



## MATHS

### BOOKS - S CHAND MATHS (ENGLISH)

#### MODEL TEST PAPER -16

#### Section A

1. For any two sets  $A$  and  $B$ ,  $A' - B' =$

A.  $A - B$

B.  $B - A$

C.  $A \cup B$

D.  $A \cap B$

**Answer: B**



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2. If  $a, b$  are positive real numbers, then  $|x| \leq a \Leftrightarrow$

A.  $-a \leq x \leq a$

B.  $x \leq -a$  or  $x \geq a$

C.  $-a < x < a$

D.  $x < -a$  or  $x > +a$

**Answer: A**



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3. If the arcs of the same length in two circles subtend angles  $65^\circ$  and  $110^\circ$  at the centre then the ratio of the radii of the circles is

A. 22 : 13

B. 11 : 13

C. 22 : 15

D. 21 : 13

**Answer: A**



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4. The number of values of  $\theta$  in  $[0, 2\pi]$  that satisfies the equation  $\sin^2 \theta - \cos \theta = \frac{1}{4}$

A. 4

B. 3

C. 2

D. None of these

**Answer: C**



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5. If the sum of  $n$  terms of an A.P. is  $2n^2 + 5n$ , then its  $n^{\text{th}}$  term

A. A.  $4n - 3$

B. B.  $3n - 4$

C. C.  $4n + 3$

D. D.  $3n + 9$

**Answer: C**



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6. Value of  $i^{37} + \frac{1}{i^{67}}$

A. 0

B.  $-1$

C.  $2i$

D.  $-2i$

**Answer: C**



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7. 4<sup>th</sup> term from end in the expansion of  $\left(\frac{3}{x^2} - \frac{x^3}{6}\right)^7$  is  $kx^6$ ,

then the value of k is

A. A.  $\frac{53}{48}$

B. B.  $\frac{35}{48}$

C. C.  $\frac{48}{35}$

D. D.  $\frac{48}{53}$

**Answer: B**



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8. The least positive integer n such that  $\left(\frac{2i}{1+i}\right)^n$  is a positive integer is

A. 16

B. 8

C. 4

D. 2

**Answer: B**



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**9.** The angle between the line  $x = a$  and  $by + c = 0$ , is

A.  $0^\circ$

B.  $60^\circ$

C.  $180^\circ$

D.  $90^\circ$

**Answer: D**



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**10.** The coordinates of the centre of the circle inscribed in the square formed by the lines  $x=2$ ,  $x=6$ ,  $y=5$  and  $y=9$  is:

A. A. (4, 7)

B. B. (7, 4)

C. C. (3, 6)

D. D. (9, 5)

**Answer: A**



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11. Evaluate :  $\lim_{x \rightarrow 1} \frac{x^m - 1}{x^n - 1}$

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12. Given  $f(x) = \frac{1}{\sec x - \tan x}$ , prove that  $f'(x) = \sec x(\sec x + \tan x)$

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13. There are three events A, B, and C, one of which one and only one can happen. The odds are 7 to 4 against A and 3 to 5 favour of B. Find the odds against C.

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14. Let  $P(n)$  be the statement "7 divides  $2^{3n} - 1$ ." What is  $P(n + 1)$ ?

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15. Find the number of terms in the expansion of  $\left(1 + \frac{x^2}{4} - x\right)^5$ .

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16. Prove that for a null set  $\phi$ ,  $n\{P(P(\phi))\} = 2$ .

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17. A function  $f$  is defined on the set of real numbers as follows:

$$f(x) = \begin{cases} x + 1 & 1 \leq x < 2 \\ 2x - 1 & 2 \leq x < 4 \\ 3x - 10 & 4 \leq x < 6 \end{cases}$$

(a) Find the domain of the function.

(b) Find the range of the function.

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18. The angles of a triangle ABC are in A.P. and it is being given that  $b : c = \sqrt{3} : \sqrt{2}$ , find  $\angle A$ .

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19. Evaluate :  $\tan \frac{2\pi}{9} + \tan \frac{\pi}{9} + \sqrt{3} \tan \frac{2\pi}{9} \tan \frac{\pi}{9}$

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20. If  $\theta = \frac{\pi}{7}$ , show that  $\cos \theta \cos 2\theta \cos 3\theta = \frac{1}{8}$ .

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21. Express in polar form, hence find the amplitude:

$$z = -1 - i.$$

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22. Find  $k$  so that the roots of the equation

$$\frac{x^2 - qx}{px - r} = \frac{k - 1}{k + 1}$$
 may be equal in magnitude but opposite

in sign.

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23. Redefine the function

$$f(x) = |1 + x| + |1 - x|, \quad -2 \leq x \leq 2.$$

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24. Evaluate :  $\cos^2 76^\circ + \cos^2 16^\circ - \cos 76^\circ \cdot \cos 16^\circ$

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25. If  $\sin \alpha \cdot \sin \beta - \cos \alpha \cdot \cos \beta + 1 = 0$ , then find the value of  $\cot \alpha \cdot \tan \beta$ .

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26. If  $y\sqrt{x^2 + 1} = \log(\sqrt{x^2 + 1} - x)$ , prove that  $(x^2 + 1)\frac{dy}{dx} + xy + 1 = 0$ .

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27. How many words each of 3 vowels and 2 consonants can be formed from the letters of the word INVOLUTE so that consonants never together?

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28. 12 persons are invited for a party. In how many different ways can they and the host be seated at a circular table, if two particular persons are to be seated on either side of the host?



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29. Prove that  $\frac{6x^2 - 22x + 21}{5x^2 - 18x + 17}$  for real values of  $x$  lies between 1 and  $\frac{5}{4}$ .



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30. Given that  $\alpha$  and  $\beta$  are the roots of the equation  $2x^2 - 3x + 4 = 0$ , find an equation whose roots are  $\alpha + \frac{1}{\alpha}$  and  $\beta + \frac{1}{\beta}$ .



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31. Find the  $n^{\text{th}}$  term of the series  $2 + \frac{5}{9} + \frac{7}{27} + \dots$ . Hence find sum to  $n$  terms.



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**32.** Calculate the co-ordinates of the foot of the perpendicular from the point  $(-4, 2)$  to the line  $3x + 2y = 5$ . Also find the equation of the smallest circle passing through  $(-4, 2)$  and having its centre on the line  $3x + 2y = 5$ .



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**33.** A triangle is formed by the lines whose equations are  $3x + 4y - 6 = 0$ ,  $12x - 5y - 3 = 0$  and  $4x - 3y + 12 = 0$ . Find the internal bisector of the angle opposite to the side  $3x + 4y - 6 = 0$ .



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34. A purchasing agent obtained samples of 60 watt bulbs from a standard company. He had the samples tested in his own laboratory for length of life with following results:

Length of life (in hours)	More than 1700	More than 1900	More than 2100	More than 2300	More than 25000
Frequency	60	50	34	14	6

Find the standard deviation for these samples.

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## Section B

1. The distance between the directrices of ellipse

$$\frac{x^2}{36} + \frac{y^2}{20} = 1$$
 is (i) 81 (ii) 9 (iii) 18 (iv) None of these

A. 81

B. 9

C. 18

D. None of these

**Answer: C**



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2. If the latus rectum of an ellipse is equal to half of minor axis, then its eccentricity is (i)  $\sqrt{\frac{3}{2}}$  (ii)  $\frac{\sqrt{3}}{2}$  (iii)  $\frac{1}{2}$  (iv) None of these

A.  $\sqrt{\frac{3}{2}}$

B.  $\frac{\sqrt{3}}{2}$

C.  $\frac{1}{2}$

D. None of these

**Answer: B**



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3. Find the ratio in which the first point divides the join of other two:  $(0,-1,-7)$ ,  $(2,1,-9)$  and  $(6,5,-13)$ .



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4. Find the equation of the hyperbola whose vertices are  $(\pm 3, 0)$  and foci at  $(\pm 5, 0)$



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5. Write the converse of the following statement: 'A positive integer is prime only if it has no divisors other than 1 and itself.'



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6. Write down the negation of following compound statement:  $|x|$  is equal to  $x$  or  $-x$ .



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7. Prove by direct method that for any real numbers  $x, y$  if  $x=y$ , then  $x^2 = y^2$ .



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8. If the distance between the foci of a hyperbola is 16 and its eccentricity is  $\sqrt{2}$ , then obtain the equation of the hyperbola.



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9. Find the equation of the parabola having focus at  $(-1, -2)$  and directrix is  $x - 2y + 3 = 0$ .



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10. If the mid points of the sides of a triangle AB, BC and CA are  $D(1, 2, -3)$ ,  $E(3, 0, 1)$  and  $F(-1, 1, -4)$ , then find the centroid of the triangle.



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1. For the given data, the calculation corresponding to all values of variables  $(x, y)$  is following:

$$\Sigma(x - \bar{x})^2 = 36, \Sigma(y - \bar{y})^2 = 25, \Sigma(x - \bar{x})(y - \bar{y}) = 20$$

Karl Pearson's correlation coefficient is

- A. 0.66
- B.  $-0.66$
- C.  $-0.5$
- D. 1.66

**Answer: a**



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2. The value of  $r$  in case of negative correlation lies in the interval

A.  $(-\infty, 0)$

B.  $(-\infty, 0]$

C.  $[-1, 0)$

D.  $[-1, 0]$

**Answer: C**



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3. Find the coefficient of correlation, when  $\text{Cov}(x, y) = -16.5$ ,  
 $\text{Var}(x) = 100$ ,  $\text{Var}(y) = 2.89$ .



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4. Calculate the index number for the total cost of the raw material uses, given  $\Sigma\omega = 10$  and  $\Sigma I\omega = 1173.61$ .

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5. If a machine cost Rs. 10000 in 2015 and Rs. 15000 in 2018, then find the price relative.

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6. Find correlation coefficient when,

$$\Sigma x_i = 40, \Sigma y_i = 55, \Sigma x_i^2 = 192, \Sigma y_i^2 = 385, \Sigma (x_i + y_i)^2 = 947$$

and  $n = 10$ .

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7. Find out rank correlation form the following data:

S. No.	1	2	3	4	5	6	7	8	9	10
Rank differences	-2	-4	-1	3	2	0	-2	3	3	-2

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8. From the following data calculate the percentage of employees who earn more than Rs. 120.96 per day.

Daily wages (in ₹)	60-70	70-80	80-90	90-100	100-110	110-120	120-130
Number of workers	40	68	86	120	90	40	26

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9. The Daily sales figure of a particular brand of TV from 1<sup>st</sup> April 2018 to 14<sup>th</sup> April are as follows:



Calculate three-days moving averages and display these and the original figures on the same graph.



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