

SECTION A

- 1 The value of $\cos(-1710^\circ)$ is
 (A) 1 (B) 0 (C) 2 (D) None of these
- 2 Let $S = \{x : x \text{ is a positive multiple of 3 less than } 100\}$ and $P = \{x : x \text{ is a prime number less than } 20\}$. Then $n(S) + n(P)$ is
 (A) 34 (B) 41 (C) 33 (D) 30
- 3 The value of $(z + 3)(\bar{z} + 3)$ is equivalent to
 (A) $|z + 3|^2$ (B) $z - 3$ (C) $z^2 + 3$ (D) None of these
- 4 If $x < 1$, then
 (A) $-x < -1$ (B) $-x \leq -1$ (C) $-x > -1$ (D) $-x \geq -1$
- 5 If $f(x) = ax + b$, where a and b are integers, $f(1) = 5$ and $f(3) = 9$, then a and b are equal to
 (A) $a = -3, b = -1$ (B) $a = 2, b = -3$ (C) $a = 0, b = 2$ (D) $a = 2, b = 3$
- 6 The value of $\cos 1^\circ \cos 2^\circ \cos 3^\circ \dots \cos 179^\circ$ is
 (A) 1 (B) 2 (C) -2 (D) 0
- 7 Let $x, y \in \mathbb{R}$, then $x + iy$ is a non-real complex number if:
 (A) $x = 0$ (B) $y = 0$ (C) $x \neq 0$ (D) $y \neq 0$
- 8 If $-3x + 17 < -13$, then
 (A) $x \in (10, \infty)$ (B) $x \in [10, \infty)$ (C) $x \in (-\infty, 10]$ (D) $x \in [-10, 10)$
- 9 Let F_1 be the set of parallelograms, F_2 the set of rectangles, F_3 the set of rhombuses, F_4 the set of squares and F_5 the set of trapeziums in a plane. Then F_1 may be equal to
 (A) $F_2 \cap F_3$ (B) $F_3 \cap F_4$ (C) $F_2 \cup F_5$ (D) $F_2 \cup F_3 \cup F_4 \cup F_5$
- 10 The domain and range of real function f defined by $f(x) = \sqrt{x - 1}$ is given by
 (A) Domain = $(1, \infty)$, Range = $(0, \infty)$ (B) Domain = $[1, \infty)$, Range = $(0, \infty)$
 (C) Domain = $[1, \infty)$, Range = $[0, \infty)$ (D) None of the above
- 11 How many terms are there in the expansion of $(x + a)^{n-1}$?
 (A) $n + 1$ (B) $n - 1$ (C) n (D) 0
- 12 The length of a rectangle is three times the breadth. If the minimum perimeter of the rectangle is 160 cm, then
 (A) breadth > 20 cm (B) length < 20 cm
 (C) breadth ≥ 20 cm (D) length ≤ 20 cm
- 13 If R is the set of real numbers and Q is the set of rational numbers, then what is $R - Q$?
 (A) Z (B) N (C) T (D) W

14 Total number of words formed by 2 vowels and 3 consonants taken from 4 vowels and 5 consonants is equal to
 (A) 60 (B) 120 (C) 7200 (D) 720

15 Simplest value of $\frac{1+i}{1-i}$ is
 (A) 1 (B) -i (C) i (D) 2

16 The total number of terms in the expansion of $(x+a)^{51} - (x-a)^{51}$ after simplification is
 (A) 102 (B) 25 (C) 26 (D) None of these

17 The number of different four digit numbers that can be formed with the digits 2, 3, 4, 7 and using each digit only once is
 (A) 120 (B) 96 (C) 24 (D) 100

18 If $f(x) = ax + b$, where a and b are integers, $f(-1) = -5$ and $f(3) = 3$, then a and b are equal to
 (A) $a = -3, b = -1$ (B) $a = 2, b = -3$ (C) $a = 0, b = 2$ (D) $a = 2, b = 3$

Questions number 19 and 20 are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (a), (b), (c) and (d) as given below.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(b) Both Assertion (A) and Reason (R) are true and Reason (R) is not the correct explanation of the Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

19 Assertion (A) : Domain of $|x|$ is R.
 Reason (R) : Range of $|x|$ is also R.

20 Assertion (A) : 10 identical balls can be arranged in 4 places in ${}^{10}C_4$ ways
 Reason (R) : When things are identical, permutation becomes combination.

SECTION B

21 Find the real numbers x and y if $(x - iy)(3 + 5i)$ is the conjugate of $-6 - 24i$.

22 List all the subsets of the set $\{-1, 0, 1\}$.

23 Solve the inequalities for real x:

$$2(2x + 3) - 10 < 6(x - 2)$$

24 Define Signum Function. Draw its graph.

25 Using Binomial Theorem, indicate which number is larger $(1.1)^{10000}$ or 1000.

SECTION C

26 Show that $9^{n+1} - 8n - 9$ is divisible by 64, whenever n is a positive integer

27 If α and β are two different complex numbers with $|\beta| = 1$, then find $\left| \frac{\beta - \alpha}{1 - \bar{\alpha}\beta} \right|$

28 Prove that $\cos 4x = 1 - 8\sin^2 x \cos^2 x$.

29 The longest side of a triangle is 3 times the shortest side and the third side is 2 cm shorter than the longest side. If the perimeter of the triangle is at least 61 cm, find the minimum length of the shortest side.

30 Prove that $(\cos x - \cos y)^2 + (\sin x - \sin y)^2 = 4 \sin^2 \frac{x-y}{2}$

31 Find the number of words with or without meaning which can be made using all the letters of the word AGAIN. If these words are written as in a dictionary, what will be the 50th word?

SECTION D

32 A solution of 8% boric acid is to be diluted by adding a 2% boric acid solution to it. The resulting mixture is to be more than 4% but less than 6% boric acid. If we have 640 litres of the 8% solution, how many litres of the 2% solution will have to be added?

Find the value of $\tan\left(\frac{\pi}{8}\right)$.

OR

Prove that $\cos^2 x + \cos^2\left(x + \frac{\pi}{3}\right) + \cos^2\left(x - \frac{\pi}{3}\right) = \frac{3}{2}$.

In how many ways can the letters of the word PERMUTATIONS be arranged if the

- (i) words start with P and end with S,
- (ii) vowels are all together,
- (iii) there are always 4 letters between P and S?

- (i) Show that if $A \subset B$, then $C - B \subset C - A$.
- (ii) Use the properties of sets to prove that for all the sets A and B
 $A - (A \cap B) = A - B$

SECTION E

A pendulum is swinging whose length is 77 cm and the tip describes an arc of length 22 cm.

- (i) Find the angle in radian measure.
- (ii) Find the angle in degree measure.

A grade 11 student was asked to draw the graph of a function by his teacher.

The function f is defined by

$$f(x) = \begin{cases} 1-x, & x < 0 \\ 1, & x = 0 \\ x+1, & x > 0 \end{cases}$$

- (i) Draw the graph of the given function.
- (ii) Find the domain of f.
- (iii) Find the range of f.

During the math class, a teacher clears the concept of permutation and combination to the 11th standard students. After the class was over she asks the students some questions:

- (i) How many 3-digit even numbers can be made using the digits 1, 2, 3, 4, 6, 7, if no digit is repeated?
- (ii) In how many ways can a student choose a programme of 5 courses if 9 courses are available and 2 specific courses are compulsory for every student?
- (iii) How many 3-digit numbers are there if no digit is repeated?

5

5

5

2+2=
4

2+1+
1=4

2+1+
1=4