that $\sqrt [ 3 ]{ { x }^{ 3 }+6 } -\sqrt [ 3 ]{ { x }^{ 3 }+3 }$ is approximately equal to $\frac { 1 }{ { x }^{ 2 } }$ when x is sufficiently large.

**(OR)**

b) If a line joining two points (3, 0) and (5, 2) is rotated about the point (3, 0) in counter clockwise direction through an angle 15°, then find the equation of the line in the new position.

45) a) Let A = {0,1, 2, 3}. Construct relations on A of the following types:

(i) reflexive, symmetric, not transitive.

(ii) reflexive, symmetric, transitive.

**(OR)**

b) A researcher wants to determine the width of a pond from east to west, which cannot be done by actual measurement from a point P, he finds the distance to the eastern most point of the pond to be 8 km, while the distance to the westernmost point form P to b 6 km. if the angle between the two lines of sight is $60^0$ find the width of the pond?

46) a) Find the Co-efficient of $x^{15}$ in $\left( { x }^{ 2 }+\frac { 1 }{ { x }^{ 3 } } \right) ^{ 10 }$

**(OR)**

b) If $(n + 1)C_8 : (n - 3) P_4 = 57:16$, find n.

47) a) Find the condition that one of the roots of $ax^2+bx+c$ may be reciprocal of the other.negative of the other

**(OR)**

b) In an examination a student has to answer 5 questions, out of 9 questions in which 2 are compulsory. In how many ways a student can answer the questions?

48) a) In $\triangle ABC$, Prove the following

$\frac { a+b }{ a-b } =\tan\left( \frac { A+B }{ 2 } \right) \cot\left( \frac { A-B }{ 2 } \right)$

**(OR)**

b) If $A + B + C = 180^0$, prove that $\sin 2A + \sin 2B + \sin 2C = 4\sin A \sin B \sin C$

S BALAKRISHNAN M.SC BED MATHS

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21) Discuss the following relations for reflexivity, symmetricity and transitivity :

The relation R defined on the set of all positive integers by "mRn if m divided n".

**Answer :** The relation R defined on the set of all positive integers by "mRn" if m divides n".

Given relation is "mRn if m divides n".

**Reflexivity :** mRm since m divides m for all positive integers m.

$\therefore$ R is reflexive.

**Symmetricity:** mRn $\Rightarrow$ nRm.

m divides n $\Rightarrow$ n divides m but 'n' does not divide 'm'

$\therefore$ R is not symmetric

**Transitive :** mRn and nRp $\Rightarrow$ mRp.

m divides n and n divides p $\Rightarrow$ m divides p.

$\therefore$ R is transitive.

$\therefore$ R is reflexive, and transitive.

22) Evaluate $\left(\left[(256)^{\frac{-1}{4}}\right]^{\frac{-1}{4}}\right)^3$

**Answer :** $\left(\left[(256)^{\frac{-1}{2}}\right]^{\frac{-1}{4}}\right)^3$ = $(256)^{\frac{-1}{2}\times\frac{-1}{4}\times 3}$ $\left[\because \frac{a^m}{a^n} = a^{m-n}\right]$

= $(256)^{\frac{3}{8}} = (2^8)^{\frac{3}{8}} = 2^{8\times\frac{3}{8}} = 2^3 = 8$

23) Without sketching the graphs, find whether the graphs of the following functions will intersect the x-axis and if so in how many points. $y = x^2 + x + 2$

**Answer :** $y = x^2 + x + 2$

Here a = 1, b = 1, c =2

$D = b^2 - 4ac = (1)^2 - 4(1)(2)$

= 1 - 8 = -7

Since D < 0, the given curve will lie above the X-axis.

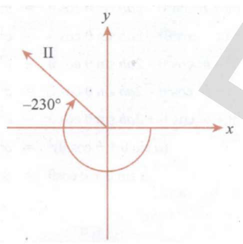
Hence the given graph will not intersect the X-axis.

24) Identify the Quadrant in which a given measure lies; $-230^0$

**Answer :** $-230^0$

$-230^0 = -230^0 = -180^0 + (-50^0)$

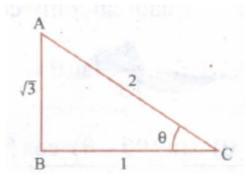
$\therefore -230^0$ lies in the II quadrant

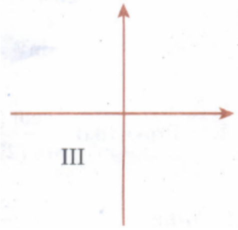



25) Find the values of other five trigonometric functions for the following

Cos $\theta = -\frac{1}{2}$ $\theta$ lies in the III quadrant

**Answer :** Given cos θ = $-\frac{1}{2}$ , θ lies in the III quadrant






$AB^2 = AC^2 - BC^2$

= 4 - 1 = 3

AB = √3

Since θ lies in the III quadrant, only tan θ and cot θ are positive.

Sin θ = $\frac{opp}{hyp}$ = $-\frac{\sqrt{3}}{2}$ ; and tan θ = √3

Cosec θ = $\frac{1}{sin\theta} = \frac{-2}{\sqrt{3}}$ ; sec θ = $\frac{1}{cos\theta}$ = -2; cot θ = $\frac{1}{tan\theta} = \frac{1}{\sqrt{3}}$

26) In how many ways 10 pigeons can be placed in 3 different pigeon holes?

**Answer :** Since each pigeon can occupy any of these 3 holes

Total number of ways of placing 10 pigeons = $3^{10}$

27) Find the value of 4!+5!

**Answer :** = 4 × 3 × 2 × 1 + 5 × 4 × 3 × 2 × 1

= 4 × 3 × 2 × 1 (1+5)

= 24 × 6 = 144

28) Write the first 6 terms of the sequences whose nth terms are given below and classify them as arithmetic progression, geometric progression, arithmetic -geometric progression, harmonic progression and none of them $\frac{2n+3}{3n+4}$

**Answer :** Let $a_n = \frac{2n+3}{3n+4}$

$a_1 = \frac{2+3}{3+4} = \frac{5}{9}$

$a_2 = \frac{4+3}{6+4} = \frac{7}{10}$

$a_3 = \frac{6+3}{9+4} = \frac{9}{13}$

$a4 = \frac{8+3}{12+4} = \frac{11}{16}$

$a_5 = \frac{10+3}{15+4} = \frac{13}{19}$

$a_6 = \frac{12+3}{18+4} = \frac{15}{22}$

$\frac{5}{9}, \frac{7}{10}, \frac{9}{13}, \frac{11}{16}, \frac{13}{19}, \frac{15}{22} \ldots$

this is neither A.P, G.P nor AGP

29) Write the $n^{th}$ term of the following sequences

$\frac{1}{2}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}, \frac{9}{10}$

**Answer :** Numerators are 1, 3, 4, 7, 9

a = 1 d = 2 -1

$a_n$ = 1 + ( n -1) 2 = 1 + 2n - 2 = 2n -1

denominator 2, 4, 6, 8, 10

a = 2, d = 2

$a_n$ = 1 +( n- 1) 2 = 1 + 2n - 2 = 2n

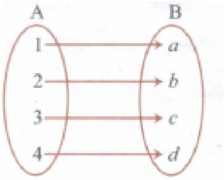
Hence nth term of the given sequence is $\frac{2n-1}{2n} = 1 - \frac{1}{2n}$

30) If the equation $12x^2 - 10xy + 2y^2 + 14x - 5y + k = 0$ represents a pair of straight lines, find k, find separate equation and also angle between them.

**Answer :** k = 2, 2x - y + 2 = 0, 6x - 2y + 1 = 0, $\theta = \tan^{-1}\left(\frac{1}{7}\right)$

**ANSWER ANY 7 QUESTION Q.NO 40 COMPLUSARY** 7 x 3 = 21

31) Let A={1,2,3,4} and B = {a,b,c,d}. Give a function from A→B for each of the following: one-to-one and onto.

**Answer :** 


Let f: A → B defined by

f = {(1,a)(2,b)(3,c)(4,d)}

Here different elements have different images

∴ f is one-to-one.

Also Co-domain = {a,b,c,d} = Range.

∴ f is onto.

∴ f is one-to-one and onto.

32) If A and B are two sets so that n(B - A) = 2n(A - B) = $4n(A \cap B)$ and if $n(A \cup B) = 14$, then find n(P (A)).

**Answer :** To find n(P(A)), we need n(A)

Let $n(A \cap B) = k$

Then $n(A - B) = 2k$ and $n(B - A) = 4k$

Now $n(A \cup B) = n(A - B) + n(B - A) + n(A \cap B) = 7k$

It is given that $n(A \cup B) = 14$

Thus 7k = 14 and hence k = 2

So n(A - B) =4 and n(B - A) = 8

As $n(A) = n(A - B) + n(A \cap B)$, we get n(A) = 6

And hence n(P(A)) = $2^6$ = 64

33) Classify each element of $\left\{\sqrt{7}, \frac{-1}{4}, 0, 3.14, 4, \frac{22}{7}\right\}$ as a member of N, Q, R, -Q or Z.

**Answer :** Since $\sqrt{7}$ is an irrational number, $\sqrt{7} \in$ R.

Since $\frac{-1}{4}$ is a negative rational number $\frac{-1}{4} \in$ Q

0 is an integer and 0 ∈Z.

3.14 = $\pi$ is a non-recurring and non-terminating decimal.

∴ 3.14 is an irrational number ⇒ 3.14 ∈ R-Q

4 is a positive integer ⇒ 4 ∈R-Q.

$\frac{22}{7}$ = 3.14 ∈ R. Which is an irrational number.

34) If $a^2+b^2$ = 7ab. Show that log $\frac{a+b}{3} = \frac{1}{2}$ (log a + log b)

**Answer :** Given $a^2+ b^2$ = 7ab

Adding 2ab both sides we get,

$a^2+b^2+2ab$ = 7ab + 2ab

⇒ $(a+b)^2$ = 9ab

⇒ $\frac{(a+b)^2}{9}$ = ab

⇒ $\left(\frac{a+b^2}{9}\right)^2$ = ab

Taking square root,we get

$\frac{a+b}{3}$ = ab

$log\left(\frac{a+b}{3}\right) = log(ab)^{\frac{1}{2}}$

= $\frac{1}{2}$ log (ab)

log $\left(\frac{a+b}{3}\right)$ = $\frac{1}{2}$ [log a + log b]

Hence proved.

35) In $\triangle$ABC, if a = $\sqrt{3} - 1$, b =$\sqrt{3} + 1$ and 0. Find the other side and the other two angles

**Answer :** by Napier's formula we have

$\left(\frac{A-B}{2}\right)=\frac{a-b}{a+b}cot\frac{C}{2}=\frac{(\sqrt{3}+1)-(\sqrt{3}-1)}{\sqrt{3}+1)+(\sqrt{3}-1)}cot\frac{60}{2}$

$\frac{2}{2\sqrt{3}}cot30=\frac{1}{\sqrt{3}}x\sqrt{3}=1$

$\frac{A-B}{2}=45 \quad A-B=90$

Also A+ B = $180^0$ - C = 180 - $60^0$ = $120^0$

Adding (1) and (2), 2A = $210^0$ Substituting A = $105^0$ in (2) we get

$105^0$ + B = $120^0$ B = 120 - 105 = $15^0$

Now by sine Formula

$\frac{c}{sinC}=\frac{a}{sinA}C=a\frac{sinC}{SinA}$

$=\frac{(\sqrt{3}+1)sin60}{sin105}=\frac{(\sqrt{3}+1)\frac{\sqrt{3}}{2}}{\frac{\sqrt{3}+1}{2\sqrt{2}}}=\frac{\sqrt{3}}{2}\times2\sqrt{2}=6$

0, 0 and C = $\sqrt{6}$

36) How many 'letter strings' together can be formed with the letters of the word "VOWELS" so that

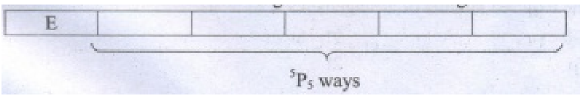
(i) the strings begin with E

(ii) the strings begin with E and end with W.

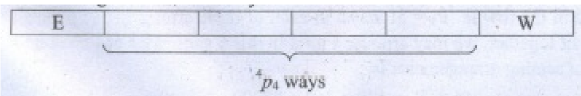
**Answer :** The given strings contains 6 letters (V, O, W, E, L, S).

(i) Since all strings must begin with E, we have the remaining 5 letters which can be arranged in $^5P_5$ = 5! ways.

Therefore the total number of strings with E as the starting letter is 5! =120.




(ii) Since all strings must begin with E, and end with W, we need to fix E and W. The remaining 4 letters can be arranged in $^4P_4$ = 4! Ways.




Therefore the total number of strings with E as the starting letter and W as the final letter is 4! = 24.

37) Find the general terms and sum to n terms of the sequence $1, \frac{4}{3}, \frac{7}{9}, \frac{10}{27}, \ldots$

**Answer :** Let $T_n$ be the nth term of the given sequence.

Given sequence is $\frac{1}{1}, \frac{4}{3}, \frac{7}{9}, \frac{10}{27} \ldots$

Consider the terms in the numerator

1, 4, 7, 10,...

Here a = 1, d = 3

The terms in the denominator are $\frac{1}{3^0}, \frac{1}{3^1}, \frac{1}{3^2}$, which is a G.P with $r=\frac{1}{3}$

∴ The given sequence can be written in the form of a, (a + d)r, (a + 2d)$r^2$,(a + 3d), $r^3$, ...

This is an arithmetic - geometric progression.

∴ $T_n$ = $[a+(n-1)d]r^{n-1}$

$=[1+(n-1)3]\left(\frac{1}{3}\right)^{n-1}$

$=(1+3n-3)\left(\frac{1}{3^{n-1}}\right)=\frac{3n-2}{3^{n-1}}$

$\therefore\ T_n=\frac{3n-2}{3^{n-1}}$

Let $S_n$ be the sum to n terms of the given sequence

$S_n=\sum_{k=1}^{n}\frac{3k-2}{3^{k-1}}$

$=\sum_{k=1}^{n}3k-2.\frac{1}{\sum_{k=1}^{n}3^{k-1}}$

$=3[1+2+3+\ldots+n]-2n\left[\frac{1}{3^0+3^2+\ldots+3^{r-1}}\right]$

$=\left[3\frac{n(n+1)}{2}-2n\right]\left[\frac{1}{1\left(\frac{3n-1}{3-1}\right)}\right]$

$=\left[\frac{3n^2+3n}{2}-2n\right]\left[\frac{2}{3^n-1}\right]=\frac{3n^2+3n-4n}{2}\times\frac{2}{3^n-1}$

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

38) Expand $\left(2x-\frac{1}{2x}\right)^4$.

**Answer :** We have $\left(2x-\frac{1}{2x}\right)^4$ = $^4C_0(2x)^4\left(-\frac{1}{2x}\right)^0$ + $^4C_1(2x)^3\left(-\frac{1}{2x}\right)^1$ + $^4C_2(2x)^2\left(-\frac{1}{2x}\right)^2$ + $^4C_3(2x)^1$ $\left(-\frac{2}{x}\right)^3$ + $^4C_4(2x)^0\left(-\frac{1}{2x}\right)^4$

= $(2x)^4 - 4(2x)^3\left(\frac{1}{2x}\right) + 6(2x)^2\left(\frac{1}{2x}\right)^2 - 6(2x)\left(\frac{1}{2x}\right)^2 + \left(\frac{1}{2x}\right)^4$

$= 16x^4 - 16x^2 + 6 - \frac{3}{2x^2} + \frac{1}{16x^4}$

39) Area of the triangle formed by a line with the coordinate axes, is 36 square units. Find the equation of the line if the perpendicular drawn from the origin to the line makes an angle of 45° with positive the x-axis.

**Answer :** Let p be the length of the perpendicular drawn from the origin to the required line.

The perpendicular makes 45° with the x-axis.

The equation of the required line is of the form,

x cos $\alpha$ + y sin $\alpha$ = p

⇒ x cos 45° +y sin 45° = p

x + y = √2p

This equation cuts the coordinate axes at A(√2p, 0) and B(0, √2p)

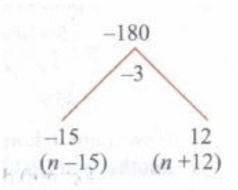
Area of the ΔOAB is $\frac{1}{2} \times \sqrt{2}p \times \sqrt{2}p = 36$

p = 6

Therefore the equation of the required line is x + y = $6\sqrt{2}$

40) A polygon has 90 diagonals. Find the number of its sides?

**Answer :**




Let there be n sides of the polygon. We know that the number of diagonals of n sided polygon is $\frac{n(n-3)}{2}$

⇒ Given $\frac{n(n-3)}{2} = 90$

⇒ $n^2$-2n = 180

⇒ $n^2$-3n-180 = 0

⇒ (n-15) (n+12) = 0

⇒ n = 15 or n = -12

⇒ There are 15 sides for the polygon which has 90 diagonals.

## ANSWER ALL THE QUESTION

7 x 5 = 35

41) a) Find the largest possible domain of the real valued function f(x) = $\frac{\sqrt{4-x^2}}{\sqrt{x^2-9}}$

**Answer :** Given f(x) = $\frac{\sqrt{4-x^2}}{\sqrt{x^2-9}}$

When x = 2, f(x) = 0

When x = -2, f(x) = 0

For all the other values, we get negative value in the square root which is not possible.

∴ Domain = {2, -2}

**(OR)**

b) A box contains two white balls, three black balls and four red balls. In how many ways can three balls be drawn from the box, if atleast one black ball is to be included in the draw?

**Answer :** Three balls must be drawn with atleast one black ball.

The possible choices are as follows

| White balls(2) | Black balls(3) | Red balls(4) | Cobination |
|---|---|---|---|
| 2 | 1 | 0 | $2C_2 \times 3C_1 \times 4C_0$ |
| 0 | 1 | 2 | $2C_0 \times 3C_1 \times 4C_2$ |
| 1 | 1 | 1 | $2C_1 \times 3C_1 \times 4C_1$ |
| 1 | 2 | 0 | $2C_1 \times 3C_2 \times 4C_0$ |
| 0 | 2 | 1 | $2C_0 \times 3C_2 \times 4C_1$ |
| 0 | 3 | 0 | $2C_0 \times 3C_3 \times 4C_0$ |

∴ Required number of ways of drawing 3 balls?

= $2C_2 \times 3C_1 \times 4C_0 + 2C_0 \times 3C_1 \times 4C_2 + 2C_1 \times 3C_1 \times 4C_1 \quad \times 2C_1 \times 3C_2 \times 4C_0 + 2C_0 \times 3C_2 \times 4C_1 + 2C_0 \times 3C_3 \times 4C_0$

= 1×3×1+1×3×6+2×3×4+2×3×1+1×3×4+1×1

= 3 + 18 + 24 + 6 + 12 + 1 = 64

42) a) Solve the equation sin $9\theta$ = sin $\theta$.

**Answer :** sin $9\theta$ = sin $\theta \Rightarrow$sin $9\theta$ - sin $\theta$ = 0

2cos $5\theta$ sin $4\theta$ = 0

Either cos $5\theta$ = 0

When, cos $5\theta$ = 0 $\Rightarrow$ $5\theta$ = (2n+1)$\frac{\pi}{2}$

$\Rightarrow \theta = (2n+1)\frac{\pi}{10}, n \in Z$

(or) sin $4\theta$ = 0

When, sin $4\theta$ = 0 $\Rightarrow$ $4\theta$ = $n\pi$

$\Rightarrow \theta\frac{n\pi}{4}, n \in Z$

Thus, the general solution of the given equation is $\theta = (2n+1)\frac{\pi}{10}, \theta = \frac{n\pi}{4}, n \in Z$.

**(OR)**

b) How many three-digit odd numbers can be formed using the digits 0, 1, 2, 3, 4, 5? if

**The repetition of digits is allowed**

**Answer : The repetition of digits is allowed**

| Hundreds | tens | unit |
|---|---|---|
| 5 | 6 | 3 |

The unit place can be filled in 3 ways using the digits 1, 3, or 5 since we need 3 digit odd numeric

Hundreds place can be filled in 5 ways excluding 0 and repetition of digits is allowed.

Tens place can be filled in 6 ways .

∴ By fundamental principle of multiplication, required number of 3 = digit odd numbers

= 5 × 6 × 3 = 30 × 3 = 90.

43) a) Prove that for any a and b,-$\sqrt{a^2+b^2} \leq$ a sin $\theta$+ b cos $\theta \leq \sqrt{a^2+b^2}$

**Answer :** Now, a sin $\theta$ + b cos$\theta \leq \sqrt{a^2+b^2}[\frac{a}{\sqrt{a^2+b^2}}sin\theta + \frac{b}{\sqrt{a^2+b^2}}cos\theta]$

=$\sqrt{a^2+b^2}$ [cos $\theta$ sin $\theta$ + sin $\alpha$ cos $\theta$] $(where\ cos\alpha = \frac{a}{\sqrt{a^2+b^2}}, sin\alpha = \frac{b}{\sqrt{a^2+b^2}})$

$= \sqrt{a^2+b^2}sin(\alpha+\theta)$

Thus, a sin $\theta$ + b cos $\theta \leq \sqrt{a^2+b^2}$

Hence, -$\sqrt{a^2+b^2}$ $\leq$a sin $\theta$ + b cos $\theta \leq \sqrt{a^2+b^2}$

**(OR)**

b) If P and $p^1$ be the perpendicular from the original upon the straight lines

$x\sec\theta + ycosec\theta = a$and $x\cos\theta - y\sin\theta = a\cos 2\theta$ , prove that 4p$^2$ +p$^1$ = a$^2$

**Answer :** Given p = length of perpendicular from (0, 0) to $x\sec\theta + ycosec\theta = a$

$\Rightarrow p = \left|\frac{0(\sec\theta)+0(cosec\theta)-a}{\sqrt{\sec^2\theta+cosec^2\theta}}\right|$

$\Rightarrow p = \frac{a}{\sqrt{\frac{1}{\cos^2\theta}+\frac{1}{\sin^2\theta}}} = \frac{a}{\sqrt{\frac{\sin^2\theta+\cos^2\theta}{\sin^2\theta\cos\theta}}}$

$\Rightarrow p = \frac{a\sin\theta\cos\theta}{\sqrt{\sin^2\theta+\cos^2\theta}} = \frac{a\sin\theta\cos\theta}{1}$

$\Rightarrow p = a\sin\theta\cos\theta$

Also, it is given that $p^1$ = length of perpendicular from (0, 0) to $x\cos\theta - y\sin\theta = a\cos 2\theta$

$\Rightarrow p^1 = \left|\frac{0(\cos\theta)-0(\sin\theta)-a\cos\theta}{\sqrt{\cos^2\theta+(-\sin\theta)^2}}\right|$

$= \frac{a\cos 2\theta}{1}$

$\Rightarrow p^1 = a\cos 2\theta$

LHS = 4p$^2$ + (p$^1$)$^2$

= 4 (a cos $\theta$ cos $\theta$)$^2$ + (a coos $2\theta$)$^2$

= a$^2$ (2 sin $\theta$ cos $\theta$)$^2$ + a$^2$ (cos $2\theta$)$^2$

= a$^2$ ((sin $2\theta$)$^2$ + (cos $2\theta$)$^2$) = a$^2$ (sin$^2$ $2\theta$ + cos$^2$ $2\theta$)

= a$^2$ (1) Hence Proved.

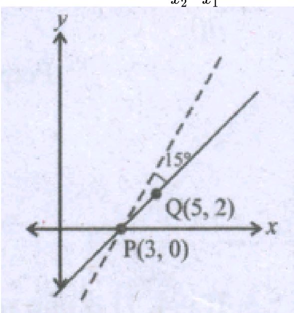
44) a) Prove that $\sqrt[3]{x^3+6} - \sqrt[3]{x^3+3}$ is approximately equal to $\frac{1}{x^2}$ when x is sufficiently large.

**Answer :** LHS = $\left(x^3+6\right)^{\frac{1}{3}}-\left(x^3+3\right)^{\frac{1}{3}}$
$=x^{3\times\frac{1}{3}}\left(1+\frac{6}{x^3}\right)^{\frac{1}{3}}-x^{3\times\frac{1}{3}}\left(1+\frac{3}{x^3}\right)^{\frac{1}{3}}$
$=x\left[1+\frac{1}{3}\left(\frac{6}{x^3}\right)\right]-x\left[1+\frac{1}{3}\left(\frac{3}{x^3}\right)\right]$
$=x+\frac{2}{x^2}-x-\frac{1}{x^2}$
$=\frac{2}{x^2}-\frac{1}{x^2}=\frac{1}{x^2}=RHS$
Hence proved.

**(OR)**

b) If a line joining two points (3, 0) and (5, 2) is rotated about the point (3, 0) in counter clockwise direction through an angle 15°, then find the equation of the line in the new position.

**Answer :** Let P (3, 0) and Q (5, 2) be the given points.
Slope of $PQ=\frac{y_2-y_1}{x_2-x_1}=1\Rightarrow$ the angle of inclination of the line $PQ=tan^{-1}(1)=\frac{\pi}{4}=45^0$




∴ The slope of the line in new position is.
m = tan(45° + 15°)
$Slope=tan(60^0)=(\sqrt{3})$
∴ Equation of the straight line passing through (3,0) and with the slope $\sqrt{3}$ is
$y-0=\sqrt{3}(x-3)$
$\sqrt{3}x-y-3\sqrt{3}=0$

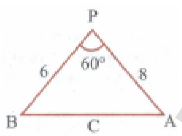
45) a) Let A = {0,1, 2, 3}. Construct relations on A of the following types:
(i) reflexive, symmetric, not transitive.
(ii) reflexive, symmetric, transitive.

**Answer :** (i) As above we get the relation {(0,0),(1,1), (2, 2), (3,3), (1,2), (2,3), (2, 1), (3, 2)} that is reflexive, symmetric and not transitive.
(ii) We have the relation {(0,0), (1, 1), (2, 2), (3, 3)} which is reflexive, symmetric and transitive.

**(OR)**

b) A researcher wants to determine the width of a pond from east to west, which cannot be done by actual measurement from a point P, he finds the distance to the eastern most point of the pond to be 8 km, while the distance to the westernmost point form P to b 6 km. if the angle between the two lines of sight is $60^0$ find the width of the pond?

**Answer :** Let A be the point on the eastern side and B be the point on the western side.
Given PA = 8, PB = 6
Let a = 6, b = 8 and ∠C = 60°
Using cosine formula




$c^2=a^2+b^2$ - 2ab cas C
= 36 + 64 - 2(6) (8) cas 60°
= 100 - 12 × 8 × $\frac{1}{2}$
= 100 - 48 = 52
$\Rightarrow\ C=\sqrt{52}=\sqrt{4\times13}$
$\therefore\ C=2\sqrt{13}km$
Hence the width of the river is $2\sqrt{13}km$

46) a) Find the Co-efficient of $x^{15}$ in $\left(x^2+\frac{1}{x^3}\right)^{10}$

**Answer :** $\left(x^2+\frac{1}{x^3}\right)^{10}$n=10, x=x2, $a=\frac{1}{x^3}$

So the genera; term is $T_{r+1}$=nCr $x^{n-1}$ $a^r$

$\Rightarrow\ T_{r+1}=10C_r(x^2)^{10-r}\left(\frac{1}{x^3}\right)$

=$10C_r$ $x^{20-2r}$.$x^{-3r}$

= $10C_r$ $x^{20-5r}$

To find the Co-efficient of $x^{15}$

put 20-5r=15

⇒ 20 - 15 = 5r

⇒ 5 = 5r

⇒ r=1

putting r=1 in (1)we get

$T_2=10C_1x^{20-5}=10x^{15}$

∴ Co-efficient $x^2$ is 10

**(OR)**

b) If (n + 1)$C_8$ : (n - 3) $P_4$ = 57:16, find n.

**Answer :** Given (n + 1)$C_8$ : (n -3) $P_4$ = 57 : 16

⇒ $\frac{(n+1)C_8}{(n-3)P_4}=\frac{57}{16}$

⇒ 16(n+2)$C_8$ = 57(n-3)$P_4$

$\frac{16(n+1)!}{8!(n+1-8)!}=\frac{57(n-3)!}{(n-3-4)!}$ $\left[\because nP_r=\frac{n!}{(n-r)!},nC_r=\frac{n!}{r!(n-r)!}\right]$

$\frac{16(n+1)n(n-1)(n-2)(n-3)!}{8!(n-7)!}=\frac{57(n-3)!}{(n-7)!}$

(n+1) n(n-1) (n-2) = $\frac{57\times8!}{16}$

= $\frac{57\times8\times7\times6\times5\times4\times3\times2\times1}{16}$

= $3\times19\times7\times6\times54\times3$

$(n+1)n(n-1)(n-2)=21\times20\times19\times18$

n = 20

47) a) Find the condition that one of the roots of $ax^2$+bx+c may be reciprocal of the other.negative of the other

**Answer :** reciprocal of the other

The roots are reciprocal of the other

Let α and $\frac{1}{\alpha}$ be the roots

$\therefore\ \alpha+\frac{1}{\alpha}=\frac{-b}{a}$

and $\alpha.\frac{1}{\alpha}=\frac{c}{a}$

$\Rightarrow\ 1=\frac{c}{a}$

⇒ c = a

which is the required condition

**(OR)**

b) In an examination a student has to answer 5 questions, out of 9 questions in which 2 are compulsory. In how many ways a student can answer the questions?

**Answer :** Since 2 questions are compulsory, a student must answer 3 questions out of 7 questions

This can be done in $7C_3$ ways.

Number of ways of answering 5 questions

= $7C_3=\frac{7\times6\times5}{3\times2\times1}$

= 35

48) a) In △ABC, Prove the following

$\frac{a+b}{a-b}=tan\left(\frac{A+B}{2}\right)cot\left(\frac{A-B}{2}\right)$

**Answer :** $\frac{a}{sin\quad A}=\frac{b}{sinB}=\frac{c}{sinC}=k$

a = k sin A, b = k sin B and c = k sin C

LHS = $\frac{a+b}{a-b}=\frac{2ksinA+2sksinB}{2ksinA-ksinB}=\frac{sinA+sinB}{sinA-sinB}$

= $\frac{2sin\left(\frac{A+B}{2}\right)cos\left(\frac{A-B}{2}\right)}{2sin\left(\frac{A+B}{2}\right)sin\left(\frac{A-B}{2}\right)}=tan\left(\frac{A+B}{2}\right)cot\left(\frac{A-B}{2}\right)=Rhs$

**(OR)**

b) If A + B + C = $180^0$, prove that sin 2A + sin 2B + sin 2C = 4sin A sin B sin C

**Answer :** LHS = sin 2A + sin 2B + sin2C

= $2sin\left(\frac{2A+2B}{2}\right)cos\left(\frac{2A-2B}{2}\right)+2sinCcosC$

= 2sin(A+B)cos(A-B) + 2sin C cos C

= 2sin(180-C)cos(A-B) + 2sin C cos C

= 2sin C cos(A-B) + 2sin C cos C

= 2sin C[cos(A-B) + 2sin C cos C

= 2sin C[cos(A-B) + cos C]

= 2sin C 2sin A sin B

= 4 sin A sin B sin C = RHS

Hence proved