CBSE Sample Question Paper Term 1

Class – XI (Session : 2021 - 22)

SUBJECT- MATHEMATICS 041 - TEST - 02

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. The number of proper subsets of the set {1, 2, 3} is : **[1]**

a) 6 b) 7

c) 8 d) 5

2. The function $\sin\left(\sin\frac{x}{3}\right)$ is periodic with period **[1]**

a) 8π b) 6π

c) 2π d) 4π

3. Mark the correct answer for: $(i^{109} + i^{144} + i^{119} + i^{124}) = ?$ **[1]**

a) 0 b) i

c) 2 d) -2i

4. A line passes through (2,2) and is perpendicular to the line 3x+y=3, then its y intercept is **[1]**

a) 4/3 b) 1

c) 2/3 d) 1/3

5. The distance between the lines 3x + 4y = 9 and 6x + 8y = 15 is **[1]**

a) $\frac{7}{10}$ b) $\frac{3}{10}$

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

6. Maximum value of $x^3 - 3x + 2$ in [0, 2] is **[1]**

a) 32 b) 4

c) 1 d) 2

7. The sum of the squares deviations for 10 observations taken from their mean 50 is 250. The **[1]**

coefficient of variation is

a) 40%
b) None of these
c) 50%
d) 10%

8. A survey shows that 63% of the people watch a News Channel whereas 76% watch another channel. If x% of the people watch both channels, then **[1]**

a) x = 39
b) x = 63
c) $39 \leq x \leq 63$
d) x = 35

9. If f(x) = $\frac{2x+1}{3x-2}$, then (fof)(2) is equal to **[1]**

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

10. Find the Amplitude of -i **[1]**

a) $-\frac{\pi}{2}$
b) $\frac{\pi}{2}$
c) π
d) none of these

11. The inclination of the line x – y + 3 = 0 with the positive direction of x-axis is **[1]**

a) –135°
b) 45°
c) 135°
d) – 45°

12. The two lines ax + by = c and a'x + b'y = c' are perpendicular if **[1]**

a) ab' = ba'
b) aa' + bb' = 0
c) ab + a'b' = 0
d) ab' + ba' = 0

13. $\lim\limits_{x \to 3} \frac{\sqrt{x^2+10}-\sqrt{19}}{x-3}$ is equal to **[1]**

a) 1
b) $\frac{6}{\sqrt{19}}$
c) $\frac{3}{\sqrt{19}}$
d) 0

14. The S.D.of 7 scores 1, 2, 3, 4, 5, 6, 7 is **[1]**

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

15. Given n (U) = 20 , n (A) = 12 , n (B) = 9 , n (A ∩ B) = 4 , where U is the universal set , A and B are subsets of U , then $n(A \cup B)'$ **[1]**

a) 3
b) 11
c) 9
d) 17

16. The domain for which the functions defined by f(x) = $3x^2$ - 1 and g (x) = 3 + x are equal is **[1]**

a) $\left(-1, \frac{4}{3}\right)$
b) $\left\{-1, \frac{4}{3}\right\}$
c) $\left[-1, \frac{4}{3}\right)$
d) $\left[-1, \frac{4}{3}\right]$

17. If $z = \frac{1+7i}{(2-i)^2}$, then **[1]**

a) amp (z) $= \frac{\pi}{4}$ b) amp (z) $= \frac{3\pi}{4}$

c) $|z| = \frac{1}{2}$ d) $|z| = 2$

18. The area of the triangle whose sides are along the lines x = 0, y = 0 and 4x + 5y = 20 is **[1]**

a) none of these b) 10 sq.units

c) $\frac{1}{10}$ sq.units d) 20 sq.units

19. The acute angle between the medians drawn from the acute angles of a right angled isosceles triangle is **[1]**

a) $\cos^{-1}\left(\frac{3}{4}\right)$ b) $\cos^{-1}\left(\frac{4}{5}\right)$

c) $\cos^{-1}\left(\frac{5}{6}\right)$ d) $\cos^{-1}\left(\frac{2}{3}\right)$

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

a) 2 b) -3/2

c) 3/2 d) 1

Section B

Attempt any 16 questions

21. The coefficient of correlation between two variables is independent of **[1]**

a) neither scale nor origin b) both origin and the scale

c) origin but not scale d) scale but not origin

22. Given the sets A = {1, 2, 3}, B = {3, 4}, C = {4, 5, 6}, then A ∪(B ∩ C) is **[1]**

a) {1, 2, 3} b) {3}

c) {1, 2, 3, 4, 5, 6} d) {1, 2, 3, 4}

23. If A = [a, b], B = [c, d], C = [d, e] then {(a, c), (a, d), (a,e), (b,c), (b, d), (b, e)} is equal to **[1]**

a) $A \cap (B \cup C)$ b) $A \times (B \cap C)$

c) $A \times (B \cup C)$ d) $A \cup (B \cap C)$

24. $\left\{\frac{1}{(1-2i)} + \frac{3}{(1+i)}\right\}\left(\frac{3+4i}{2-4i}\right)$ = ? **[1]**

a) $\left(\frac{3}{4} - \frac{5}{4}i\right)$ b) $\left(\frac{1}{2} + \frac{3}{2}i\right)$

c) $\left(\frac{3}{4} + \frac{9}{4}i\right)$ d) $\left(\frac{1}{4} + \frac{9}{4}i\right)$

25. The line segment joining the points (-3, -4) and (1, -2) is divided by y-axis in the ratio. **[1]**

a) 1 : 3 b) 3 : 2

c) 2 : 3 d) 3 : 1

26. $\lim\limits_{x \to \pi/4} \frac{4\sqrt{2}-(\cos x+\sin x)^5}{1-\sin 2x}$ is equal to **[1]**

a) None of these b) $5\sqrt{2}$

c) $3\sqrt{2}$ d) $\sqrt{2}$

27. If the S.D. of a set of observations is 8 and if each observation is divided by - 2, the S.D. of the new set of observations will be **[1]**

a) 8

b) -4

c) 4

d) -8

28. Let A and B be two sets such that n (A) = 16, n (B) = 14, n (A ∪ B) = 25. Then, n (A ∩ B) is equal to **[1]**

a) None of these

b) 50

c) 5

d) 30

29. The domain of definition of f(x) = $\sqrt{4x - x^2}$ is **[1]**

a) R - [0, 4]

b) (0, 4)

c) $[0, 4]$

d) R - (0, 4)

30. The amplitude of $\frac{1+i\sqrt{3}}{\sqrt{3}+i}$ is **[1]**

a) $\frac{\pi}{6}$

b) $-\frac{\pi}{6}$

c) $\frac{\pi}{3}$

d) $-\frac{\pi}{3}$

31. The sum of n terms of an AP is ($3n^2$ + 2n). Its common difference is **[1]**

a) 6

b) 5

c) -6

d) -5

32. The value of $\lim\limits_{x \to \infty} \frac{(x+1)^{10}+(x+2)^{10}+\ldots+(x+100)^{10}}{x^{10}+10^{10}}$ is: **[1]**

a) 100

b) 10

c) 10^{10}

d) None of these

33. The mean of the first n terms of the A.P. (a + d) + (a + 3d) + (a + 5d) +..........is **[1]**

a) a + n^2d

b) $a + \frac{n}{2}d$

c) a + nd

d) $\frac{a+nd}{2}$

34. If z = $\bar{z}$, then **[1]**

a) none of these

b) z is a complex number

c) z is purely real

d) z is purely imaginary

35. If the point (5, 2) bisects the intercept of a line between the axes, then its equation is **[1]**

a) 2x - 5y = 20

b) 5x + 2y = 20

c) 2x + 5y = 20

d) 5x - 2y = 20

36. f(A) = {ϕ, {ϕ}}, then the power set of A is **[1]**

a) {ϕ, A}

b) {ϕ , {ϕ}, A}

c) {ϕ, {ϕ}, {{ϕ}}, A}

d) A

37. The range of the function f(x) = cos ($\frac{x}{3}$) is **[1]**

a) [- 1, 1]

b) $\left[-\frac{1}{3}, \frac{1}{3}\right]$

c) [-3, 3]

d) none of these

38. Mark the correct answer for i^{273} = ? **[1]**

a) 1
b) i
c) -1
d) -i

39. If 7th and 13th terms of an A.P. be 34 and 64 respectively, then its 18th term is **[1]**

a) 89
b) 90
c) 88
d) 87

40. The sum of the infinite geometric series $\left(\frac{-5}{4}+\frac{5}{16}-\frac{5}{64}+\ldots\infty\right)=?$ **[1]**

a) $\frac{-1}{4}$
b) $\frac{5}{8}$
c) $\frac{1}{4}$
d) -1.

Section C

Attempt any 8 questions

41. If A = {1, 2, 3, 4, 5, 6} then the number of proper subsets is **[1]**

a) 63
b) 36
c) 64
d) 25

42. If f (x) = cos (log x), then value of f (x) $f(4)\ -\frac{1}{2}\left\{f\left(\frac{x}{4}\right)+f(4x)\right\}$ is **[1]**

a) 0
b) ± 1
c) -1
d) 1

43. If z is any complex number, then $\frac{z-\bar{z}}{2i}$ is **[1]**

a) either 0 or purely imaginary
b) purely imaginary
c) purely real
d) none of these

44. The sum of an infinite geometric series is 15 and the sum of the squares of these terms is 45. The first term of the series is **[1]**

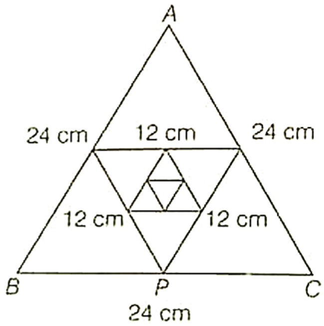
a) 6
b) 7
c) 5
d) 9

45. Mode of the data 3, 2, 5, 2, 3, 5, 6, 6, 5, 3, 5, 2, 5 is **[1]**

a) 5
b) 6
c) 3
d) 4

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

Each side of an equilateral triangle is 24 cm. The mid-point of its sides are joined to form another triangle. This process is going continuously infinite.



46. The perimeter of 7th triangle is (in cm) **[1]**

a) $\frac{3}{4}$
b) $\frac{5}{8}$
c) $\frac{9}{8}$
d) $\frac{7}{8}$

47. The sum of perimeter of all triangle is (in cm) **[1]**

a) 144
b) 625
c) 400
d) 169

48. The area of all the triangle is (in sq cm) **[1]**

a) 576
b) $144\sqrt{3}$
c) $169\sqrt{3}$
d) $192\sqrt{3}$

49. The sum of perimeter of first 6 triangle is (in cm) **[1]**

a) 120
b) $\frac{567}{4}$
c) $\frac{569}{4}$
d) 144

50. The side of the 5th triangle is (in cm) **[1]**

a) 6
b) 1.5
c) 0.75
d) 3

Solution

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Class 11 - Mathematics

Section A

1. **(b)** 7

   Explanation: The no. of proper subsets = $2^n - 1 = 2^3 - 1 = 7$
   Here n = no of elements of given set = 3.

2. **(b)** 6π

   Explanation: $\sin\left(6\pi + \frac{x}{3}\right) = \sin\left[2\pi + \left(4\pi + \frac{x}{3}\right)\right]$
   $= \sin\left(4\pi + \frac{x}{3}\right)$ [$\because$ sin is periodic with period 2π]
   $= \sin\left[2\pi + \left(2\pi + \frac{x}{3}\right)\right] \sin\left(2\pi + \frac{x}{3}\right)$
   $= \sin\left(\frac{x}{3}\right)$
   $\therefore \sin[\sin\left(6\pi + \frac{x}{3}\right)] = \sin(\sin\frac{\pi}{3})$
   $\therefore \sin[\sin\left(6\pi + \frac{x}{3}\right)]$ is periodic with period 6π.

3. **(a)** 0

   Explanation: $i^{109} + i^{114} + i^{119} + i^{124} = [1 + i^4 \times 1 + (i^4)^2 \times i^2 + (i^4)^3 \times i^3] = i^{109}[1 + i + i^2 + i^3]$
   $= i^{109} \times [1 + i - 1 - i] = i^{109} \times 0 = 0$

4. **(a)** 4/3

   Explanation: The line which is perpendicular to the given line is x-3y+k=0
   This passes through the point (2,2)
   Substituting the values,
   2-3(2)+k=0
   k = 4
   Hence the equation of the line is x-3y+4=0
   This can be written as $\frac{x}{-4} + \frac{y}{4/3} = 1$
   Hence the y intercept is 4/3

5. **(b)** $\frac{3}{10}$

   Explanation: Distance between two parallel lies is given by $\frac{|c_1 - c_2|}{\sqrt{A^2 + B^2}}$
   The given lines are parallel where $c_1 = 9$ and $c_2 = \frac{15}{2}$
   Sustituting the values
   $d = \frac{|9 - 15/2|}{\sqrt{9+16}} = \frac{3}{10}$

6. **(b)** 4

   Explanation: Polynomial functions are continuous and derivable into their entire domain f'(x) > 0. for |x| > 0.
   So it will be an increasing function in [0, 2]
   $\Rightarrow$ f(0) = 2 and f(2) = 4
   So, f(2) will be maximum.

7. **(d)** 10%

   Explanation: Given, n = 10 mean 250
   SD, $\sigma = \sqrt{\left(\frac{250}{10}\right)}$
   $\sigma = \sqrt{25}$
   SD = 5
   Now, Coefficient of variance = $\frac{\text{SD}}{\text{Mean}} \times 100$
   Cv = $\frac{5}{50} \times 100$

Cv = 50

Hence, Coefficient of Variation is 10

8. **(c)** $39 \leq x \leq 63$

Explanation: Suppose p% and q% of people watch a news channel and another channel respectively

$n(p) = 63$, $n(q) = 76$, $n(p \cap q) = x$, $n(p \cup q) \geq 100$

We know that,

$n(p \cup q) \geq n(p) + n(q) - n(p \cap q)$

$\Rightarrow 100 \geq 63 + 76 - x$

$\Rightarrow x \geq 139 - 100$

$\Rightarrow x \geq 39$

Now, $n(p \cup q) \leq n(p)$ and $n(p \cup q) \leq n(q)$

$\Rightarrow x \leq 63$ and $x \leq 76$

Therefore, $39 \leq x \leq 63$

9. **(a)** 2

Explanation: f(2) = $\frac{2.2+1}{3.2-2} = \frac{4+1}{6-2} = \frac{5}{4}$

$\therefore$ (fof)(2) = f(f(2))

$= f\left(\frac{5}{4}\right) = \frac{2\cdot\frac{5}{4}+1}{3\cdot\frac{5}{4}-2}$

$= \frac{10+4}{15-8} = \frac{14}{7} = 2$

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

Explanation: Let Z = -i = $r\left(cos\theta + isin\theta\right)$

Then comparing the real and imaginary parts, we get

r cos θ and r sin θ = -1

$\therefore r^2(\cos^2\theta + \sin^2\theta) = 1$

$\Rightarrow r^2 = 1 \Rightarrow r = 1$

$\therefore$ cos θ = 0 and sin θ = -1 $\left[cos\left(\frac{\Pi}{2}\right) = 0, sin\left(\frac{\Pi}{2}\right) = 1\right]$ [Format of amplitude is $-\theta$ in the fourth quadrant]

Since θ lies in the fourth quadrant, we have the principal value of the argument (Amplitude) = $-\frac{\pi}{2}$

11. **(b)** 45°

Explanation: The equation of the line x – y + 3 = 0 can be rewritten as y = x + 3 ⇒ m = tan θ = 1 and therefore θ = 45°.

12. **(b)** aa' + bb' = 0

Explanation: We know that Slope of the line ax + by = c is $\frac{-a}{b}$, and the slope of the line a'x + b'y = c' is $\frac{-a'}{b'}$ The lines are perpendicular if $\tan\theta = \frac{3}{5-x}$ (1)

$\frac{-a}{b}\frac{-a'}{b'} = -1$ or $aa' + bb' = 0$

13. **(c)** $\frac{3}{\sqrt{19}}$

Explanation: Using L'Hospital,

$\lim_{x\to 3} \frac{\frac{2x}{\sqrt[2]{x^2+10}}}{1}$

Substituting x = 3 in $\frac{\frac{2x}{2\sqrt{x^2+10}}}{1}$

We get $\frac{3}{\sqrt{19}}$

14. **(b)** 2

Explanation: Mean = $\frac{1+2+3+4+5+6+7}{7} = \frac{28}{7} = 4$

So, $\sum_{i=1}^{n}\left(X_i - \bar{X}\right)^2$ = $(-3)^2 + (-2)^2 + (-1)^2 + 0 + (1)^2 + (2)^2 + (3)^2 = 28$

Variance = $\frac{1}{n}\sum_{i=1}^{n}\left(X_i - \bar{X}\right)^2 = \frac{28}{7} = 4$

S.D = $\sqrt{\text{var}} = \sqrt{4} = 2$

15. **(a)** 3

Explanation: Given $n(A) = 12, n(B) = 9, n(A \cap B) = 4$

$n(A \cup B) = n(A) + n(B) - n(A \cap B) = 12 + 9 - 4 = 17$

$n(A \cup B)' = n(U) - n(A \cup B) = 20 - 17 = 3$

16. **(b)** $\{-1, \frac{4}{3}\}$

Explanation: We have, f(x) = $3x^2$ - 1 and g(x) = 3 + x

f(x) = g(x)

$\Rightarrow 3x^2 - 1 = 3 + x$

$\Rightarrow 3x^2 - x - 4 = 0$

$\Rightarrow (3x - 4)(x + 1) = 0$

$\therefore x = -1, \frac{4}{3}$

17. **(b)** amp (z) $= \frac{3\pi}{4}$

Explanation: amp (z) $= \frac{3\pi}{4}$

$z = \frac{1+7i}{(2-i)^2}$

$\Rightarrow z = \frac{1+7i}{4+i^2-4i}$

$\Rightarrow z = \frac{1+7i}{4-1-4i}$ $[\because i^2 = -1]$

$\Rightarrow z = \frac{1+7i}{3-4i}$

$\Rightarrow z = \frac{1+7i}{3-4i} \times \frac{3+4i}{3+4i}$

$\Rightarrow z = \frac{3+4i+21i+28i^2}{9-16i^2}$

$\Rightarrow z = \frac{3-28+25i}{9+16}$

$\Rightarrow z = \frac{-25+25i}{25}$

$\Rightarrow = -1 + i$

$\tan\alpha = \left|\frac{\text{Im}(z)}{\text{Re}(z)}\right|$

= 1

$\Rightarrow \alpha = \frac{\pi}{4}$

since, z lies in the second quadrant.

Therefore amp (z) $= \pi - a$

$= \pi - \frac{\pi}{4}$

$= \frac{3\pi}{4}$

18. **(b)** 10 sq.units

Explanation: The equation 4x + 5y = 20 can be written as $\frac{x}{5} + \frac{y}{4} = 1$

This implies the intercepts cut by this line on the X and Y axes are 5 and 4 respectively.

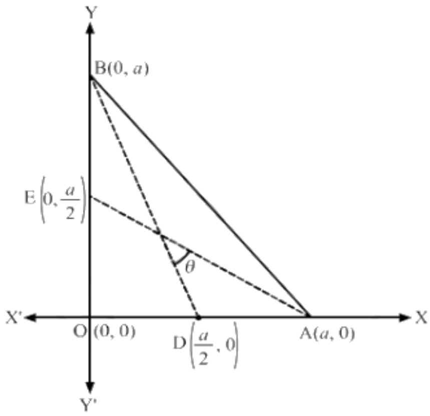
Hence the area of the triangle is $\frac{1}{2}[5 \times 4]$ = 10 square units.

19. **(b)** $\cos^{-1}\left(\frac{4}{5}\right)$

Explanation:

$\cos^{-1}\left(\frac{4}{5}\right)$

Let the coordinates of the right-angled isosceles triangle be O (0, 0), A(a, 0) and B(0, a).



Here, BD and AE are the medians drawn from the acute angles B and A respectively.

∴ Slope of BD = m_1

$= \frac{0-a}{\frac{a}{2}-0}$

= -2

Slope of AE = m_2

$= \frac{\frac{a}{2}-0}{0-a}$

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

Let θ be the angle between BD and AE., using formula of slope we get,

$\tan\theta = \left|\frac{-2+\frac{1}{2}}{1+1}\right|$

$= \frac{3}{4}$

$\Rightarrow \cos\theta = \frac{4}{\sqrt{3^2+4^2}}$

$\Rightarrow \cos\theta = \frac{4}{5}$

$\Rightarrow \theta = \cos^{-1}\left(\frac{4}{5}\right)$

Hence, the acute angle between the medians is $\cos^{-1}\left(\frac{4}{5}\right)$

20. **(a)** 2

Explanation: Given $\lim\limits_{x\to 0} \frac{x^2 \cos x}{1-\cos x} = \lim\limits_{x\to 0} \frac{x^2 \cos x}{2\sin^2 \frac{x}{2}} \left[\because 1-\cos x = 2\sin^2 \frac{x}{2}\right]$

$= \lim\limits_{x\to 0} \frac{\frac{x^2}{4} \times 4\cos x}{2\sin^2 \frac{x}{2}} = \lim\limits_{\frac{x}{2}\to 0} \frac{\left(\frac{x}{2}\right)^2 \cdot 2\cos x}{\sin^2 \frac{x}{2}}$

$= \lim\limits_{\frac{x}{2}\to 0} \left(\frac{\frac{x}{2}}{\sin \frac{x}{2}}\right)^2 \cdot 2\cos x$

= 2 cos 0 = 2 × 1 = 2 $\left[\because \lim\limits_{x\to 0} \frac{x}{\sin x} = 1\right]$

Section B

21. **(b)** both origin and the scale

Explanation: Because variance and Covariance are independent of change in origin.

22. **(d)** {1, 2, 3, 4}

Explanation: Given A = {1, 2, 3}, B = {3, 4} and C = {4, 5, 6}

B ∩ C = {4}

A ∪ (B ∩ C) = {1, 2, 3, 4}

23. **(c)** $A \times (B \cup C)$

Explanation: A × (B ∪ C) = (A × B) ∪ A × C

= {a, b} × {c, d} ∪ {a, b} × {d, c}

= {(a, c), (a, d), (b, c), (b, d)} ∪ {(a, d), (a, c), (b, d), (b, c)}

= {(a, c), (a, d), (a, c), (b, c), (b, d), (b, e)}

24. **(d)** $\left(\frac{1}{4}+\frac{9}{4}i\right)$

Explanation: $\frac{1}{(1-2i)}$ = $\frac{1}{(1-2i)}$ $\times$ $\frac{(1+2i)}{(1+2i)}$ = $\left(\frac{1}{5}+\frac{3}{5}i\right)$

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

$\frac{(3+4i)}{(2-4i)}$ = $\frac{(3+4i)}{(2-4i)}$ $\times$ $\frac{(2+4i)}{(2+4i)}$ = $\frac{-10+20i}{(4-16i^2)}$ = $\left(\frac{-10}{20}+\frac{20}{20}i\right)$ = $\left(\frac{-1}{2}+i\right)$

$\therefore$ given expression = $\left\{\left(\frac{1}{5}+\frac{3}{2}\right)+\left(\frac{2}{5}-\frac{3}{2}i\right)\right\}\left(\frac{-1}{2}+i\right)$ = $\left(\frac{17}{10}-\frac{11i}{10}\right)\left(\frac{-1}{2}+i\right)$

$\left(\frac{-17}{20}+\frac{11}{10}\right)+\left(\frac{17}{10}+\frac{11}{20}\right)i$ = $\left(\frac{5}{20}+\frac{45}{20}i\right)$ = $\left(\frac{1}{4}+\frac{9}{4}i\right)$

25. **(d)** 3 : 1

Explanation: Let the points (-3, -4) and (1, -2) be divided by y-axis (0, t) in the ratio m : n.

Using section formula we get the following points ,

$\therefore\left(\frac{m-3n}{m+n}, \frac{-2m-4n}{m+n}\right)$ = (0, t)

$\Rightarrow 0=\frac{m-3n}{m+n}$

$\Rightarrow$ m : n = 3 : 1

26. **(b)** $5\sqrt{2}$

Explanation: $\lim\limits_{x\to\frac{\pi}{4}} \frac{4\sqrt{2}-(\cos x+\sin x)^5}{1-\sin 2x}$

$=\lim\limits_{x\to\frac{\pi}{4}} \frac{2^{\frac{5}{2}}-\left((\cos x+\sin x)^2\right)^{\frac{5}{2}}}{2-(1+\sin 2x)}$

$=\lim\limits_{x\to\frac{\pi}{4}} \frac{2^{\frac{5}{2}}-\left((\cos x+\sin x)^2\right)^{\frac{5}{2}}}{2-(\cos x+\sin x)^2}$

Let t= (cos x + sin x)^2

$x\to\frac{\pi}{4}$

$\therefore t=\left(\cos\frac{\pi}{4}+\sin\frac{\pi}{4}\right)^2\to(\sqrt{2})^2=2$

$\lim\limits_{x\to\frac{\pi}{4}} \frac{4\sqrt{2}-(\cos x+\sin x)^5}{1-\sin 2x}=\lim\limits_{t\to 2}\frac{2^{\frac{5}{2}}-(t)^{\frac{5}{2}}}{2-(t)}$

$=\frac{5}{2}(2)^{\frac{3}{2}}\left[\because \lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}\right]$

$=5\sqrt{2}$

27. **(c)** 4

Explanation: If a set of observations, with SD σ, are multiplied with a non-zero real number a, then SD of the new observations will be $|a|\sigma$

Dividing the set of observations by -2 is same as multiplying the observations by $\frac{1}{-2}$

New S.D. = $\left|-\frac{1}{2}\right|\times 8$

= $\frac{8}{2}$ = 4

28. **(c)** 5

Explanation: Using formula:

n(A ∪ B) = n(A) + n(B) - n(A ∩ B)

Now, n(A ∩ B) = n(A) + n(B) - n(A ∪ B)

= 16 + 14 - 25

= 5

29. **(c)** $[0,4]$

Explanation: Here, 4x - $x^2\geq 0$

$x^2-4x\leq 0$

x(x - 4) ≤ 0

So, $x\in[0,4]$

30. **(a)** $\frac{\pi}{6}$

Explanation: $\frac{\pi}{6}$

Let z $=\frac{1+i\sqrt{3}}{\sqrt{3}+i}$

$\Rightarrow z=\frac{1+i\sqrt{3}}{\sqrt{3}+i}\times\frac{\sqrt{3}-i}{\sqrt{3}-i}$

$\Rightarrow z=\frac{\sqrt{3}+2i-\sqrt{3}i^2}{3-i^2}$

$\Rightarrow z=\frac{\sqrt{3}+\sqrt{3}+2i}{4}$

$\Rightarrow z=\frac{2\sqrt{3}+2i}{4}$

$\Rightarrow z=\frac{\sqrt{3}}{2}+\frac{1}{2}i$

$\tan\alpha=\left|\frac{\mathrm{Im}(z)}{\mathrm{Re}(z)}\right|$

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

$\Rightarrow\alpha=\frac{\pi}{6}$

since, z lies in the first quadrant.

Therefore, arg (z) $=\tan^{-1}\left(\frac{1}{\sqrt{3}}\right)=\frac{\pi}{6}$

31. **(a)** 6

Explanation: We have, $S_n = (3n^2 + 2n)$

$\Rightarrow S_{n-1} = 3(n - 1)^2 + 2(n - 1) = (3n^2 - 4n + 1)$

$T_n = (S_n - S_{n-1}) = (3n^2 + 2n) - (3n^2 - 4n + 1) = (6n - 1)$

$\Rightarrow T_1 = (6 \times 1 - 1) = 5$ and $T_2 = (6 \times 2 - 1) = 11$

$\Rightarrow d = (T_2 - T_1) = (11 - 5) = 6$.

32. **(a)** 100

Explanation: $\lim\limits_{x\to\infty}\frac{(x+1)^{10}+(x+2)^{10}+\ldots+(x+100)^{10}}{x^{10}+10^{10}}$

Dividing N^r and D^r by x^{10}

$\Rightarrow\lim\limits_{x\to\infty}\frac{\left(1+\frac{1}{x}\right)^{10}+\left(1+\frac{2}{x}\right)^{10}+\ldots+\left(1+\frac{100}{x}\right)^{10}}{1+\frac{10^{10}}{x^{10}}}$

= 1 + 1 + 1 + ... + 100 times

= 100

33. **(c)** a + nd

Explanation: mean = $\frac{\frac{n}{2}[2(a+d)+(n-1)2d]}{n}=\frac{\frac{n}{2}[2a+2d+2nd-2d]}{n}=\frac{1}{2}(2a+2nd)$ = a + nd

34. **(c)** z is purely real

Explanation: Let z = x + iy

Now $z=\bar{z}\Rightarrow x+iy=x-iy\Rightarrow 2iy=0\Rightarrow y=0$

Which means z is purely real.

35. **(c)** 2x + 5y = 20

Explanation: Let the equation of the line be $\frac{x}{a}+\frac{y}{b}=1$

The coordinates of the intersection of this line with the coordinate axes are (a, 0) and (0, b).

The midpoint of (a, 0) and (0, b) is $\left(\frac{a}{2},\frac{b}{2}\right)$

According to the question , the given condition for the points is as follows ,

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

$\Rightarrow\frac{a}{2}=5,\frac{b}{2}=2$

$\Rightarrow$ a = 10, b = 4

The equation of the required line is given below:

$\frac{x}{10} + \frac{y}{4} = 1$
$\Rightarrow$ 25x + 5y = 20.

36. **(c)** $\{\phi, \{\phi\}, \{\{\phi\}\}, A\}$
Explanation: Subsets of A are ϕ, $\{\phi\}, \{\{\phi\}\}, \{\phi, \{\phi\}\}$
$\therefore \mathrm{P(A)} = \{\phi, \{\phi\}, \{\{\phi\}\}, \mathrm{A}\}$

37. **(a)** [- 1, 1]
Explanation: Since the cosine function takes values between
- 1 and 1 including - 1 and 1 also.
$\therefore$ range of given function = [-1, 1]

38. **(b)** i
Explanation: $i^{273} = (i^4)^{68} \times i = (1)^{68} \times i = 1 \times i = i$

39. **(a)** 89
Explanation: From given we can write,
$a_7 = 34 \Rightarrow a + 6d = 34$ ...(i)
Also, $a_{13} = 64 \Rightarrow a + 12d = 64$...(ii)
Solve the equations 1 and 2, we get:
$a = 4$ and $d = 5$
$\therefore a_{18} = a + 17d$
= 4 + 175
= 89

40. **(d)** -1.
Explanation: Given, a = $\frac{-5}{4}$ and r = $\frac{5}{16} \times \frac{(-4)}{5} = \frac{-1}{4}$.
Clearly, |r| = $\frac{1}{4} < 1$.
$\therefore S_{-} = \frac{a}{(1-r)} = \frac{\left(\frac{-5}{4}\right)}{\left(1+\frac{1}{4}\right)} = \left(\frac{-5}{4} \times \frac{4}{5}\right) = -1.$

Section C

41. **(a)** 63
Explanation: 63
The no. of proper subsets = $2^n - 1$
Here n(A) = 6
In case of the proper subset, the set itself is excluded that's why the no. of the subset is 63. But if it is asked no. of improper or just no. of subset then you may write 64
So no. of proper subsets = 63

42. **(a)** 0
Explanation: f (x) = cos (log x)
Now, $f(x)f(4) - \frac{1}{2}\left\{f\left(\frac{x}{4}\right) + f(4x)\right\}$
= cos (logx) cos (log 4) - 1/2 $\left\{ \cos\left(\frac{x}{4}\right)\right) + \cos(\log 4x)\}$
= cos (log x) cos (log 4) $-\frac{1}{2}\{\cos(\log x - \log 4) + \cos(\log x + \log 4)\}$
Using cox cosy = 1/2 (cos (x + y) + cos (x - y)
= cos (log x) cos (log 4) - cos (log x) cos(4)
= 0

43. **(c)** purely real
Explanation: Let Z = x + iy
Then $\bar{Z}$ = x - iy
$\therefore$ Z - $\bar{Z}$ = (x + iy) - (x - iy) = 2iy
Now $\frac{Z-\bar{Z}}{2i}$ = y
Hence $\frac{z-\bar{z}}{2i}$ is purely real.

44. **(c)** 5

Explanation: Let (a + ar + ar^2 + ... ∞) = 15 and (a^2 + a^2r^2 + a^2r^4 + ...∞) = 45.

Then, $\frac{a}{(1-r)} = 15$ and $\frac{a^2}{(1-r^2)} = 45$.

On dividing, we get $\frac{a^2}{(1-r^2)} \times \frac{(1-r)}{a} = \frac{45}{15} \Rightarrow \frac{a}{(1+r)} = 3$

$\Rightarrow \frac{15(1-r)}{(1+r)} = 3$ [using $\frac{a}{(1-r)} = 15$]

⇒ 3 + 3r = 15 - 15r ⇒ 18r = 12 ⇒ r= $\frac{2}{3}$

$\therefore \frac{a}{\left(1-\frac{2}{3}\right)} = 15 \Rightarrow 3a = 15 \Rightarrow a = 5.$

Therefore, the required first term is 5.

45. **(a)** 5

Explanation: Most repeated value is the mode. Here it is 5

46. **(c)** $\frac{9}{8}$

Explanation: $\frac{9}{8}$

47. **(a)** 144

Explanation: 144

48. **(d)** $192\sqrt{3}$

Explanation: $192\sqrt{3}$

49. **(b)** $\frac{567}{4}$

Explanation: $\frac{567}{4}$

50. **(b)** 1.5

Explanation: 1.5