MATHS

BOOKS - S CHAND MATHS (ENGLISH)

MODEL TEST PAPER -3

Section A

1. The value of $2\sin 15^\circ . \cos 75^\circ$

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

B. 1

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

D. $\frac{2-\sqrt{3}}{2}$

Answer: D

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2. $i^{57} + \frac{1}{i^{125}}$, is equal to

A. A. $2i$

B. B. $-2i$

C. C. 0

D. D. 2

Answer: C

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3. If $A = \{1, 3, 5, 6\}$, the number of elements in $P\{P(A)\}$ is

A. A. 2^4

B. B. 2^{16}

C. C. 4

D. $D.\ 16$

Answer: B

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4. The range of the function $f(x) = \frac{|x-4|}{x-4}$ is

A. A. $[1, \infty)$

B. B. $\{-1, 1\}$

C. C. R

D. D. $\{-1, 3\}$

Answer: D

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5. The argument of the complex number $\left(\frac{3+i}{2-i} + \frac{3-i}{2+i}\right)$ is equal to

A. A. $\frac{\pi}{2}$

B. B. $\frac{\pi}{4}$

C. C. 0

D. D. $-\frac{\pi}{4}$

Answer: C

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6. The equation of circle having centre at (2,2) and passes through the point (4,5) is

A. $(x+2)^2+(y+2)^2=13$

B. $(x-4)^2+(y-5)^2=13$

C. $(x-2)^2+(y-2)^2=13$

D. $(x+2)^2+(y-2)^2+13$

Answer: C

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7. The perpendicular distance from the point (1,-1) to the line $x + 5y - 9 = 0$ is equal to

A. $\sqrt{\frac{2}{13}}$

B. $\frac{\sqrt{13}}{2}$

C. $\frac{2}{13}$

D. $\frac{13}{2}$

Answer: B

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8. $\lim_{k \to \infty} \frac{1^3 + 2^3 + \ldots\ldots\ldots + k^3}{k^4}$ is equal to

A. A. 0

B. B. 2

C. C. $\frac{1}{3}$

D. D. $\frac{1}{4}$

Answer: D

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9. Value of $\tan 130^\circ . \tan 140^\circ$.

A. 1

B. -1

C. 0

D. 2

Answer: A

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10. We wish to select 6 persons from 8 persons, but if the person A is chosen, then B must be chosen. Then the number of ways the selection can be made is

A. 15

B. 7

C. 22

D. 20

Answer: C

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11. If a is the arithmetic mean of b and c, and two geometric means G_1 and G_2 are inserted between b and c such that $G_1^3 + G_2^3 = \lambda abc,$ then find the value of λ.

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12. If without repetition of the numbers, four digit numbers are formed with the number 0, 2,3, and 5, then find the probability of such number being divisible by 5.

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13. Differentiate w.r.t x : $f(x) = \left(\sin x + \sin\left(\frac{\pi}{2} - x\right)\right)^2$

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14. Find the coefficient of one middle term in the expansio of $(1+x)^{2n}$.

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15. In how many ways can the letters of the word ARRANGE be arranged so that the two R's are never together.

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16. If $A = \{1, 2, 3, 5\}, B = \{4, 6, 9\}$ and $R = \{(a, b) \mid a \in A, b \in B, a - b \text{ is odd}\}$, then

a. Write R in roster form.

b. Represent R by an arrow diagram.

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17. If the angles of a triangle are in the ratio 3:4:5, find the smallest angle in degrees and the greatest angle in radians.

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18. Solve $3\cos 2\theta - \sin\theta = 2$

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19. If $18x = \pi$, then prove that $\tan 2x . \tan 3x . \tan 4x . \tan 8x = 1$

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20. Find Re $\left(\frac{z_1 z_2}{z_1}\right)$, give $z_1 = 2 - i$ and $z_2 = -2 + i$

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21. Represent to solution set of each of the following inequation graphically in two dimensional plane: $-3x + 2y \leq 6$

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22. Show that the function $f: N \to N$ defined by $f(x) = 2x - 1$ is one-one but not onto.

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23. Prove that $\cos 12^\circ + \cos 84^\circ + \cos 132^\circ + \cos 156^\circ = -\frac{1}{2}$

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24. If in a triangle ABC, $\cos A + \cos B + \cos C = \frac{3}{2}$, prove that the triangle is equilateral.

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25. Using mathematical induction prove that

$$\frac{1}{n+1} + \frac{1}{n+2} + \ldots\ldots + \frac{1}{2} > \frac{13}{24} \forall n \in N \text{ and } n > 1$$

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

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27. Given $f(x) = \begin{cases} \frac{x+|x|}{x} & x \neq 0 \\ -2 & x = 0 \end{cases}$ show that $\lim_{x \to 0} f(x)$ does not exist.

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28. If α and β are the roots of $x^2 + ax + b = 0$, then prove that $\frac{\alpha}{\beta}$ is a root of the equation $bx^2 + \left(2b - a^2\right)x + b = 0$

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29. Find the values of x for which the inequality $\frac{8x^2 + 16x - 51}{(2x - 3)(x + 4)} > 3$ holds.

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30. If (p+q)th term of G.P is m, $(p - q)$ th term is n, show that pth term is $\sqrt{mn}$ and qth term is $m\left(\frac{n}{m}\right)^{\frac{p}{2q}}$.

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31. Find the equation of the line passing through the intersection of the lines $3x - 4y + 1 = 0$ and $5x + y - 1 = 0$ which cuts off equal intercepts on the axes.

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32. Find the equation of the circle which has extremities of a diameter the origin and the point (2, - 4). Find also the equations of the tangents to the circle which are parallel to this diameter

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33. There are 60 students in a class. The followng is the frequency distribution of marks obtained by the students in a test.

Marks	0	1	2	3	4	5
Frequency	$x-2$	x	x^2	$(x+1)^2$	$2x$	$x+1$

where x is positive integer. Determine the mean of the marks.

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Section B

1. The eccentricity of the ellipse $12x^2 + 7y^2 = 84$ is equal to

A. $\frac{\sqrt{5}}{7}$

B. $\sqrt{\frac{5}{12}}$

C. $\frac{\sqrt{5}}{12}$

D. $\frac{5}{7}$

Answer: B

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2. Which of the following sentences is a statement?

A. A. 5 is less than 7

B. B. Where are you going?

C. C. Close the door

D. D. How funny he is !

Answer: A

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3. Find the equation of the hyperbola with vertices at $(0, \pm 6)$ and $e = \frac{5}{3}$

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4. Find the point on y-axis which is at a distance of 3 units from the point (2,3,-1).

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5. Find the equation of the directrix of the parabola whose vertex is at (3,-2) and focus is at (6,2).

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6. Prove by direct method that for any integer n, $n^3 - n$ is always even.

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7. Show that the statement .

p : 'If x is a real number such that $x^3 + 4x = 0$, then x=0' is true by Method of contrapositive

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8. Find the equation of the parabola with its axis parallel to y-axis and passing through the points (0,0),(10,12) and (30,8).

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9. Find the equation of ellipse whose eccentricity is $\frac{2}{3}$, focus is at (3,0) and vertex is at (1,0). Also find the coordinates of other focus.

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10. Find the coordinates of the point which trisect the line segment joining $A(2, 1, -3)$ and $B(5, -8, 3)$.

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Section C

1. A particle just clears a wall of height b at distance a and strikes the ground at a distance c from the point of projection. The angle of projection is (1) $\frac{\tan^{-1} b}{ac}$ (2) 45^o (3) $\frac{\tan^{-1}(bc)}{a(c-a)}$ (4) $\frac{\tan^{-1}(bc)}{a}$

A. 4

B. 4.91

C. 4.19

D. 100

Answer: B

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2. 25th percentile is 20 and 75th percentile is 50, then semi interquartile range is

A. 10

B. 40

C. 15

D. 25

Answer: C

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3. The distribution of masses to the nearest kg, of 90 men is shown in the following table:

Mass (in kg)	50 – 58	59 – 67	68 – 76	77 – 85	86 – 94	95 – 103
Frequency	15	15	23	20	9	8

Find Q_1 class.

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4. The price index of a commodity is 99. What does it indicate about the charge in price of the commodity in current year as compared to base year?

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5. Let 40% of employees earn more than Rs. 18000 per month. Then to find the percentage of employees earn less than or equal to Rs. 18000 you

have to calculate which percentile?

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6. Compute Q_1 and Q_3 from the following data:

Marks	10	20	30	40	50	80
Number of pupils	4	7	15	8	7	2

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7. Find D_8 and P_{40} from the following distribution:

Class	10 – 14	15 – 19	20 – 24	25 – 29	30 – 34	35 – 39
Frequency	3	7	16	12	9	5

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8. The rainfall and the output of wheat per acre for a firm are as follows:

Rainfall (in cm)	35	20	40	32	45	43	25	30	40	50
Production (in quintals)	150	120	100	145	120	120	130	155	120	140

Find the correlation coefficient between rainfall and wheat production.

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9. The final positions of twelve clubs in a football league and the average arttandeances at their home matches were as follows:

Club	A	B	C	D	E	F	G	H	I	J	K	L
Position	1	2	3	4	5	6	7	8	9	10	11	12
Attendance (in thousands)	27	30	18	25	32	12	19	11	32	12	12	15

Find Spearman's rank correlation coefficient and comment on your result.

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10. The following is a record of the rquarterly electrickty bill for 3 years for a household (to the nearest Rupees):

Year	April-June	July-September	October-December	January-March
2015	87	58	48	102
2016	149	60	48	86
2017	154	114	58	160

Plot these and four quarterly moving averages.

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11. The standard deviation of the numbers 2, 3, 11, x is $3\frac{1}{2}$, find the value of x

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12. Find $\rho(x, y)$ if Cav(x,y) = - 16.5 var (x) = 2.25 and $\sigma_y = 12$

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13. Index number for the total cost of raw materials used for the manufacturing of the commod- ity in 2015 ,using 2001 as the base year calculated as 179.94 . If the commodity was for ₹ 1055.75 in 2010 , calculate the selling price in 2015 on assumption that selling prices are directly proportional to the cost of raw materials.

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14. Calculate Karl Pearson's coefficient of correlation between the heights of husbands and wives on the following data (given in inches) and interpret the result. Take assumed means of husbands and wives are 70 and 66 respectively

Couple	1	2	3	4	5	6	7	8	9	10	11	12	13
Height of husband	76	75	75	72	72	71	71	7	68	68	68	68	67
Height of wife	71	70	70	67	71	65	65	67	64	65	65	66	63

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15.

Marks in Mathematics	15	18	21	24	27	30	36	39	42	48
Marks in Statistics	25	25	27	27	31	33	35	41	41	45

Find spearman's rank correlation coefficient

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16. Find the mode of the following distribution

Marks	$10-20$	$20-30$	$30-40$	$40-50$	$50-60$	$60-70$
No. of students	60	45	120	25	90	80

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17. An analysis of daily wages of casual labourers in two firms A and B belonging to the industry . Gives the following result

	Firm A	Firm B
No. of workers	50	60
Average daily wages (in ₹)	113	120
SD	6.5	8.2

Find the mean and SD of wages of all casual labourers in the two firms taken together.

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18. The table given below shows the number of visitors (in hundreds) to a certain exhibition over a period of two weeks :

Week 1	52	48	64	68	52	70	72
Week 2	55	47	51	65	58	75	81

Calculate the 7 days moving averages and illustrate these and the original information on the same graph, using the same scales.

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Section A

1. If the perimeter of a certain sector of a circle is equal to the length of the arc of the semicircle having the same radius, find the angle of the sector in degrees, minutes and second.

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2. Find the value of θ, if $m_2 \sin\frac{\pi}{2} = n^2 \sin\frac{3\pi}{2} + 2 \text{ mn sec } \theta(m-n)^2, 0 \leq \theta \leq \pi$

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3. Find the least positive value of n if $\left(\frac{1+i}{1-i}\right)^n = 1$

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4. If $\lim_{x \to -a} \frac{x^9 + a^9}{x + a} = 9$ find the value of a

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5. Find the value of λ and μ if both roots of the equation $(3\lambda + 1)x^2 = (2\lambda + 3\mu)x - 3$ are infinite

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6. There are 12 points in a plane, of which 5 are collinear. Find the number of straight lines obained by joining these points in pairs

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7. The probability that a contractor will get a plumbing contract is $\frac{2}{3}$ and electric contract is $\frac{4}{9}$. If the probability of getting at least one contract is $\frac{4}{5}$, find the probability that he will get both

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8. Define modulus function, Write its domain and range. Draw the graph of it .

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9. Z is the set of integers. Describe the following relation in set builder form , given its domain and range. {(0,-7),(2,-5),(4,-3),(-13,-20),. . . }

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10. Find the number of

combinations

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11. Find the number of

permutations of four letters each that can made from the leeters of the

word "TENNESSEE"

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12. Solves : $2\cos^2\theta = 3\sin\theta (0^\circ \leq \theta \leq 360^\circ)$

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13. cosec $10^\circ - \sqrt{3}\sec 10^\circ = 4$

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14. Differentiate w.r.t. 'x' f(x) $= \dfrac{\sqrt{x^2+1}+\sqrt{x^2-1}}{\sqrt{x^2+1}-\sqrt{x^2-1}}$

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15. Evaluate : $\lim_{x \to \infty} \sqrt{x^2 + x + 1} - \sqrt{x^2 + 1}$

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16. A rod of length 1 m slides between two perpendicular lines. Find the locus of the point on the rod which divides it in the ratio 1 : 2

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17. Find the equations of the bisectors of the angles between the lines 12x + 5y - 4 = 0 and 3x + 4y + 7 = 0. Prove that bisectors are at right angles of each other.

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18. If the coefficient of $2^{nd}, 3^{nd}$ and 4^{nd} terms in the expansion of $(1 + x)^{2n}$ are in AP, Prove that $2x^2 - 9x + 7 = 0$

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19. The sum of four numbers in GP is 60 and the arithmetic mean of the first and the last numbers is 18. Find the numbers.

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20. If S be the P be the product and R be the sum of reciprocals of n terms in GP prove that $P^2 = \left(\frac{S}{R}\right)^n$

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21. An original frequency table with mean 10.5 and variance 9.9 was lost but the following table derived from it was found . Construct the original table .

u_i	-2	-1	0	1	2
f_i	1	6	7	4	2

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Section B

1. Construct truth table for $(p \Rightarrow q) A (q \Rightarrow p)$

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2. Find the values of k so that the line 2x + y + k = 0 may touch the hyperbola $3x^2 - y^2 = 3$

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3. Find the equation of parabola with its axis parallel to x-axis and passing through the points (-2,2),(1,2) and (-1,3)

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4. Find the centre, foci and the equations of the directrices of the ellipse $8x^2 + 9y^2 - 16x + 18y - 55 = 0$

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5. What is the geometrical significance of x-coordinate of a point in space. Hence find the ratio in which the line segement joining the points P(2, 3, 4) and Q(-3, 5, -4) is divided by the yz plane . Also find the point of contact

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6. Find the equation of locus or a point whose distance from y-axis is equal to its distance from (2,1-1)

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7. Find the equation of the parabola whose focus and vertex are (5,3) and (3,1) respectively.

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