CBSE Sample Question Paper Term 1

Class – XI (Session : 2021 - 22)

SUBJECT- MATHEMATICS 041 - TEST - 04

Class 11 - Mathematics

Time Allowed: 1 hour and 30 minutes **Maximum Marks: 40**

General Instructions:

1. This question paper contains three sections - A, B and C. Each part is compulsory.
2. Section - A has 20 MCQs, attempt any 16 out of 20.
3. Section - B has 20 MCQs, attempt any 16 out of 20
4. Section - C has 10 MCQs, attempt any 8 out of 10.
5. There is no negative marking.
6. All questions carry equal marks.

Section A

Attempt any 16 questions

1. If A = {(x, y) : $x^2 + y^2 = 25$} and B = {(x, y) : $x^2 + 9y^2 = 144$} then A ∩ B contains **[1]**

    a) three points   b) two points

    c) one point   d) four points

2. Domain of definition of the function f(x) = $\frac{3}{4-x^2} + \log_{10}(x^3 - x)$ is **[1]**

    a) (- 1, 0) ∪ (1, 2) ∪ (2, ∞)   b) (1, 2) ∪ (2, ∞)

    c) (- 1, 0) ∪ (1, 2)   d) (1, 2)

3. A line is drawn through the points (3, 4) and (5, 6). If the is extended to a point whose ordinate is – 1, then the abscissa of that point is **[1]**

    a) -1   b) 1

    c) 0   d) - 2

4. The A.M. between two positive numbers a and b is twice the G.M. between them. The ratio of the numbers is **[1]**

    a) none of these   b) $(\sqrt{3}+1):(\sqrt{3}-1)$

    c) $(2+\sqrt{3}):(2-\sqrt{3})$ d) $(2+3):(\sqrt{2}-3)$

5. A line L passes through the points (1, 1) and (2, 0) and another line M which is perpendicular to L passes through the point (1/2, 0). The area of the triangle formed by these lines with y axis is : **[1]**

    a) 25/8   b) 25/16

    c) none of these   d) 25/4

[1]

6. $\underset{x \to 0}{Lim} \frac{(1+x)^n - 1}{x}$ is equal to

a) -n

b) 1

c) 0

d) n

7. If the variance of the data is V, then its S.D. is **[1]**

a) $\pm\sqrt{V}$

b) $\sqrt{V}$

c) V^2

d) - $\sqrt{V}$

8. The set A = {x : x is a positive prime number less than 10} in the tabular form is **[1]**

a) {2, 3, 5, 7}

b) {1, 2, 3, 5, 7}

c) none of these

d) {1, 3, 5, 7, 9}

9. If f(x) $= \frac{x-1}{x+1}$, then $\left(f \frac{1}{f(x)}\right)$ equals **[1]**

a) 0

b) 1

c) x

d) $\frac{1}{x}$

10. The line which is parallel to X-axis and crosses the curve y = $\sqrt{x}$ at an angle of 45^0 is: **[1]**

a) y = $\frac{1}{2}$

b) y = 1

c) none of these

d) y = $\frac{1}{4}$

11. How many numbers are there between 102 and 750 which are divisible by 8? **[1]**

a) 78

b) 75

c) 81

d) 84

12. For specifying a straight line, how many geometrical parameters should be known? **[1]**

a) 4

b) 2

c) 1

d) 3

13. $\underset{x \to \infty}{lim} \left(\sqrt{x^2+1} - x\right)$ is equal to **[1]**

a) 0

b) 2

c) -1

d) $\frac{1}{2}$

14. Coefficient of variation of two distributions are 50 and 60, and their arithmetic means are 30 and 25 respectively. Difference of their standard deviation is **[1]**

a) 1

b) 0

c) 1.5

d) 2.5

15. P(A) = P(B) $\Rightarrow$ **[1]**

a) $B \subseteq A$

b) A = B

c) B $\supseteq$ A

d) B $\subset$ A

16. The domain of the function $f(x) = \sqrt{\frac{(x+1)(x-3)}{x-2}}$ is **[1]**

a) $(-1, 2) \cup [3, \infty)$

b) $[-1, 2) \cup [3, \infty)$

c) None of these | d) $[-1,2] \cup [3,\infty)$

17. The lines y = mx, y + 2x = 0, y = 2x + λ and y = - mx + λ form a rhombus if m = **[1]**

a) 1 | b) -2

c) none of these | d) - 1

18. Which term of the GP $\sqrt{3}$, 3, 3$\sqrt{3}$, ...is 729? **[1]**

a) 10th | b) 12th

c) 11th | d) 13th

19. L is a variable line such that the algebraic sum of the distances of the points (1, 1), (2, 0) and (0, 2) from the line is equal to zero. The line L will always pass through **[1]**

a) (2, 1) | b) (1, 1)

c) (1, 2) | d) None of these

20. $\lim\limits_{x \to 2} \frac{\sqrt{1+\sqrt{2+x}}-\sqrt{3}}{x-2}$ is equal to **[1]**

a) $\frac{1}{8\sqrt{3}}$ | b) $8\sqrt{3}$

c) $\sqrt{3}$ | d) $\frac{1}{\sqrt{3}}$

Section B

Attempt any 16 questions

21. If two variables X and Y are connected by the relation 2x + y = 3, then $\rho(X,Y)$ is equal to **[1]**

a) 2 | b) -1

c) 1 | d) - 2

22. Out of 800 boys in a school, 224 played cricket, 240 played hockey and 336 played basketball. Of the total, 64 played both basketball and hockey, 80 played cricket and basketball and 40 played cricket and hockey, 24 played all the three games. The number of boys who did not play any game is: **[1]**

a) 160 | b) 128

c) 150 | d) 240

23. The range of the function f(x) = |x - 1| is **[1]**

a) R | b) $(-\infty, 0)$

c) $(0, \infty)$ | d) $[0, \infty)$

24. Two vertices of a triangle are (-2, -1) and (3, 2) and the third vertex lies on the line x + y = 5. If the area of the triangle is 4 square units, then the third vertex is **[1]**

a) (5, 0) or (1, 4) | b) (5, 0) or (4, 1)

c) (0, 5) or (4, 1) | d) (0, 5) or (1, 4)

25. In an A.P. the pth term is q and the (p + q) th term is 0. Then the qth term is **[1]**

a) p | b) -p

c) p - q | d) p + q

26. $\lim\limits_{x \to 0} \frac{1-\cos 2x}{x}$ is **[1]**

a) 0
b) 1
c) 4
d) 2

27. If the median = (mode + 2 mean)μ, then μ is equal to **[1]**

a) $\frac{2}{3}$
b) 3
c) 2
d) $\frac{1}{3}$

28. If A and B be two sets such that n(A) = 70 , n(B) = 60 , and n(A ∪ B) = 110 . Then n (A ∩ B) is equal to **[1]**

a) 240
b) 100
c) 120
d) 20

29. The range of the function f(x) $= \frac{x+2}{|x+2|}, x \neq -2$ is **[1]**

a) {1}
b) {-1, 1}
c) $(0, \infty)$
d) {-1, 0, 1 }

30. The equations of the lines through (-1, -1) and making angles of 45^0 with the line x + y = 0 are **[1]**

a) none of these
b) x + 1 = 0, y + 1 = 0
c) x – 1 = 0, y – x = 0
d) x + y = 0, y + 1 = 0

31. The sum of first 80 natural numbers is **[1]**

a) 3236
b) 3250
c) 3248
d) 3240

32. $\lim\limits_{\theta \to \pi/2} \frac{1-\sin\theta}{(\pi/2-\theta)\cos\theta}$ is equal to **[1]**

a) -1
b) 1
c) $-\frac{1}{2}$
d) $\frac{1}{2}$

33. If for a sample of size 60, we have the following information Σx_i^2 = 18000 and Σx_i = 960, then the variance is **[1]**

a) 16
b) 44
c) 6.63
d) 22

34. The argument of $\frac{1-i}{1+i}$ is **[1]**

a) $-\frac{\pi}{2}$
b) $\frac{3\pi}{2}$
c) $\frac{5\pi}{2}$
d) $\frac{\pi}{2}$

35. The product (32), $(32)^{\frac{1}{6}}, (32)^{\frac{1}{36}}$ ... to ∞ is equal to **[1]**

a) 0
b) 64
c) 16
d) 32

36. For any set A, (A')' is equal to **[1]**

a) ϕ

b) None of these

c) A

d) A'

37. If $A=\{(x,y): x^2+y^2=25\}$ and $B=\{(x,y): x^2+9y^2+y^2=144\}$, then $A \cap B$ contains **[1]**

a) three points

b) two points

c) four points

d) one point

38. If (x + iy)$^{\frac{1}{3}}$ = a + ib, then $\frac{x}{a}+\frac{y}{b}=$ **[1]**

a) 1

b) None of these

c) 0

d) -1

39. The arithmetic mean of two numbers is 34 and their geometric mean is 16. The numbers are **[1]**

a) 56 and 12

b) 64 and 4

c) 60 and 8

d) 52 and 16

40. The fourth term of a G. P. is 2, then product of first 7 terms is **[1]**

a) 32

b) 128

c) 64

d) 30

Section C

Attempt any 8 questions

41. If a set A has n elements then the total number of subsets of A is **[1]**

a) 2n

b) n

c) 2^n

d) n^2

42. Let $f\left(x+\frac{1}{x}\right)=x^2+\frac{1}{x^2}, x \neq 0$, then f(x) = **[1]**

a) x^2-2

b) x^2-1

c) x^2

d) x^2+1

43. The complex numbers z = x + iy ; x , y $\in$ R which satisfy the equation $\left|\frac{z-3i}{z+3}\right|=1$ lies on **[1]**

a) the y axis

b) the x axis

c) the line x + y = 0

d) the line parallel to y axis

44. If a, b, c are in A. P., a, mb, c are in G.P., then a, m^2b, c are in **[1]**

a) H.P.

b) A.P.

c) none of these

d) G.P.

45. If Cov(X, Y) = 0, then $\rho(X, Y)$ = **[1]**

a) ± 1

b) 0

c) - 1

d) 1

Question No. 46 to 50 are based on the given text. Read the text carefully and answer the questions:

Two complex numbers Z_1 = a + ib and Z_2 = c + id are said to be equal, if a = c and b = d.

46. If (x + y) + i(x - y) = 4 + 6i, then xy is equal to **[1]**

a) 5 b) -5

c) 4 d) -4

47. If $\frac{(1+i)^2}{2-i}$ = x + iy, then value of x + y is **[1]**

a) $\frac{1}{5}$ b) $\frac{4}{5}$

c) $\frac{3}{5}$ d) $\frac{2}{5}$

48. If $\left(\frac{1-i}{1+i}\right)^{100}$ = a + ib, then the values of a and b are respectively **[1]**

a) 0, 1 b) 1, 2

c) 1, 0 d) 2, 1

49. If (2a + 2b) + i(b - a) = -4i, then the real values of a and b are **[1]**

a) 3, 1 b) 2, 3

c) 2, -2 d) -2, 2

50. If (3a - 6) + 2ib = -6b + (6 + a)i, then the real values of a and b are respectively. **[1]**

a) 4, 2 b) 3, -3

c) -2, 2 d) 2, -2

Solution

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Class 11 - Mathematics

Section A

1. **(d)** four points

   Explanation: From A, $x^2 + y^2 = 25$ and from B, $x^2 + 9y^2 = 144$

   $\therefore$ From B, $(x^2 + y^2) + 8y^2 = 144$

   $\Rightarrow 25 + 8y^2 = 144$

   $\Rightarrow 8y^2 = 119$

   $\Rightarrow y = \pm\sqrt{\frac{119}{8}}$

   $\therefore x^2 + y^2 = 25 \Rightarrow x^2 = 25 - y^2 = 25 - \frac{119}{8} = \frac{81}{8}$

   $\Rightarrow x = \pm\sqrt{\frac{81}{8}}$

   Since we solved equations simultaneously, therefore $A \cap B$ has four points A has 2 elements & B has 2 elements.

2. **(a)** $(-1, 0) \cup (1, 2) \cup (2, \infty)$

   Explanation: For f(x) to be real, we must have

   $4 - x^2 \neq 0$ and $x^3 - x > 0$

   $\Rightarrow x^2 \neq 4$ and $x(x^2 - 1) > 0$

   $\Rightarrow x \neq 2, -2$ and $x(x - 1)(x + 1) > 0$

   $\Rightarrow x \neq 2, -2$ and $-1 < x < 0, 1 < x < \infty$

   $\therefore$ Domain = $(-1, 0) \cup (1, 2) \cup (2, \infty)$

3. **(d)** - 2

   Explanation: The slope of the given line is $\frac{y_2-y_1}{x_2-x_1} = \frac{6-4}{5-3} = 1$

   Therefore $\frac{4-(-1)}{3-x} = 1$

   That is 4 + 1 = 3 - x

   Therefore x = -2

4. **(c)** $(2+\sqrt{3}) : (2-\sqrt{3})$

   Explanation: Given a and b are two positive numbers

   Also given A.M=2.G.M

   $\frac{a+b}{2} = 2\sqrt{ab}$

   $\Rightarrow \frac{a+b}{2\sqrt{ab}} = \frac{2}{1}$

   Applying componendo dividendo

   $\frac{a+b+2\sqrt{ab}}{a+b-2\sqrt{ab}} = \frac{2+1}{2-1}$

   $\Rightarrow \frac{(\sqrt{a}+\sqrt{b})^2}{(\sqrt{a}-\sqrt{b})^2} = \frac{3}{1}$

   $\Rightarrow \frac{\sqrt{a}+\sqrt{b}}{\sqrt{a}-\sqrt{b}} = \frac{\sqrt{3}}{1}$

   Applying componendo dividendo again we get

   $\Rightarrow \frac{2\sqrt{a}}{2\sqrt{b}} = \frac{\sqrt{3}+1}{\sqrt{3}-1}$

   $\Rightarrow \frac{a}{b} = \frac{(\sqrt{3}+1)^2}{(\sqrt{3}-1)^2} = \frac{4+2\sqrt{3}}{4+2\sqrt{3}} = \frac{2(2+\sqrt{3})}{2(2-\sqrt{3})} = \frac{2+\sqrt{3}}{2-\sqrt{3}}$

5. **(b)** 25/16

   Explanation: The equation of the line joining the two points (x_1, y_1) and (x_2, y_2) is

   $\frac{y-y_1}{y_2-y_1} = \frac{x-x_1}{x_2-x_1}$

   The given points are (1, 1) and (2, 0)

On substituting the values we get

$\frac{y-1}{0-1} = \frac{x-1}{2-1}$

On simplifying we get,

x + y - 2 = 0

The line which is perpendicular to this line is x - y + k = 0

Since it passes through (1/2, 0)

(1/2) - 0 = k

This implies k = -1/2

Hence the equation of this line is x - y - 1/2 = 0

On solving these twolines we get the point of intersection as (5/4, 3/4)

The point which line x + y - 2 = 0 cuts the Y axis is (0, 2) and the point which the line x - y - 1/2 = 0 cuts the Y axis is (0, -1/2)

Hend e the area of the triangle = [1/2] x [5/4] x [5/4] = 25/16 squnits

6. **(d)** n

Explanation: $\underset{x \to 0}{Lt} \frac{(1+x)^n - 1^n}{(1+x)-(1)} = \underset{x \to 0}{Lt} n(1+x)^{n-1} = n$

7. **(b)** $\sqrt{V}$

Explanation: Standard deviation have the same units as the data but the variance is mean of the square of differences.

8. **(a)** {2, 3, 5, 7}

Explanation: Prime no. less then 10 is 2, 3, 5, 7 so

Set A = {2, 3, 5, 7}

9. **(d)** $\frac{1}{x}$

Explanation: We have $f(x) = \frac{x-1}{x+1}$ then

$f\left(\frac{1}{f(x)}\right) = \frac{\frac{1}{f(x)}-1}{\frac{1}{f(x)}+1} = \frac{1-f(x)}{1+f(x)}$

$= \frac{1-\frac{x-1}{x+1}}{1+\frac{x-1}{x+1}} = \frac{x+1-x+1}{x+1+x-1} = \frac{2}{2x} = \frac{1}{x}$

10. **(a)** y = $\frac{1}{2}$

Explanation: The equation of the line which is a tangent to the curve y = $\sqrt{x}$ is

y = mx + a/m

Since it makes and angle of 45^{o}, m = 1

y^2 = x implies a = $\frac{1}{4}$

Hence the equation of the tangent is y = x + $\frac{1}{4}$

That is the y-intercept is $\sqrt{\frac{1}{4}} = \frac{1}{2}$

Hence the equation of the line is y = $\frac{1}{2}$

11. **(c)** 81

Explanation: The required numbers are 104, 112, 120,..., 744.

This is an AP in which a = 104, d = 8 and T_n = 744.

Therefore, a + (n - 1) d = 744 $\Rightarrow$ 104 + (n - 1) $\times$ 8 = 744

$\Rightarrow$ (n - 1) = $\frac{640}{8} = 80$

$\Rightarrow$ n = 81.

Therefore, there are 81 such numbers.

12. **(b)** 2

Explanation: We know that general equation of straight line or linear equation in two variables is ax + by + c = 0

We know that at least one of a and b must be non zero.

Suppose a $\neq$ 0 Then equation of the line is :

$x+\frac{b}{a}y+\frac{c}{a}=0$ or x + py + q = 0,
where $p=\frac{b}{a}$ or $q=\frac{c}{a}$
Therefore,for getting the equation of the fixed straight line two parameters should be known.

13. **(a)** 0
Explanation: Put x = $\frac{1}{t}$
Then, $\lim\limits_{t\to 0}\frac{\left(\sqrt{1+t^2}-1\right)}{t}$
Applying L'Hospital
$\lim\limits_{t\to 0}\frac{\frac{2t}{2\sqrt{1+t^2}}}{1}$ = 0

14. **(b)** 0
Explanation: Given Coefficient of variation of two distributions are
CV_1 = 50 and CV_2 = 60
And there arithmetic means are
$\overline{x}_1$ = 30, $\overline{x}_2$ = 25
We know Coefficient of variation can be written as
CV = $\frac{\sigma}{\bar{x}}\times$ 100
Now for first distribution, we have
CV_1 = $\frac{\sigma_1}{\bar{x}_1}\times$ 100
Substituting corresponding values, we get
50 = $\frac{\sigma_1}{30}\times$ 100
50 = $\frac{\sigma_1}{3}\times$ 10
$\frac{50}{10}=\frac{\sigma_1}{3}$
5 = $\frac{\sigma_1}{3}$
$\Rightarrow\ \ \sigma_2$ = 15 ..(i)
Now for second distribution, we have
CV_2 = $\frac{\sigma_2}{\bar{x}_2}\times$ 100
Substituting corresponding values, we get
60 = $\frac{\sigma_2}{25}\times$ 100
60 = $\sigma_2\times$ 4
$\frac{60}{4}=\sigma_2$
$\Rightarrow\ \ \sigma_2$ = 15 ...(ii)
So from equation (i) and (ii), the difference of their standard deviation is 0

15. **(b)** A = B
Explanation: To prove A = B it is enough to prove B $\subseteq$ A and A $\subseteq$ B
So let P(A) = P(B)
Also let x $\in$ A
Now we have A $\in$ P(A)
$\Rightarrow$ A $\in$ P(B), since P(A) = P(B)
$\therefore$ x $\in$ E for some E $\in$ P(B)
Now E $\subset$ B
$\Rightarrow$ x $\in$ B
Hence we proved A $\subseteq$ B
Similarly by taking x $\in$ B and showing x $\in$ A we get B $\subseteq$ A
Hence A = B

16. **(b)** $[-1,2)\cup[3,\infty)$
Explanation: Here $\frac{(x+1)(x-3)}{(x-2)}\geq 0$
But $x\neq 2$
so, $x\in[-1,2)\cup[3,\infty)$

17. **(b)** -2
Explanation: Rhombus is a parallelogram in which the opposite sides are equal and parallel.
Therefore the lines y = mx and y = -2x are parallel, similarly y = 2x + λ and y = -mx + λ are parallel.
If two lines are equal, then their slopes are equal.
This implies m = -2

18. **(b)** 12th
Explanation: Given GP is $\sqrt{3}$, 3, 3$\sqrt{3}$ ...
Here, we have a = $\sqrt{3}$ and r = $\frac{3}{\sqrt{3}}$ = $\sqrt{3}$.
Let T_n = 729. Then, ar^{n-1} = 729 $\Rightarrow$ $\sqrt{3} \times (\sqrt{3})^{n-1}$ = 729 = 36
$\therefore (\sqrt{3})^n = (\sqrt{3})^{12} \Rightarrow$ n = 12.

19. **(b)** (1, 1)
Explanation: (1, 1)
Let ax + by + c = 0 be the variable line. It is given that the algebraic sum of the distances of the points (1, 1), (2, 0) and (0, 2) from the lines is equal to zero.
$\therefore \frac{a+b+c}{\sqrt{a^2+b^2}} + \frac{2a+0+c}{\sqrt{a^2+b^2}} + \frac{0+2b+c}{\sqrt{a^2+b^2}} = 0$
$\Rightarrow$ 3a + 3b + 3c = 0
$\Rightarrow$ a + b + c = 0
Substituting c = - a - b in ax + by + c = 0, we get:
ax + by + a - b = 0
$\Rightarrow$ a(x - 1) + b(y - 1) = 0
$\Rightarrow$ (x - 1) + $\frac{b}{a}$ (y - 1) = 0
This lines is of the form
$L_1 + \lambda L_2 = 0$, which passes through the intersection of $L_1 = 0$ and $L_2 = 0$, i.e. substituting the obtained values,
x - 1 = 0 and y - 1 = 0
$\Rightarrow$ x = 1, y = 1

20. **(a)** $\frac{1}{8\sqrt{3}}$
Explanation: $\because \lim\limits_{x \to 2} \frac{\sqrt{1+\sqrt{2+x}}-\sqrt{3}}{x-2} = \lim\limits_{x \to 2} \frac{\sqrt{1+\sqrt{2+x}}-\sqrt{3}}{x-2} \times \frac{\sqrt{1+\sqrt{2+x}}+\sqrt{3}}{\sqrt{1+\sqrt{2+x}}+\sqrt{3}}$
$= \lim\limits_{x \to 2} \frac{\sqrt{2+x}-2}{(x-2)(\sqrt{1+\sqrt{2+x}}+\sqrt{3})}$
$= \lim\limits_{x \to 2} \frac{\sqrt{2+x}-2}{(x-2)(\sqrt{1+\sqrt{2+x}}+\sqrt{3})} \times \frac{\sqrt{2+x}+2}{\sqrt{2+x}+2}$
$= \lim\limits_{x \to 2} \frac{(x-2)}{(x-2)(\sqrt{1+\sqrt{2+x}}+\sqrt{3})(\sqrt{2+x}+2)}$
$= \lim\limits_{x \to 2} \frac{1}{(\sqrt{1+\sqrt{2+x}}+\sqrt{3})(\sqrt{2+x}+2)}$
$= \frac{1}{(\sqrt{1+\sqrt{2+2}}+\sqrt{3})(\sqrt{2+2}+2)}$
$= \frac{1}{2\sqrt{3}\times 4}$
$= \frac{1}{8\sqrt{3}}$

Section B

21. **(b)** -1
Explanation: Comparing the given equation with ax + by + c = 0
a = 2, b = 1 and c = -3
Therefore, $\rho(x, y) = \frac{\frac{-b}{a}}{\left|\frac{b}{a}\right|} = -1$ (as ab > 1 so, a and b are of same sign)

22. **(a)** 160
Explanation: Let U denote the set of boys in a school and let C, H and B denote the sets of boys who played Cricked, Hockey and Basketball respectively.

Then we have n(U) = 800, n(C) = 224, n(H) = 240 and n(B) = 336
Also $n(C \cap H) = 40 \quad , n(B \cap H) = 64, n(C \cap B) = 80$ and $n(C \cap B \cap H) = 24$
Now we have $n(C \cup H \cup B) = n(C) + n(H) + n(B)$
$-n(C \cap H) - n(B \cap H) - n(C \cap B) + n(C \cap B \cap H)$
$\Rightarrow n(C \cup H \cup B) =$ 224 + 240 + 336 - 40 - 64 - 80 + 24
$\Rightarrow n(C \cup H \cup B) = 640$
Which means the number of boys who play any one game = 640
Hence the number of boys who Did not play any game $= n(U) - n(C \cup H \cup B) = 800 - 640 = 160$

23. **(d)** $[0, \infty)$
Explanation: A modulus function always gives a positive value
R(f) = $[0, \infty)$

24. **(c)** (0, 5) or (4, 1)
Explanation: Let (h, k) be the third vertex of the triangle.
It is given that the area of the triangle with vertices (h, k), (-2, -1) and (3, 2) is 4 square units.
$\frac{1}{2}$[h(-1 - 2) - 3(-1 - k) - 2(2 - k)] = 4
$\Rightarrow$ 3h - 5k + 1 = $\pm$8
Taking positive sign, we get,
3h - 5k + 1 = 8
3h - 5k + 7 = 0 ...(i)
Taking negative sign, we get,
3h - 5k + 9 = 0 ...(ii)
The vertex (h, k) lies on the line x + y = 5.
h + k - 5 = 0 ...(iii)
On solving (i) and (iii), we find (4, 1) to be the coordinates of the third vertex.
Similarly, on solving (ii) and (iii), we find the required vertex (0, 5) or (4, 1).

25. **(a)** p
Explanation: Suppose a, d be the first term and common difference respectively.
Thus, T_p = a + (p - 1) d = and ... (1)
T_P + q = a + (p + q - 1) d = 0 ... (2)
Subtracting (1), from (2) we obtain qd = - q
Putting in (1) we obtain, a = q - (p - 1) (-1) = q + p - 1
Now, q = a + (q - 1) d = q + p - 1 + (q - 1) (-1)
= q + p - 1 - q + 1 = p

26. **(a)** 0
Explanation: $\lim\limits_{x \to 0} \frac{1 - \cos 2x}{x}$
$= \lim\limits_{x \to 0} \frac{2 \sin^2 x}{x}$
$= \lim\limits_{x \to 0} 2x \times \frac{\sin^2 x}{x^2}$
= 0

27. **(d)** $\frac{1}{3}$
Explanation: We know that 3 median = mode + 2 mean
So,
3(mode + 2mean) μ = mode + 2mean
μ = $\frac{1}{3}$

28. **(d)** 20
Explanation: n(A $\cap$ B) = n(A) + n(B) - n(A $\cup$ B)
= 70 + 60 - 100
= 20

29. **(b)** {-1, 1}
Explanation: We have $f(x) = \frac{x+2}{|x+2|}$

when x > -2,

f(x) = $\frac{x+2}{x+2} = 1$

When x < -2

We have $= \frac{x+2}{-(x+2)}$ = -1

R(f) = {-1, 1}

30. **(b)** x + 1 = 0, y + 1 = 0

Explanation: The lines x + 1 = 0 and y + 1 = 0 are perpendicular to each other.

The slope of the line x + y = 0 is -1

Hence the angle made by this line with respect to X-axis is 45^{o}

In other words, the angle made by this line with x + 1 = 0 is 45^{o}

Clearly the other line with which it can make 45^{o} is y + 1 = 0

31. **(d)** 3240

Explanation: We have to calculate, 1+ 2 + 3 + ...+ 80.

We know, sum is given by, $S = \frac{n}{2}(a + l)$ = $\frac{80}{2} \times (1 + 80)$ = (40 × 81) = 3240.

32. **(d)** $\frac{1}{2}$

Explanation: $\lim\limits_{\theta \to \frac{\pi}{2}} \frac{1-\sin\theta}{\left(\frac{\pi}{2}-\theta\right)\cos\theta}$

$= \lim\limits_{h \to 0} \frac{1-\cos h}{\left(\frac{\pi}{2}-\left(\frac{\pi}{2}-h\right)\right)\sin h}$

$= \lim\limits_{h \to 0} \frac{2\sin^2\frac{h}{2}}{h\sin h}$

$= \lim\limits_{h \to 0} \frac{2\sin^2\frac{h}{2}}{\frac{\frac{4h^2}{4}}{\frac{\sin h}{h}}}$

$= \frac{2}{4}$

$= \frac{1}{2}$

33. **(b)** 44

Explanation: Given,

Σx_i^2 = 18000, Σx_i = 960 and n = 60

∴ Variance

= $\frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2$

= $\frac{18000}{60} - \left(\frac{960}{60}\right)^2$

= 300 - 256

= 44

34. **(a)** $-\frac{\pi}{2}$

Explanation: $-\frac{\pi}{2}$

Let z $= \frac{1-i}{1+i}$

$\Rightarrow z = \frac{1-i}{1+i} \times \frac{1-i}{1-i}$

$\Rightarrow z = \frac{1+i^2-2i}{1-i^2}$

$\Rightarrow z = \frac{1-1-2i}{1+1}$

$\Rightarrow z = \frac{-2i}{2}$

$\Rightarrow$ z = -i

Since, z lies on negative direction of imaginary axis.

Therefore, arg (z) $= \frac{-\pi}{2}$

35. **(b)** 64

Explanation: We have, 32 $\times (32)^{\frac{1}{6}} \times (32)^{\frac{1}{36}} \times \infty$

= $32^{\left(1+\frac{1}{6}+\frac{1}{36}+\ldots\infty\right)}$

= $32\left(\frac{1}{1-\frac{1}{6}}\right)$ [$\because$ it is a G.P.]

= $32^{\left(\frac{6}{5}\right)}$

= $\left(2^5\right)^{\left(\frac{6}{5}\right)}$

= 2^6

= 64

36. **(c)** A

Explanation: We have to find (A')' = ?

Now, A = U\A

$\Rightarrow$ (A')' = (U\A)' = U'\A'

$\Rightarrow$ (A')' = U'\(U\A)

$\Rightarrow$ (A')' = U'\(U\A)

$\Rightarrow$ (A')' = A

37. **(c)** four points

Explanation: We will solve equations in A and B simultaneously and find values of x and y. The no. of possible ordered pairs from these values will be elements in $A \cap B$.

Now, From B,$x^2 + 9y^2 + y^2 = 144$ and

From $A,\ x^2 + y^2 = 25$

$\therefore 9y^2 + 25 = 144 \Rightarrow 9y^2 = 119$

$\Rightarrow y = \pm\sqrt{\frac{119}{9}}$

$\therefore x^2 + y^2 = 25 \Rightarrow x^2 = 25 = \frac{119}{9} = \frac{106}{9}$

$\Rightarrow x = \pm\sqrt{\frac{106}{9}}$

$\therefore$ x has two value, y has two values

$\therefore$ possible ordered pairs = 4

$\therefore A \cap B$ has 4 elements

38. **(b)** None of these

Explanation: $(x + iy)^{\frac{1}{3}}$ = a + ib

Cubing on both the sides, we get :

x + iy = $(a + ib)^{\frac{1}{3}}$

x + iy = $(a + ib)^3$

$\Rightarrow$ x + iy $a^3 (ib)^3 + 3a^2bi + a(ib)^2$

$\Rightarrow$ x + iy = $a^3 + i^3b^3 + 3a^2ib + 3i^2ab^2$

$\Rightarrow$ x + iy = $a^3 - ib^3 + 3a^2ib - 3ab^2$ ($\because i^2 = -1, i^3 = -i$)

$\Rightarrow$ x + iy = $a^3 - .3ab^2 + i(-b^3 + 3a^2b)$

$\therefore$ x = $a^3 - 3ab^2$ and y = $3a^2b - b^3$

or $\frac{x}{a} = a^2 - 3b^2$ and $\frac{y}{b} = 3a^2 - b^2$

$\Rightarrow \frac{x}{a} + \frac{y}{b} = a^2 - 3b^2 + 3a^2 - b^2$

$\Rightarrow \frac{x}{a} + \frac{y}{b} = 4a^2 - 4b^2$

39. **(b)** 64 and 4

Explanation: Let the required numbers be a and b. Then,

$\left(\frac{a+b}{2} = 34 \Rightarrow a + b = 68\right)$ and $\sqrt{ab} = 16 \Rightarrow ab = (16)^2$ = 256

$(a - b)^2 = (a + b)^2 - 4ab = (68)^2 - 4 \times 256$ = (4624 - 1024)= 3600

$\Rightarrow a - b = \sqrt{3600} = 60$

On solving a + b = 68 and a - b = 60, we obtain a = 64, & b= 4.

$\therefore$ the required numbers are 64 and 4.

40. **(b)** 128

Explanation: Let a be the first term and r be the common ratio of the G.P

Given $T_4 = 2 \Rightarrow ar^3 = 2$

Then product of the first 7 terms = $a \cdot ar \cdot ar^2 \cdot ar^3 \cdot ar^4 \cdot ar^5 \cdot ar^6$ = $a^7r^{21} = (ar^3)^7 = 2^7 = 128$

Section C

41. **(c)** 2^n

Explanation: The total no of subsets = 2^n

42. **(a)** $x^2 - 2$

Explanation: $f\left(x + \frac{1}{x}\right) = x^2 + \frac{1}{x^2} = \left(x + \frac{1}{x}\right)^2 - 2$

$\therefore f(x) = x^2 - 2$

43. **(c)** the line x + y = 0

Explanation: Let z=x+iy

Now $\left|\frac{z-3i}{z+3}\right| = 1$

$\Rightarrow |z-3i| = |z+3|$

$\Rightarrow |(x+iy)-3i| = |x+iy+3|$

$\Rightarrow |x+i(y-3)| = |(x+3)+iy|$

$\Rightarrow \sqrt{(y-3)^2+x^2} = \sqrt{(x+3)^2+(y)^2}$

$\Rightarrow (y-3)^2+x^2 = (x+3)^2+(y)^2$

$\Rightarrow y^2-6y+9+x^2 = x^2+6x+9+y^2$

$\Rightarrow 6x+6y = 0$

$\Rightarrow x+y = 0$

44. **(a)** H.P.

Explanation: If the numbers a, b, c are in A.P. we have b = $\frac{a+c}{2}$ ....(i)

Since a, mb, c are in G.P. we get $(mb)^2 = ac$ ....(ii)

Now $m^2b = \frac{2(mb)^2}{2b} = \frac{2ac}{a+c}$

$\Rightarrow$ a, m^2b, c are in H.P.

45. **(b)** 0

Explanation: Here, $\rho(x,y) = \frac{\operatorname{cov}(x,y)}{\sigma_x \sigma_y} = \frac{0}{\sigma_x \sigma_y}$ = 0

46. **(b)** -5

Explanation: -5

47. **(d)** $\frac{2}{5}$

Explanation: $\frac{2}{5}$

48. **(c)** 1, 0

Explanation: 1, 0

49. **(c)** 2, -2

Explanation: 2, -2

50. **(c)** -2, 2

Explanation: -2, 2