



## MATHS

### BOOKS - SURA MATHS (TAMIL ENGLISH)

### GOV. MODEL QUESTION PAPER - 1

#### Section I

1. If  $A = \{ (x,y) : y = \sin x, x \in \mathbb{R} \}$  and  $B = \{ (x,y) : y = \cos x, x \in \mathbb{R} \}$  then  $A \cap$

B contains

- A. no element
- B. infinity many elements
- C. only one element
- D. cannot be determined.

**Answer: A**



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2. The number of relations on a set containing 3 elements is

- A. 9
- B. 81
- C. 512
- D. 1024

**Answer: A::B**



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3. The function  $f : [0, 2\pi] \rightarrow [-1, 1]$  defined by  $f(x) = \sin x$  is

- A. one-to-one
- B. onto
- C. bijection cannot be defined

D. cannot be defined

**Answer:**



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4. Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  be defined by  $f(x) = 1|x|$ . Then the range of  $f$  is

A.  $\mathbb{R}$

B.  $(1, \infty)$

C.  $(-1, \infty)$

D.  $(-\infty, 1]$

**Answer: A**



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5. If quadratic with coefficients has no real roots, then its discriminant is

\_\_\_\_\_

A. 0

B.  $< 0$

C.  $> 0$

D. 1

**Answer:**



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6. If  $|x + 2| \leq 9$ , then  $x$  belongs to

A.  $(-\infty, 7)$

B.  $[-11, 7]$

C.  $(-\infty, -7) \cup [11, \infty)$

D.  $(-11, -7)$

**Answer: A**



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7. If  $a$  and  $b$  are the roots of the equation  $x^2 - kx + 16 = 0$  and satisfy  $a^2 + b^2 = 32$ , then the value of  $k$  is

A. 10

B. -8

C.  $-8, 8$

D. 6

**Answer:**



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8. If  $\sqrt{x + 14} < 2$ , then  $x$  belongs to

A.  $(-14, -10)$

B.  $(-14, 10)$

C.  $(-\infty, -10)$

D.  $(14, -10)$

**Answer: A::D**



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**9.**  $\cos 1^\circ + \cos 2^\circ \cos 3^\circ \dots + \cos 179^\circ$  is

A. 0

B. 1

C. -1

D. 89

**Answer:**



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10. Which one of the following is not true for any  $\theta$ ?

A.  $\sin \theta = -\frac{3}{4}$

B.  $\sin \theta = -1$

C.  $\tan \theta = 25$

D.  $\sec \theta = \frac{1}{4}$

**Answer: A::C::D**



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11. A wheel is spinning at 2 radians/second. How many seconds will it take to make 10 complete rotations?

A.  $10\pi$  seconds

B.  $20\pi$  seconds

C.  $5\pi$  seconds

D.  $15\pi$  seconds

**Answer: A::C::D**



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12.  $\frac{\cos 10^\circ - \sin 10^\circ}{\cos 10^\circ + \sin 10^\circ}$  is

A.  $\tan 35^\circ$

B.  $\sqrt{3}$

C.  $\tan 75^\circ$

D. 1

**Answer: A::C**



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13. The product of  $r$  consecutive positive integers is divisible by



A.  $r!$

B.  $(r - 1)!$

C.  $(r + 1)!$

D.  $r^r$

**Answer:**



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**14.** Number of sides of a polygon having 44 diagonals is

A. 4

B.  $4!$

C. 11

D. 22

**Answer: A**



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15. If  ${}^{''}C_4, {}^{''}C_5, {}^{''}C_6$  are in AP then value of n is

A. 14

B. 11

C. 9

D. 5

**Answer: A::D**



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16. The sum of the digits in the unit's place of all the 4-digit numbers formed by 3,4,5 and 6, without repetition , is

A. 432

B. 108

C. 36

D. 72

**Answer: A**



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17. If  $a$  is the arithmetic mean and  $g$  is the geometric mean of two numbers, then

A.  $a \leq g$

B.  $a \geq g$

C.  $a = g$

D.  $a > g$

**Answer: A**



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18. The coefficient of  $x^8y^{12}$  in the expansion of  $(2x + 3y)^{20}$  is

A. 0

B.  $2^83^{12}$

C.  $2^83^{12} + 2^{12}3^8$

D.  $C_8^{20}2^83^{12}$

Answer: A::B::C



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19. The value of  $\frac{1}{2!} + \frac{1}{4!} + \frac{1}{6!} + \dots$  is

A.  $\frac{e^2 + 1}{2e}$

B.  $\frac{(e + 1)^2}{2e}$

C.  $\frac{(e - 1)^2}{2e}$

D.  $\frac{e^2 + 1}{2e}$

**Answer: A::B**



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**20.** The remainder when  $52^{40}$  is divided by 17 is

A. 1

B. 3

C. 5

D. 6

**Answer: A**



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1.

If

$A = \{1, 2, 3, 4\}$  and  $B = \{3, 4, 5, 6\}$ , find  $n((A \cup B) \times (A \cap B) \times (A \cap B))$ .



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2. In the set  $Z$  of integers, define  $m R n$  if  $m - n$  is a multiple of 12. Prove that

$R$  is an equivalence relation.



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3.

Prove

$A \times A$  has 9 elements,  $S = \{(a, b) \in A \times A : a > b\}$ ,  $(2, -1)$  and  $(2, 1)$

are two elements. , then find the remaining elements of  $S$ .



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4.

Prove

$A \times A$  has 9 elements,  $S = \{(a, b) \in A \times A : a > b\}$ ,  $(2, -1)$  and  $(2, 1)$  are two elements. , then find the remaining elements of  $S$ .



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5. Solve :  $(x - 2)(x + 3)^2 < 0$ .



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6. If  $A + B = 45^\circ$ , show that  $(1 + \tan A)(1 + \tan B) = 2$ .



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7. Prove that  $\frac{\sin 4x + \sin 2x}{\cos 4x + \cos 2x} = \tan 3x$



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8. Out of 6 consonants and 4 vowels, how many strings of 3 consonants and 2 vowels can be formed ?



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9. Prove that  $\sum_{k=1}^n \frac{1}{k(k+1)} = 1 - \frac{1}{n+1}$ .



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10. Prove that  $\log_4 2 - \log_8 2 + \log_6 2 \dots$  is  $1 - \log_e 2$ .



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## Section Iii

1. If  $f: \mathbb{R} \rightarrow \mathbb{R}$  is defined by  $f(x) = 3x-5$ , prove that  $f$  is a bijection and find its inverse.





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2. For the curve  $y = x^3$  given in figure draw,  $y = (x + 1)^3$



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3. If one root  $k(x - 1)^2 = 5x - 7$  is double the other root, show that  $k = 2$  or  $-25$ .



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4. Resolve into partial fractions :  $\frac{10x + 30}{(x^2 - 9)(x + 7)}$ .



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5. Suppose that a boat travels 10 km from the port towards east and then turns  $60^\circ$  to its left. If the boat travels further 8 km, how far from the

port is the boat?



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6. If  $A + B + C = \frac{\pi}{2}$ , prove that

$$\sin 2A + \sin 2B + \sin 2C = 4 \cos A \cos B \cos C$$



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7. How many different selections of 5 books can be made from 12 different books if,

- (i) Two particular books are always selected ?
- (ii) Two particular books are never selected ?



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8. How many different selections of 5 books can be made from 12 different books if,

(i) Two particular books are always selected ?

(ii) Two particular books are never selected ?



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9. How many numbers are three between 100 and 500 with the digits 0,1,2,3,4,5, ? If

(i) repetition of digits allowed

(ii) the repetition of digits is not allowed ?



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10. Find the co-efficient of  $x^{15}$  in  $\left(x^2 + \frac{1}{x^3}\right)^{10}$



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11. In  $\triangle ABC$ , if  $\tan \frac{A}{2} = \frac{5}{6}$  and  $\tan \frac{C}{2} = \frac{2}{5}$ , then show that a, b, c, are in A.P.

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## Section IV

1. Show that range of the function

$$\frac{1}{2\cos x - 1} \text{ is } \left(-\infty, -\frac{1}{3}\right] \cup [1, \infty)$$

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2. Let

$f, g: \mathbb{R} \rightarrow \mathbb{R}$  defined as  $f(x) = 2x - |x|$  and  $g(x) = 2x + |x|$ . Find  $f \circ g$ .

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3. Prove that the solution of  $\frac{x+1}{x+3} < 3$  is  $(-\infty, -4) \cup (-3, \infty)$ .

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4. If  $x \cos \theta = y \cos \left( \theta + \frac{2\pi}{3} \right) = z \cos \left( \theta + \frac{4\pi}{3} \right)$ , find the value of  $xy + yz + zx$



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5. Solve  $\sqrt{3} \tan^2 \theta + (\sqrt{3} - 1) \tan \theta - 1 = 0$



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6. If the letters of the word APPLE are permuted in all possible ways and the strings then formed are arranged in the dictionary order show that the rank of the word APPLE is 12.



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7. A van has 8 seats. It has two seats in the front with two rows of three seats behind. The van belongs to a family, consisting of seven members,

$F, M, S_1, S_2, S_3, D_1, D_2$ . How many ways can the family sit in the van if

i. There are no restrictions?

ii. Either  $F$  or  $M$  drives the van?

iii.  $D_1, D_2$  sits next to a window and is driving?



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8. Using Mathematical induction, show that for any natural number  $n$ ,

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)} = \frac{n}{n+1}$$



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9. Prove that  $\sqrt[3]{x^3 + 7} - \sqrt[3]{x^3 + 4}$  is approximately equal to  $\frac{1}{x^2}$  when  $x$  is large.



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10. Let  $A = \{2, 3, 5\}$  and relation  $R = \{(2, 5)\}$  write down the minimum number of ordered pairs to be included to  $R$  to make it an equivalence relation.



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11.

If

$$x \sum_{n=0}^{\infty} \cos^{2n} \theta, y = \sum_{n=0}^{\infty} \sin^{2n} \theta \text{ and } z = \sum_{n=0}^{\infty} \cos^{2n} \theta \sin^{2n} \theta, < \theta < \frac{\pi}{2},$$

then show that  $xyz = x + y + z$ .



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