CBSE Sample Question Paper Term 1

Class – XI (Session : 2021 - 22)

SUBJECT- MATHEMATICS 041 - TEST - 05

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 : x $\neq$ x} represents **[1]**

   a) {1} b) { }

   c) {x} d) {0}

2. 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)

3. If z = $(3i - 1)^2$ then |z| = ? **[1]**

   a) 10 b) None of these

   c) 8 d) 4

4. An A.P. consists of n (odd) terms and its middle term is m. Then the sum of the A.P. is **[1]**

   a) 2 mn b) $\frac{1}{2}mn$

   c) mn^2 d) mn

5. The angle between the lines 2x - y + 3 = 0 and x + 2y + 3 = 0 is **[1]**

   a) 90° b) 30°

   c) 45° d) 60°

6. The value of $\lim\limits_{x \to \infty} \frac{\sqrt{1+x^4} + (1+x^2)}{x^2}$ is: **[1]**

   a) 2 b) -1

   c) None of these d) 1

7. The coefficient of variation is computed by **[1]**

a) $\frac{Mean.}{S.D} \times 100$

b) $\frac{Mean}{S.D.}$

c) $\frac{S.D.}{Mean}$

d) $\frac{S.D.}{Mean} \times 100$

8. If A = {x : x is a multiple of 3, x natural no., x < 30} and B = {x : x is a multiple of 5, x is natural no., x < 30} then A - B is **[1]**

a) {3, 6, 9, 12, 15, 18, 21, 24, 27, 30}

b) {3, 6, 9, 12, 18, 21, 24, 27}

c) {3, 5, 6, 9, 10, 12, 15, 18, 20, 21, 25, 27, 30}

d) {3, 6, 9, 12, 18, 21, 24, 27, 30}

9. The domain of the function $f(x) = \sqrt{x-1} + \sqrt{6-x}$ **[1]**

a) (-∞, 6)

b) [2, 6]

c) [1, 6]

d) none of these

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

a) $\frac{\pi}{2}$

b) π

c) None of these

d) 0

11. If the 4th and 9th terms of a GP are 54 and 13122 respectively then its 6th term is **[1]**

a) 486

b) 1458

c) 729

d) 243

12. The orthogonal projection of the point (2, - 3) on the line x + y = 0 is **[1]**

a) (2, -3)

b) (2, 3)

c) (-2, -3)

d) $(\frac{5}{2}, \frac{-5}{2})$

13. $\lim\limits_{n \to \infty} \left\{ \frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} + \ldots + \frac{1}{(2n+1)(2n+3)} \right\}$ is equal to **[1]**

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

b) 0

c) 2

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

14. The variance of 2, 4, 6, 8, 10 is **[1]**

a) 7

b) 8

c) 4

d) 6

15. If A and B are two sets then $A \cap (A \cap B')$= . . . . **[1]**

a) $\in$

b) A

c) ϕ

d) B

16. R is a relation from {11, 12, 13} to {8, 10, 12} defined by y = x - 3. Then, R^{-1} is **[1]**

a) None of these

b) {(10,13), (8,11), (12,10)}

c) {(11,8), (13,10)}

d) {(8,11), (10,13)}

17. If z is purely real and Re (z) > 0, then Amp. (z) is **[1]**

a) 0

b) - π

c) π

d) none of these

18. If the numbers a, b, c, d, e are in A.P then find the value of a - 4b + 6c - 4d + e **[1]**

a) -1

b) 1

c) 0

d) 2

19. The distance between the lines y = mx + c_1 and y = mx + c_2 is **[1]**

a) $\frac{c_1 - c_2}{\sqrt{m^2+1}}$

b) 0

c) $\frac{|c_1 - c_2|}{\sqrt{1+m^2}}$

d) $\frac{c_2 - c_1}{\sqrt{1+m^2}}$

20. $\underset{x \to 0}{lim} \left(\frac{\tan x - x}{x}\right) \sin\left(\frac{1}{x}\right)$ is equal to **[1]**

a) 1

b) a real number other than 0 and 1

c) -1

d) 0

Section B

Attempt any 16 questions

21. The mean of 100 observations is 50 and their standard deviation is 5. The sum of all squares of all the observations is **[1]**

a) 252500

b) 50,000

c) 250,000

d) 255000

22. Let A = {a, b, c}, B = {a, b}, C = {a, b, d}, D = {c, d} and E = {d}. Then which of the following statement is not correct? **[1]**

a) D $\supseteq$ E

b) C - B = E

c) B $\cup$ E = C

d) C - D = E

23. The domain and range of the function f given by f(x) $= 2 - |x - 5|$ is **[1]**

a) Domain = R, Range = $(-\infty, 2)$

b) Domain = R$^+$, Range = $(-\infty, 1]$

c) Domain = R$^+$, Range = $(-\infty, 2]$

d) Domain = R, Range = $(-\infty, 2]$

24. If (x + iy)(p + iq) = (x^2 + y^2)i, then **[1]**

a) none of these

b) p = ix, q = 0

c) p = x, q = y

d) p = y, q = x

25. The sum of first 7 terms of an AP is 10 and the sum of next 7 terms is 17. What is the 3rd term of the AP? **[1]**

a) $1\frac{5}{7}$

b) 2

c) $1\frac{3}{7}$

d) $1\frac{2}{7}$

26. $\lim\limits_{x \to \frac{\pi}{4}} \frac{\sec^2 x - 2}{\tan x - 1}$ is equal to **[1]**

a) 1

b) 0

c) 2

d) 3

[1]

27. Mean deviation for n observations $x_1, x_2, ..., x_n$ from their mean $\bar{x}$ is given by

a) $\sum_{i=1}^{n}(x_i-\bar{x})^2$

b) $\sum_{i=1}^{n}(x_i-\bar{x})$

c) $\frac{1}{n}\sum_{i=1}^{n}(x_i-\bar{x})^2$

d) $\frac{1}{n}\sum_{i=1}^{n}|x_i-\bar{x}|$

28. The number of non-empty subsets of the set {1, 2, 3, 4} is: **[1]**

a) 14

b) 16

c) 17

d) 15

29. If $x \neq 1$ and f (x) $= \frac{x+1}{x-1}$ is a real function, then f (f (f(2))) is **[1]**

a) 4

b) 3

c) 2

d) 1

30. If α is a complex number such that $\alpha^2+\alpha+1=0$ then α^{31} is **[1]**

a) 1

b) 0

c) α

d) α^2

31. Let Sn denote the sum of the first n terms of an A.P. If $S_{2n} = 3S_n$ then $S_{3n} : S_n$ is equal to **[1]**

a) 10

b) 8

c) 6

d) 4

32. $\lim\limits_{x\to\frac{\pi}{4}} \frac{\tan x-1}{x-\frac{\pi}{4}}$ is equal to **[1]**

a) 1

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

c) 0

d) 2

33. Standard deviations for first 10 natural numbers is **[1]**

a) 2.87

b) 5.5

c) 3.87

d) 2.97

34. Which of following statements is correct? **[1]**

a) (2+ 3i) > (2 - 3i)

b) (5 + 4i) > (-5 - 4i)

c) (3 + 2i) > (-3 + 2i)

d) None of these

35. Let x be the A.M. and y, z be two G.M.s between two positive numbers. Then $\frac{y^3+z^3}{xyz}$ is equal to **[1]**

a) None of these

b) 1

c) 2

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

36. In a town of 840 persons, 450 persons read Hindi, 300 read English and 200 read both. Then the number of persons who read neither is **[1]**

a) 290

b) 260

c) 180

d) 210

37. The domain of the function $f(x)=\sqrt{2-2x-x^2}$ **[1]**

a) (-2, 2)

b) $[-1-\sqrt{3},-1+\sqrt{3}]$

c) $[-2-\sqrt{3},-2+\sqrt{3}]$

d) $1-\sqrt{3},\sqrt{3}$

38. $(1 - \sqrt{-1})(1 + \sqrt{-1})(5 - \sqrt{-7})(5 + \sqrt{-7}) = ?$ **[1]**

a) (29 - 3i)

b) (32 + 5i)

c) None of these

d) (25 + 7i)

39. Which term of the AP 40, 35, 30,... is the first negative term? **[1]**

a) 14th

b) 12th

c) 10th

d) 9th

40. The second and 7th terms of an AP are 2 and 22 respectively. The sum of its first 35 terms is **[1]**

a) 2310

b) 2160

c) 2470

d) 2240

Section C

Attempt any 8 questions

41. In a class of 100 students, 55 students have passed in Mathematics and 67 students have passed in Physics. Then the number of students who have passed in Physics only is **[1]**

a) 47

b) 45

c) 25

d) 33

42. Let A = {1, 2, 3}, B = {2, 3, 4}, then which of the following is a function from A to B ? **[1]**

a) {(1,2), (2,3), (3,2), (3,4)}

b) {(1, 3), (1, 4)}

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

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

43. The principal value of the amplitude of (1 + i) is **[1]**

a) $\frac{3\pi}{4}$

b) $\frac{\pi}{4}$

c) $\frac{\pi}{12}$

d) π

44. If A be one A.M. and p, q be two G.M.'s between two numbers, then 2 A is equal to **[1]**

a) $\frac{p^3+q^3}{pq}$

b) $\frac{p^2+q^2}{2}$

c) $\frac{pq}{2}$

d) $\frac{p^3-q^3}{pq}$

45. If the standard deviation of a variable X is a, then the standard deviation of variable $\frac{aX+b}{c}$ is **[1]**

a) $\frac{a}{c}\sigma$

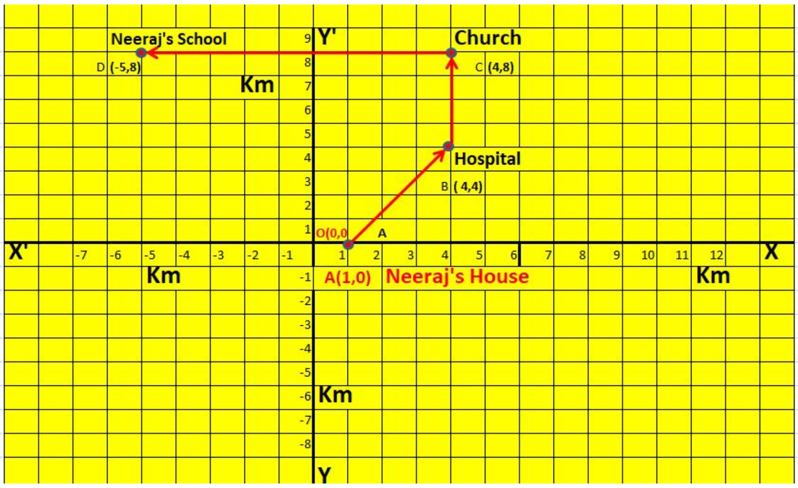
b) $a\sigma$

c) $\left|\frac{a}{c}\right|\sigma$

d) $\frac{a\sigma+b}{c}$

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

Neeraj's house is 1 km in the east of origin (0, 0), While going to the school first he takes auto till hospital at B(4, 4). From the hospital (4, 4) to church (4, 8) he travels by city bus. From Church C(4, 8) he rides in a metro train and he reaches the school at D(-5, 8). All the units are in km.



46. What is the slope of Neeraj's journey from home to Hospital? **[1]**

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

b) $\frac{4}{3}$

c) $\frac{3}{4}$

d) $\frac{5}{4}$

47. What is the distance of School from Hospital? **[1]**

a) 12 km

b) $\sqrt{97}$ km

c) $\sqrt{145}$ km

d) 10 km

48. What is the equation of the straight line joining the points A and D? **[1]**

a) 5x + 4y = 10

b) 6x + 7y = -15

c) 4x + 3y = 4

d) 4x - 3y = 4 km

49. What is the equation of the straight line joining church and hospital? **[1]**

a) x = 4

b) x = -4

c) 5x + 4y = 10

d) y = 4 km

50. What is the equation of the straight line joining the points A (House) and C (church)? **[1]**

a) 4x - 3y = 4 km

b) 4x + 3y = 4

c) 8x - 3y = 8

d) 6x + 7y = -15

Solution

SUBJECT- MATHEMATICS 041 - TEST - 05

Class 11 - Mathematics

Section A

1. **(b)** { }
   Explanation: Here value of x is not possible so A is a null set.
2. **(c)** $[0,4]$
   Explanation: Here, 4x - $x^2 \geq 0$
   $x^2 - 4x \leq 0$
   x(x - 4) ≤ 0
   So, $x \in [0,4]$
3. **(a)** 10
   Explanation: z = $(3i - 1)^2$ = $(9i^2 + 1 - 6i)$ = (-9 + 1 - 6i) = (-8 - 6i)
   $\Rightarrow |z|^2 = \{(-8)^2 + (-6)^2\}$ = (64 + 36) = 100
   $\Rightarrow |z| = \sqrt{100}$ = 10
4. **(d)** mn
   Explanation: Let a be the first term, d be the common difference and n be the number of terms of the A.P.
   Then we have $S_n = \frac{n}{2}[2a+(n-1)d] = n\left[a+\frac{n-1}{2}d\right]$ ....(i)
   As n is odd $\frac{n-1}{2}$ will give the number of terms just before the middle term.
   Hence $a+\frac{n-1}{2}d$ will give the middle term, but given middle term is m.
   Hence we get m = $a+\frac{n-1}{2}d$ .... (ii)
   Now from (i) and (ii) we get S_n = nm
5. **(a)** 90°
   Explanation: Let m_1 and m_2 be the slope of the lines 2x - y + 3 = 0 and x + 2y + 3 = 0, respectively.
   Let θ be the angle between them.
   Here,
   $m_1 = 2$ and $m_2 = -\frac{1}{2}$
   $\therefore m_1m_2 = -1$
   Therefore, the angle between the given lines is 90° , as it satisfy the condition of product of slopes of two lines is -1.
6. **(a)** 2
   Explanation: $\lim\limits_{x\to\infty}\frac{\sqrt{1+x^4}+(1+x^2)}{x^2}$
   $=\lim\limits_{x\to\infty}\sqrt{\frac{1}{x^4}+1}+\frac{1}{x^2}+1$
   = 2
7. **(c)** $\frac{S.D.}{Mean}$
   Explanation: Its the basic concept $\frac{S.D.}{Mean}$
8. **(b)** {3, 6, 9, 12, 18, 21, 24, 27}
   Explanation: Since set B represent multiple of 5 so from Set A common multiple of 3 and 5 are excluded.
9. **(c)** [1, 6]
   Explanation: For f(x) to be real, we must have,
   $x-1\geqslant 0 \; and \; 6-x\geqslant 0$
   $\Rightarrow \; x\geqslant \varphi \; and \; x-6 \; \leqslant 6$
   $\therefore$ Domain = [1, 6]

10. **(d)** 0

Explanation: 0

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

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

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

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

$\Rightarrow$ z = 1

Since point (1, 0) lies on the positive direction of real axis, we have:

arg (z) = 0

11. **(a)** 486

Explanation: Given T_4 = 54 and T_9 = 13122.

$\therefore ar^3 = 54$ and $ar^8 = 13122$

$\Rightarrow \frac{ar^8}{ar^3} = \frac{13122}{54} = 243 \Rightarrow r^5 = 3^5 \Rightarrow$ r = 3

$\therefore a \times 3^3 = 54 \Rightarrow a = \frac{54}{27} = 2$

Therefore, a = 2 and r = 3.

$\therefore T_6 = ar^5 = (2 \times 3^5) = (2 \times 243) = 486$.

Therefore, the required 6th term is 486.

12. **(d)** $(\frac{5}{2}, \frac{-5}{2})$

Explanation: Equation of the line which is perpendicular to the given line is x - y + k = 0

Since this line passes through (2, -3)

2-(-3) + k = 0

This implies k = -5

Hence the equation og the line is x - y = 5

On solving the lines x + y = 0 and x - y = 5, we get the point of intersection as x = $\frac{5}{2}$ and y = $\frac{-5}{2}$

Hence $(\frac{5}{2}, \frac{-5}{2})$ is the coordinates of orthogonal projection.

13. **(a)** $\frac{1}{2}$

Explanation: $\lim\limits_{n \to \infty} \left[\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} \dots \frac{1}{(2n+1)(2n+3)}\right]$

Here, $T_n = \frac{1}{(2n-1)(2n+1)}$

$\Rightarrow T_n = \frac{A}{(2n-1)} + \frac{B}{(2n+1)}$

On equating A = $\frac{1}{2}$ and B = -$\frac{1}{2}$

$T_n = \frac{1}{2(2n-1)} - \frac{1}{2(2n+1)}$

$\Rightarrow T_1 = \frac{1}{2}\left[1 - \frac{1}{3}\right]$

$\Rightarrow T_2 = \frac{1}{2}\left[\frac{1}{3} - \frac{1}{5}\right]$

$\Rightarrow T_{n-1} = \frac{1}{2}\left[\frac{1}{2n-1} - \frac{1}{2n-1}\right]$

$\Rightarrow T_n = \frac{1}{2}\left[\frac{1}{2n-1} - \frac{1}{2n+1}\right]$

$\Rightarrow T_1 + T_2 + T_3 \dots T_n = \frac{1}{2}\left[1 - \frac{1}{2n+1}\right]$

$\Rightarrow T_1 + T_2 + T_3 \dots T_n = \frac{1}{2}\left[\frac{2n}{2n+1}\right]$

$\Rightarrow T_1 + T_2 + T_3 \dots T_n = \frac{n}{2n+1}$

$\therefore \lim\limits_{n \to \infty} \left[\frac{1}{1.3} + \frac{1}{3.5} + \frac{1}{5.7} \cdots \frac{1}{(2n+1)(2n+3)}\right]$

$= \lim\limits_{n \to \infty} \left[\sum_{n=1}^{n} \frac{1}{(2n-1)(2n+1)}\right]$

$= \lim\limits_{n \to \infty} \left(\frac{n}{2n+1}\right)$

$= \lim_{n\to\infty}\left(\frac{1}{2+\frac{1}{n}}\right)$ [Dividing N^r and D^r by n]
$= \frac{1}{2}$

14. **(b)** 8
Explanation: Mean = $\frac{2+4+6+8+10}{5}$ = $\frac{30}{5}$ = 6
So, $\sum_{i=1}^{n}\left(X_i - \bar{X}\right)^2$ = $(-4)^2 + (-2)^2 + 0 + (2)^2 + (4)^2 = 40$
Variance = $\frac{1}{n}\sum_{i=1}^{n}\left(X_i - \bar{X}\right)^2$ = $\frac{40}{5}$ = 8

15. **(b)** A
Explanation: $(A \cap B') = A$
$\Rightarrow A \cap (A \cap B') = A \cap A = A$

16. **(d)** {(8,11), (10,13)}
Explanation: Since, y = x – 3;
Therefore, for x = 11, y = 8.
For x = 12, y = 9. [But the value y = 9 does not exist in the given set.]
For x = 13, y =10.
So, we have R = {(11, 8), (13, 10)}
Now, R^{-1} = {(8, 11), (10, 13)}.

17. **(a)** 0
Explanation: To find the amplitude of a complex number Z = x + iy first find a value of θ which satisfy the equation $\theta = \tan^{-1}\left|\frac{y}{x}\right|, 0 \leq \theta \leq \frac{\Pi}{2}$
Now depending on the complex number lies in the first, second, third or fourth quadrants the amplitudes will be $\theta, (\Pi - \theta), -(\Pi - \theta), -(\theta)$ respectively.
Given z is purely real and Re (z) > 0
$\therefore$ Z = x + 0i, x > 0
Now $\tan^{-1}\left|\frac{y}{x}\right| = \tan^{-1}\left|\frac{0}{1}\right|$ = $\tan^{-1} 0 = 0$
Also Z = x + 0i, x > 0 lies in the first quadrant
Hence Amp(Z) = 0

18. **(c)** 0
Explanation: Given a, b, c, d, e are in A.P
Let D be the common difference of the A.P
Then we have b = a + D
c = b + D = a + 2D
d = c + D = a + 3D
e = d + D = a + 4D
Hence a - 4b + 6c - 4d + e = a - 4(a + D) + 6(a + 2D) - 4(a + 3D) + a + 4D = 0

19. **(c)** $\frac{|c_1 - c_2|}{\sqrt{1+m^2}}$
Explanation: Here, it is given the equation of lines
y = mx + c_1 ...(i)
and y = mx + c_2 ...(ii)
Firstly, we find the slope of eq. (i) and (ii)
Since, both the equations have the same slope i.e. m
Therefore, they are parallel lines.
We know that, distance between two parallel lines
Ax + By + C_1 = 0 and Ax + By + C_2 = 0 is
$$\mathrm{d} = \frac{|\mathrm{c}_1 - \mathrm{c}_2|}{\sqrt{\mathrm{A}^2 + \mathrm{B}^2}}$$

$\Rightarrow \mathrm{d} = \frac{|\mathrm{c}_1 - \mathrm{c}_2|}{\sqrt{\mathrm{m}^2 + (-1)^2}}$

$\Rightarrow \mathrm{d} = \frac{|\mathrm{c}_1 - \mathrm{c}_2|}{\sqrt{\mathrm{m}^2 + 1}}$

20. **(d)** 0

Explanation: $\lim\limits_{x \to 0} \left(\frac{\tan x}{x} - \frac{x}{x}\right) \sin\left(\frac{1}{x}\right)$

$\Rightarrow$ (0) Finite number = 0

Section B

21. **(a)** 252500

Explanation: Given, $\overline{\mathbf{x}}$ = 50, n = 100 and σ = 5

$\sigma = \frac{\sum x_i}{N}$

$\sum x_i$ = 50 $\times$ 100

$\sum x_i$ = 5000

Now, $\sigma^2 = \frac{\sum x_i^2}{N} - (\bar{x})^2$

25 = $\frac{\sum x_i^2}{100}$ - (50)^2

$\sum x_i^2$ = 252500

22. **(d)** C - D = E

Explanation: C - D = {a, b, c} - {c, d} = {a, b}

But E = {d}

Hence C - D $\neq$ E

23. **(d)** Domain = R, Range = $(-\infty, 2]$

Explanation: We have, f(x) = $2 - |x - 5|$

Clearly, f(x) is defined for all x$\in$R

$\therefore$ Domain of f = R

Now, $|x - 5| \geq 0, \forall x \in R$

$\Rightarrow -|x - 5| \leq 0$

$\Rightarrow 2 - |x - 5| \leq 2$

$\therefore f(x) \leq 2$

$\therefore$ Range of f $= (-\infty, 2]$

24. **(d)** p = y, q = x

Explanation: (x + iy)(p + iq) = (x^2 + y^2)i

$\Rightarrow$ (xp - yq) + i(xq + yp) = (x^2 + y^2)i

$\Rightarrow$ xp - yp = 0 and xq = + yp = x^2 + y^2

$\Rightarrow$ p = $\frac{yq}{x}$ ....(i) and xq + yp = x^2 + y^2 ...(ii)

Substituting (i) in (ii), we get

xq + $y\left(\frac{yq}{x}\right)$ = x^2 + y^2 $\Rightarrow$ x^{2}q + y^{2}q = x(x^2 + y^2)

$\Rightarrow$ q(x^2 + y^2) = x(x^2 + y^2) $\Rightarrow$ q = x

Now from (i), we get p = y

25. **(d)** $1\frac{2}{7}$

Explanation: Given, S_7 = 10 and S_{14} = 27.

$\therefore \quad \frac{7}{2} \cdot (2a + 6d) = 10$ and $\frac{14}{2} \cdot (2a + 13d) = 27$

$\Rightarrow a + 3d = \frac{10}{7}$ ..(i) and 2a + 13d = $\frac{27}{7}$..(ii),

Solving(i) and(ii) ,we get

$\Rightarrow \ d = \frac{1}{7}$ and a = 1

$\therefore T_3 = (a + 2d) = \left(1 + \frac{2}{7}\right) = 1\frac{2}{7}$

26. **(c)** 2

Explanation: Given, $\lim\limits_{x \to \frac{\pi}{4}} \frac{\sec^2 x - 2}{\tan x - 1} = \lim\limits_{x \to \frac{\pi}{4}} \frac{1 + \tan^2 x - 2}{\tan x - 1}$

$= \lim\limits_{x \to \frac{\pi}{4}} \frac{\tan^2 x - 1}{\tan x - 1} = \lim\limits_{x \to \frac{\pi}{4}} \frac{(\tan x + 1)(\tan x - 1)}{(\tan x - 1)}$

$= \lim\limits_{x \to \frac{\pi}{4}} (\tan x + 1) = \tan \frac{\pi}{4} + 1 = 1 + 1 = 2$

27. **(d)** $\frac{1}{n} \sum\limits_{i=1}^{n} |x_i - \bar{x}|$

Explanation: We know for n observations $x_1, x_2, \ldots, x_n$ having $\bar{x}$ is given by

M.D = $\frac{\sum d_i}{n}$

But we know

$d_i = |x_i - \bar{x}|$

So mean deviation becomes,

M.D = $\frac{\sum |x_i - \bar{x}|}{n}$

Or

M.D = $\frac{1}{n} \sum\limits_{i=0}^{n} |x_i - \bar{x}|$

28. **(d)** 15

Explanation: Total no. of subset including empty set = 2^n

So total subset = 2^4 = 16

The no. of non empty set = 16 - 1 = 15

29. **(b)** 3

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

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

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

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

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

= 3

30. **(c)** α

Explanation: $\alpha^2 + \alpha + 1 = 0 \Rightarrow \alpha = \frac{-1 \pm \sqrt{1-4}}{2} = \frac{-1 \pm i\sqrt{3}}{2} = \omega, \omega^2$

When $\alpha = \omega \Rightarrow \alpha^{31} = \omega^{31}$ = $\left(\omega^3\right)^{10} \cdot \omega = 1 \cdot \omega = \omega = \alpha$

Also when $\alpha = \omega^2 \Rightarrow \alpha^{31} = \left(\omega^2\right)^{31}$ = $\omega^{62} = \left(\omega^3\right)^{20} \cdot \omega^2 = 1.\omega^2 = \omega^2 = \alpha$

Hence α^{31} = α

31. **(c)** 6

Explanation: Given that: S_n denote the sum of first n terms

and $S_{2n} = 3S_n$

Now we have to find: $S_{3n} : S_n$

Now, we know that

$S_n = \frac{n}{2}[2a + (n-1)d]$

$\therefore \mathrm{S_{2n} = \frac{2n}{2}[2a + (2n-1)d]}$

$\therefore \mathrm{S_{2n} = \frac{2n}{2}[2a + (2n-1)d]}$

S_{2n} = n[2a + (2n – 1)d]

As per the given condition of the question, we have

$S_{2n} = 3S_n$

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

$\Rightarrow 2an + nd(2n-1) = \frac{3n}{2}[2a + (n-1)d]$

⇒ 4an + 2nd(2n – 1) = 6an + 3nd(n – 1)

⇒ 2nd(2n – 1) – 3nd(n – 1) = 6an – 4an

⇒ $4n^2d$ – 2nd – $3n^2d$ + 3nd = 2an

⇒ nd + n^2d = 2an

⇒ nd(1 + n) = 2an

⇒ d(n + 1) = 2a ...(i)

Now, we have to find S_{3n}:S_n

Therefore,

$\frac{S_{3n}}{S_n} = \frac{\frac{3n}{2}[2a+(3n-1)d]}{\frac{n}{2}[2a+(n-1)d]}$

$\Rightarrow \frac{S_{an}}{S_n} = \frac{\frac{3n}{2}[(n+1)d+(3n-1)d]}{\frac{n}{2}[(n+1)d+(n-1)d]}$ [from (i)]

$\Rightarrow \frac{S_{3n}}{S_n} = \frac{3[nd+d+3nd-d]}{nd+d+nd-d}$

$\Rightarrow \frac{S_{3n}}{S_n} = \frac{3[4nd]}{2nd}$

$\Rightarrow \frac{S_{3n}}{S_n} = 6$

Therefore,the correct option is 6.

32. **(d)** 2

Explanation: Let $x - \frac{\pi}{4}$ = t

$\Rightarrow \lim\limits_{t\to 0} \frac{\tan\left(\frac{\pi}{4}+t\right)-1}{t}$

$\Rightarrow \lim_{t\to 0} \frac{2\tan t}{(1-\tan t)(t)}$

= 2

33. **(a)** 2.87

Explanation: We know the standard deviation of the first n natural numbers is $\sqrt{\frac{n^2-1}{12}}$

Now for first 10 natural numbers, n=10, substituting this in the above equation of standard deviation we get

$\sigma = \sqrt{\frac{(10)^2-1}{12}}$

$\sigma = \sqrt{\frac{100-1}{12}}$

$\sigma = \sqrt{\frac{99}{12}}$

$\sigma = \sqrt{8.25}$

σ = 2.87

Hence the Standard deviations for first 10 natural numbers is 2.87

34. **(d)** None of these

Explanation: Two complex numbers cannot be compared

35. **(c)** 2

Explanation: Suppose the two numbers be a and b.

a, x and b are in A.P.

∴ 2x = a + b ...(i)

Also, a, y, z and b are in G.P.

$\therefore \frac{y}{a} = \frac{z}{y} = \frac{b}{z}$

$\Rightarrow$ y^2 = az, yz = ab, z^2 = by ...(ii)

Now, $\frac{y^3+z^3}{xyz}$

$= \frac{y^2}{xz} + \frac{z^2}{xy}$

$= \frac{1}{x}\left(\frac{y^2}{z} + \frac{z^2}{y}\right)$

$= \frac{1}{x}\left(\frac{az}{z} + \frac{by}{y}\right)$ [Using (ii)]

= $\frac{1}{x}$(a + b)

= $\frac{2}{(a+b)}$(a + b) [Using (i)]

= 2

36. **(a)** 290

Explanation: We have,total number of persons are 840
Persons who read Hindi and English are 450 and 300 respectively
Persons who read both are 200
Now to find: number of persons who read neither
Suppose U be the total number of persons, H and E be the number of persons who read Hindi and English respectively
n(U) = 840, n(H) = 450, n(E) = 300, n(H ∩ E) = 200
Number of persons who read either of them
n(H ∪ E)= n(H) + n(E) – n(H ∩ E)
= 450 + 300 – 200 = 550
Number of persons who read neither,we have
= Total – n(H ∪ E)
= 840 – 550 = 290
Therefore, there are 290 persons who read neither Hindi nor English.

37. **(b)** $[-1-\sqrt{3}, -1+\sqrt{3}]$

Explanation: For f(x) to be defined,

2 - 2x - $x^2 \geq 0$

x^2 + 2x - 2 ≤ 0

(x - (1 - √3)) (x - (-1 + √3)) ≤ 0

$x \in [-1-\sqrt{3}, -1+\sqrt{3}]$

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

Explanation: Given expression = (! - i)(1+ i)(5 - $\sqrt{7}i$)(5 + $\sqrt{7}i$)

= (1 - i^2)(25- 7i^2) = (1 + 1)(25 + 7) = (2 $\times$ 32) = 64

39. **(c)** 10th

Explanation: Let T_n < 0 . Then, {a + (n - 1) d} < 0, where a = 40 and d = -5

$\therefore$ {40 + (n-1) $\times$ (-5)} < 0 $\Rightarrow$ 45 < 5n $\Rightarrow$ 5n > 45 $\Rightarrow$ n > 9

$\therefore$ 10th term is the first negative term.

40. **(a)** 2310

Explanation: Here, a + d = 2 and a + 6d = 22.
On solving, we obtain d = 4 and a = -2.

$\therefore S_{35} = \frac{35}{2} \cdot [2a + 34d] = \frac{35}{2} \cdot [2 \times (-2) + 34 \times 4]$

$= \left(\frac{35}{2} \times 132\right) = (35 \times 66)$ = 2310.

Section C

41. **(b)** 45

Explanation: Let U denote the set of students of the class and let M and P denote the sets of students who passed in mathematics and physics respectively. Then
n(U) = 100, n(M) = 55 and n(P) = 67
Since all the students have passed in any of these subjects, we have
n(U) = 100 $\Rightarrow$ n(M $\cup$ P) = 100
Now we have, n(M $\cup$ P) = n(M) + n(P) - n(M $\cap$ P)
$\Rightarrow$ 100 = 55 + 67 - n(M $\cap$ P)
$\Rightarrow$ n(M $\cap$ P) = 122 - 100 = 22

Which means the number of students who passed in both the subjects = 22
Hence the number of students who passed only in physics = n(P) - n(M ∩ P) = 67 - 22 = 45

42. **(c)** {(1,3), (2,2), (3,3)}
Explanation: A relation is a function if first entry in each pair (element) is not repeated.

43. **(b)** $\frac{\pi}{4}$
Explanation: $\frac{\pi}{4}$
Let z = (1 + i)
$\tan\alpha = \left|\frac{\mathrm{Im}(z)}{\mathrm{Re}(z)}\right|$
= 1
$\Rightarrow \alpha = \frac{\pi}{4}$
since, z lies in the first quadrant.
Therefore, arg (z) $= \frac{\pi}{4}$

44. **(a)** $\frac{p^3+q^3}{pq}$
Explanation: Let the two positive numbers be a and b
a, A and b are in A.P.
∴ 2A = a + b ....(i)
Also, we have a, p, q and b are in G.P.
$\therefore r = \left(\frac{b}{a}\right)^{\frac{1}{3}}$
Again, p = ar and q = ar^2 ...(ii)
Now, 2A = a + b [From (i)]
= a + a$\left(\frac{b}{a}\right)$
= a + a$\left(\left(\frac{b}{a}\right)^{\frac{1}{3}}\right)^3$
= a + ar^3
$= \frac{(ar)^2}{ar^2} + \frac{(ar^2)^2}{ar}$
$= \frac{p^2}{q} + \frac{q^2}{p}$ [Using (ii)]
$= \frac{p^3+q^3}{pq}$

45. **(c)** $\left|\frac{a}{c}\right|\sigma$
Explanation: Y = $\frac{aX+b}{c}$
Y = $\frac{\sum y_i}{n} = \frac{\frac{a\sum X+nb}{c}}{n}$
= $\frac{a\sum X}{nc} + \frac{nb}{nc}$
= $\frac{a\bar{X}}{c} + \frac{b}{c}$
Var(X) = $\frac{\sum\left(x_i-\bar{X}\right)^2}{n}$
= σ^2
Var(Y) = $\frac{\sum\left(y_i-\bar{Y}\right)^2}{n}$
= $\frac{\sum\left(\frac{aX}{c}+\frac{b}{c}-\frac{a}{c}\bar{X}-\frac{b}{c}\right)^2}{n}$
= $\frac{\sum\left(\frac{aX}{c}-\frac{a}{c}\bar{X}\right)^2}{n}$
= $\left(\frac{a}{c}\right)^2\frac{\sum\left(x_i-\bar{X}\right)^2}{n}$
= $\left(\frac{a}{c}\right)^2\sigma^2$

SD $(\sigma)=\sqrt{\left(\frac{a}{c}\right)^2\sigma^2}$

= $\left|\frac{a}{c}\right|\sigma$

46. **(b)** $\frac{4}{3}$

    Explanation: $\frac{4}{3}$

47. **(b)** $\sqrt{97}$ km

    Explanation: $\sqrt{97}$ km

48. **(c)** 4x + 3y = 4

    Explanation: 4x + 3y = 4

49. **(a)** x = 4

    Explanation: x = 4

50. **(c)** 8x - 3y = 8

    Explanation: 8x - 3y = 8