CTS ACADEMY
COMPETE TO SUCCEED

CTS - SAT 2022

CTS ACADEMY SCHOLARSHIP – CUM – ADMISSION TEST

MOCK TEST PAPER (Maths)

Time: 60 Minutes **Class: 11th Moving to 12th** **Max. Marks: 120**

INSTRUCTIONS

- ***PLEASE READ THE INSTRUCTIONS CAREFULLY :***

A. General:

1. This Booklet is your Question Paper. Answers have to be marked on a separate sheet. Write your **NAME, ROLL NO.** and **CONTACT NUMBER** clearly on the Answer Sheet.
2. **Darken t**he appropriate bubbles with **Blue/Black Ball Point only**. Use of Pencil is strictly prohibited.
3. No additional sheets will be provided for rough work.
4. Blank paper, Clipboards, Calculators, Cellular Phones and Electronic Gadgets in any form are not allowed.
5. Do not tamper/spoil the test sheet.

B. Question Paper Format & Marking Scheme:

1. The Question Paper consists of total **30 questions**.
2. Each question carries **4 marks.**
3. There will be **negative marking** of one mark.

COMPETE TO SUCCEED

Best of Luck !!!

Q.1. Let S = {1, 2, 3, 4, 5}, then if $A \subseteq S$, then the Cardinality of $\Omega \coloneqq \{A \subseteq S \mid 3 \le n(A) \le 5\}$ is
(a) 13 (b) 14 (c) 15 (d) 16

Q.2. If $A = \{(x, y) \in \mathbb{R}^2 \mid y = \sin(x)\}$ and $B = \left\{(x, y) \in \mathbb{R}^2 \mid y = \frac{3}{4}x\right\}$ then $n(A \cap B)$ = ?
(a) 1 (b) 0 (c) 3 (d) None of these

Q.3. If the equation $||x + 3| - 2| = k$ has exactly 4 distinct solutions, then number of possible values for 'k' are:-
(a) zero (b) one (c) three (d) infinite

Q.4. The Domain of the function

$$f(x) = \left(\log_3\left(\frac{1}{\log_2(x)}\right)\right)^{\frac{1}{4}}$$

(a) $(0, \infty)$ (b) $(0, 1)$ (c) $(1, 2]$ (d) $(1, \infty)$

Q.5. The range of the function

$f(x) = \sum_{n=0}^{3}\left(\left(\sin^2(x)\right)^n + \left(\cos^2(x)\right)^n\right)$; $x \in \mathbb{R}$ is:

(a) $\left[\frac{7}{4}, 3\right]$ (b) $\left[\frac{15}{4}, 5\right]$ (c) {4} (d) None of the above

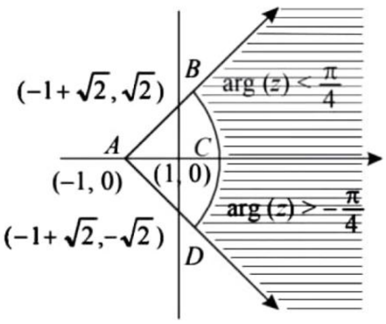
Q.6. If $f(x) = |\sin(x)|$, then number of solutions of the equation $f(|x|) = |x| - 1$ is/are:
(a) 7 (b) 5 (c) 3 (d) 2

Q.7. The sum to infinity of the series $1 - 3x + 5x^2 - 7x^3 + \ldots \infty$; $|x| < 1$ is
(a) $\frac{1-x}{(1+x)^2}$ (b) $\frac{1+x}{(1+x)^2}$ (c) $\frac{|1-x|}{(1-x)^2}$ (d) None of the above

Q.8. If $c = \frac{a^{n+2} + b^{n+2}}{a^{n+1} + b^{n+1}}$ is geometric mean between a and b, then n = ?

(a) 0 (b) 1 (c) $-\frac{1}{2}$ (d) none of the above

Q.9. The locus of z which lies in shaded region (excluding the boundaries) is best represented by



(a) $z : |z + 1| > 2$ and $|\arg(z + 1)| < \pi/4$
(b) $z : |z - 1| > 2$ and $|\arg(z - 1)| < \pi/4$
(c) $z : |z + 1| < 2$ and $|\arg(z + 1)| < \pi/2$
(d) $z : |z - 1| < 2$ and $|\arg(z + 1)| < \pi/2$

Q.10. For all complex numbers z_1, z_2 satisfying $|z_1| = 12$ and $|z_2 - 3 - 4i| = 5$, the minimum value of $|z_1 - z_2|$ is
(a) 0 (b) 2 (c) 7 (d) 17

Q.11. If $\left(\frac{1+i}{1-i}\right)^x = 1$ then
(a) x = 2n + 1, where n is any positive integer
(b) x = 4n, where n is any positive integer
(c) x = 2n, where n is any positive integer
(d) x = 4n + 1, where n is any positive integer

Q.12. The number $\log_2 7$ is
(a) an integer (b) a rational number
(c) an irrational number (d) a prime number

Q.13. If $\ln(a+c), \ln(a-c), \ln(a-2b+c)$ are in A.P., then
(a) a, b, c are in A.P. (b) a^2, b^2, c^2 are in A.P.
(c) a, b, c are in G.P. (d) a, b, c are in H.P.

Q.14. Let $a_1, a_2, \ldots, a_{10}$ be in A.P. and $h_1, h_2, \ldots, h_{10}$ be in H.P. If $a_1 = h_1 = 2$ and $a_{10} = h_{10} = 3$, then $a_4 h_7$ is
(a) 2 (b) 3 (c) 5 (d) 6

Q.15. $\lim_{n\to\infty}\left\{\frac{1}{1-n^2} + \frac{2}{1-n^2} + \ldots + \frac{n}{1-n^2}\right\}$ is equal to
(a) 0 (b) $-\frac{1}{2}$ (c) $\frac{1}{2}$ (d) none of these

Q.16. If

$$f(x) = \frac{\sin[x]}{[x]}, [x] \neq 0$$
$$= 0, \quad [x] = 0$$

where [x] denotes the greatest integer less than or equal to x. Then $\lim_{x\to 0} f(x)$ equals –
(a) 1 (b) 0
(c) -1 (d) none of these

Q.17. If the standard deviation of a variable X is σ, then the standard deviation of variable Y = $\frac{4-3X}{5}$ is:
(a) -3σ (b) 3σ (c) $\frac{4-3\sigma}{5}$ (d) $\frac{3}{5}\sigma$

Q.18. Let $\langle a_n \rangle$ be an H.P.
$a_8 = \frac{1}{2}, a_{14} = \frac{1}{3}$ then $a_{20} = \ldots$
(a) $\frac{1}{6}$ (b) $\frac{1}{5}$
(c) $\frac{1}{4}$ (d) None of the above

Q.19. If a, b, c are in G.P. then, $\frac{1}{3+\log(a^2)}, \frac{1}{3+\log(b^2)}, \frac{1}{3+\log(c^2)}$ are in

(a) A.P. (b) G.P. (c) H.P. (d) None of the above

Q.20. If $\frac{(a+b)}{1-ab}, b, \frac{b+c}{1-bc}$ are in A.P., then $\frac{1}{a}, b, \frac{1}{c}$ are in

(a) A.P. (b) G.P. (c) H.P. (d) None of the above

Q.21. Let S_n denotes the sum of 1st n terms of an A.P. and $\frac{S_a}{a^2} = \frac{S_b}{b^2} = c$, then S_c is

(a) c^3 (b) $\frac{c}{ab}$ (c) abc (d) a + b + c

Q.22. If $\alpha = \sum_{n=1}^{\infty} \frac{1}{n(n+1)(n+2)(n+3)}$, then

(a) $\alpha = 0$ (b) $\alpha = \frac{1}{18}$ (c) $\alpha = \frac{1}{6}$ (d) None of the above

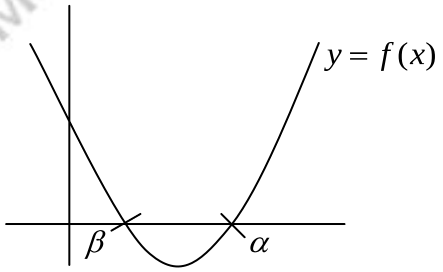
Q.23. If $\alpha = \underset{n\to\infty}{lt} \frac{1}{\sqrt{n}}\left(\frac{1}{\sqrt{2}+\sqrt{4}} + \frac{1}{\sqrt{4}+\sqrt{6}} + \dots + \frac{1}{\sqrt{2n}+\sqrt{2n+2}}\right)$ then

(a) $\alpha = 0$ (b) $\alpha = \sqrt{2}$ (c) $\alpha = \frac{1}{\sqrt{2}}$ (d) None of the above

Q.24. If both roots of equation $x^2 - 2\alpha x + \alpha^2 - 1 = 0$ lie between -3 and 4, then $[\alpha]$ is not equal to

(a) 0 (b) 1 (c)-1 (d) 4

Q.25. The following figure show the graph of $f(x) = ax^2 + bx + c$. Then,



(a) $4ac - b^2 \geq 0$ (b) c < 0 (c) a.b < 0 (d) a < 0

Q.26. The equation $3^{\log_{\sqrt{3}}(\sqrt{x})} + 9^{\log_3(x)} + 27^{\log_3(2x^2)} = 3$ has:

(a) no real roots
(b) only one real root
(c) exactly two real roots
(d) None of the above

Q.27. The equation:
$2^x + 3^x + 5^x + 7^x = 11^x$ has:
(a) infinitely many real roots
(b) exactly two roots
(c) exactly one real root
(d) None of the above

Q.28. The equation

$\sin(x)+\frac{1}{x}=x+\frac{1}{x}$ has

(a) no root
(b) one root
(c) three roots
(d) None of the above

Q.29. If $z=\frac{\pi}{8}(1+i)^8\left(\frac{1-i\sqrt{e}}{i+\sqrt{e}}+\frac{\sqrt{e}-i}{1+i\sqrt{e}}\right)$ then, $\left(\frac{|z|}{\arg(z)}\right)$ = ?

(a) $\frac{2}{3}$
(b) $\frac{4}{3}$
(c) $\frac{8}{3}$
(d) None of the above

Q.30. Let $w=e^{i\frac{2\pi}{3}}$ and let set A be the collection of all natural powers of w ; i.e. A ≔ $\{w^n \mid n \in \mathbb{N}\}$

Let S_1 ≔ $\{z \in \mathbb{C} \mid \mathrm{Re}(z) > 0\}$ and S_2 ≔ $\{z \in \mathbb{C} \mid \mathrm{Re}(z) < 0\}$.

Let $z_1 \in A \cap S_1$ and $z_2 \in A \cap S_2$ and let o be the origin, then; the least value of $\angle z_1 o z_2$ is …

(a) $\frac{2\pi}{3}$
(b) $\frac{\pi}{2}$
(c) $\frac{\pi}{6}$
(d) $\frac{5\pi}{6}$