MATHEMATICS TEACHERS ASSOCIATION MALAPPURAM (MAM)

MATHEMATICS TEST SERIES – I
MAY 2022

CLASS : XI   **Time : 2 Hrs**

Max. score : 60   **Cool off time : 15 min**

(Sets, Relations and functions, Trigonometric functions, Principle of Mathematical Induction)

General Instructions to Candidates :

- There is a 'cool-off time' of 15 minutes in addition to the writing time.
- Use the 'cool-off time' to get familiar with questions and to plan your answers.
- Read questions carefully before answering.
- Read the instructions carefully.
- Calculations, figures and graphs should be shown in the answer sheet itself.
- Give equations wherever necessary.
- Electronic devices except non-programmable calculators are not allowed in the Examination.

വിദ്യാർത്ഥികൾക്കുള്ള പൊതു നിർദേശങ്ങൾ :

- നിർദിഷ്ട സമയത്തിനു പുറമെ 15 മിനുറ്റ് "കൂൾ ഓഫ് ടൈം " ഉണ്ടായിരിക്കും
- ഉത്തരങ്ങൾ എഴുതുന്നതിനു മുൻപ് ചോദ്യങ്ങൾ ശ്രദ്ധാപൂർവം വായിക്കണം
- എല്ലാ ചോദ്യങ്ങൾക്കും ഉത്തരം എഴുതണം.
- കണക്കു കൂട്ടലുകൾ , ചിത്രങ്ങൾ , ഗ്രാഫുകൾ എന്നിവ ഉത്തരപ്പേപ്പറിൽ തന്നെ ഉണ്ടായിരിക്കണം.
- ആവശ്യമുള്ള സ്ഥലത്തു സമവാക്യങ്ങൾ കൊടുക്കണം.
- പ്രോഗ്രാമുകൾ ചെയ്യാനാകാത്ത കാല്കുലേറ്ററുകൾ ഒഴികെയുള്ള ഒരു ഇലക്ട്രോണിക് ഉപകരണവും ഉപയോഗിക്കാൻ പാടില്ല.

1. If $A = \{x : x \text{ is a letter in the word "MATHEMATICS"}\}$,
   $B = \{y : y \text{ is a letter in the word "STATISTICS"}\}$, then write
   (a) A and B in roster form   (1)
   (b) $A - B$ (1)
   (c) $A \cap B$ (1)

2. If $A = \{1,2,3\}$
   (a) Write the number of subsets of A   (1)
   (b) Write P(A), where P(A) is the power set of A   (2)

3. Find the domain of $f(x) = \dfrac{x^2 + 3x + 5}{x^2 - 5x + 4}$ (3)

4. If $f(x) = x^3 + 5x$, $g(x) = 2x + 1$. Then find $f + g$, fg and f/g (3)

5. (a) $sin(-x) = \ldots\ldots$ (1)
       (i) $sin\ x$ (ii) $-sin\ x$
       (iii) $cos\ x$ (iv) $-cos\ x$
   (b) Prove that $\dfrac{\tan\left(\frac{\pi}{4}+x\right)}{\tan\left(\frac{\pi}{4}-x\right)} = \left(\dfrac{1+\tan x}{1-\tan x}\right)^2$ (2)

6. (a) Find the degree measure corresponding to $\dfrac{2\pi}{3}$ radian   (1)
   (b) $sinx = \dfrac{3}{5}$, x lies in the second quadrant.
       Find the values of $cosx$ and $tan\ x$ (2)

7. (a) Find the principal solutions of the equation $sin\ x = \dfrac{1}{2}$ (2)
   (b) Hence write the general solution of the above equation $sin\ x = \dfrac{1}{2}$
                                                                  (1)

8. Consider the statement "$7^n - 3^n$ is divisible by 4"
   (a) Verify the result for $n = 1$ (1)
   (b) Prove the statement using mathematical induction.   (2)

(Answer ANY SIX, each question carries 4 marks)

9. If $A \subset B$
   (a) $A \cup B = \ldots\ldots$ (1)
   (b) $A \cap B = \ldots\ldots$ (1)
   (c) Draw the Venn diagram of $B - A$ (2)

10. In a school, there are 20 teachers who teach Mathematics or Physics. Of these 12 teach Mathematics and 12 teach Physics.
    (a) How many teach both the subjects. (2)
    (b) How many teach physics only. (2)

11. If $A = \{x : x \in R, x^2 - 5x + 6 = 0 \}, B = \{x : x \in R, x^2 = 9\}$
    (a) Write A and B in roster form (2)
    (b) Verify that $(A - B) \cup (B - A) = (A \cup B) - (A \cap B)$ (2)

12. (a) A={2,3}, B={1,3,5}, then the number of relations from A to B is
    (i) 2   (ii) 64   (iii) 32   (iv) 62   (1)
    (b) R is a relation defined on the set $A = \{1,2,3, \ldots, 14\}$ by
    $R = \{(x, y): 3x - y = 0, x, y \in A\}$.
    (i) Write R in roster form (1)
    (ii) Write the domain and range of R (2)

13. Consider the modulus function $f(x) = |x|$.
    (a) Draw the graph of the function $f(x) = |x|$. (2)
    (b) Find the domain and range of the function $f(x) = |x|$. (2)

14. (a) Find the value of $\cos 15°$ (2)
    (b) Prove that $\cos\left(\frac{\pi}{4} + x\right) + \cos\left(\frac{\pi}{4} - x\right) = \sqrt{2}\cos x$ (2)

15. (a) Find the value of $\sin\left(\frac{31\pi}{3}\right)$ (1)
    (b) Show that $(\cos x + \cos y)^2 + (\sin x + \sin y)^2 = 4\cos^2\left(\frac{x-y}{2}\right)$ (3)

16. Consider the statement $P(n): 1 + 3 + 3^2 + 3^3 + \cdots + 3^{n-1} = \frac{3^n - 1}{2}$
    (a) Show that $P(1)$ is true (1)
    (b) Prove by principle of mathematical induction, that $P(n)$ is true for all $n \in N$ (3)

(Answer ANY THREE, each question carries 6 marks)

17. If $U = \{1,2,3,4,5,6,7,8,9\}$, $A = \{2,4,6,8\}$, $B = \{2,3,5,7\}$.
    (a) Verify that $(A \cap B)' = A' \cup B'$ (3)
    (b) Verify that $(A \cup B)' = A' \cap B'$ (3)

18. Let $A = \{1,2,3,4,5,6\}$. Define a relation R on A by
    $R = \{(x, y): y = x + 1\}$
    (a) Depict the relation using an arrow diagram   (2)
    (b) Write down the domain, codomain and range of R.   (3)
    (c) Is R a function? Why ?   (1)

19. **(a)** Prove that $\tan 3x . \tan 2x . \tan x = \tan 3x - \tan 2x - \tan x$ (2)
    (b) Find $\sin 765°$ (1)
    (c) Prove that: $\dfrac{Cos7x + Cos5x}{Sin7x - Sin5x} = cotx$ (3)

20. **(a)** Solve $\sin 2x + \cos x = 0$ (3)
    (b) Prove that $\dfrac{cos4x + cos3x + cos2x}{sin4x + sin3x + sin2x} = cot3x$ (3)

21. **(a)** Find x and y if $(x + 1, y - 2) = (3,1)$ (1)
    (b) If $A = \{-1,1\}$, find $A \times A$ (1)
    (c) The figure shows a relation between the sets P and Q.
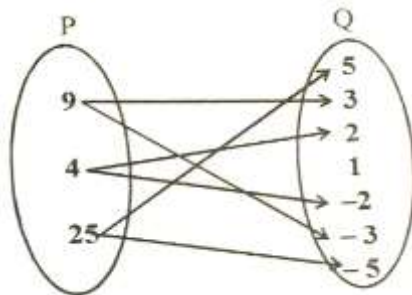
    (i) Write the relation in set builder form   (1)
    (ii) Write the relation in roster form   (1)
    (iii) Write its domain and range.   (2)