

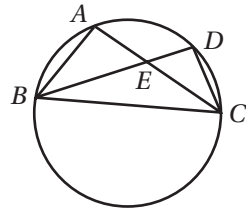
**CENTRE FOR PEDAGOGICAL STUDIES IN MATHEMATICS (CPSM)  
ACHIEVEMENT-CUM-DIAGNOSTIC TEST IN MATHEMATICS-2023**

**INSTRUCTION:** Write your Name, Class Roll No. etc. in the answersheet. Select the correct answer out of (a), (b), (c) and (d) of particular item and fill the specific rectangle  with blue/black ball pen denoting the correct answer. For example, if (c) is the correct answer to Q. No. X: blacken like this: Q. No. X:    . Rough work is to be done on separate paper. Marks will be deducted for wrong answer. Don't waste time for answering a question which appears difficult to you, better try the next question.

**[Students of W. B. Board will answer Group A & Group B, students of ICSE or CBSE Board will answer Group A and Group C]**

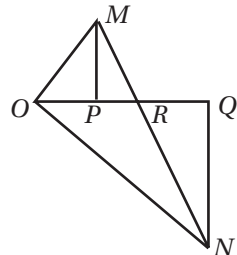
**GROUP A**

1.  $A, B, C, D$  are four points on the circumference of a circle,  $AC$  and  $BD$  intersect at  $E$ . If  $\angle BEC = 130^\circ$  and  $\angle ECD = 20^\circ$ , find  $\angle BAC$ .



- (a)  $110^\circ$                       (b)  $150^\circ$   
(c)  $75^\circ$                         (d)  $100^\circ$
2. In a circle with centre at  $O$ ,  $AB$  is a chord and  $OM \perp AB$ , if  $OA = 5$  cm,  $OM = 3$  cm, then the length of  $BM$  is

- (a) 8 cm                      (b) 4 cm                      (c) 2 cm                      (d) 6 cm
3. In the adjoining figure  $\angle MON = \angle MPO = \angle OQN = 90^\circ$ ,  $OQ$  is the bisector of  $\angle MON$  and  $QN = 10$  cm,  $OR = \frac{40}{7}$  cm, find  $OP$ .



- (a) 8 cm                                      (b) 7 cm  
(c) 4 cm                                      (d) 3 cm

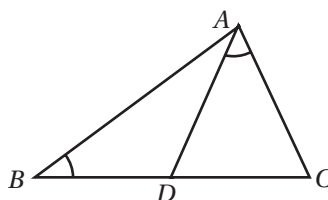
4. The bisectors of the angles  $\angle BAC$ ,  $\angle ABC$  and  $\angle ACB$  of  $\triangle ABC$  meet  $BC$ ,  $CA$  and  $AB$  at  $X$ ,  $Y$ ,  $Z$  respectively,

then  $\frac{BX \cdot CY \cdot AZ}{XC \cdot YA \cdot ZB} =$

- (a) 2                      (b)  $\frac{1}{3}$                       (c)  $\frac{1}{2}$                       (d) 1
5.  $ABC$  is a right angled triangle with  $\angle ABC = 90^\circ$ ,  $D$  is a point on  $AB$  and  $DE \perp AC$ . Find the ratio of the areas of  $\triangle ADE$  and the quadrilateral  $BCED$ .

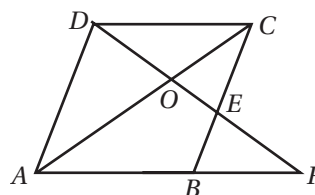
- (a) 1 : 4                      (b) 1 : 6                      (c) 3 : 8                      (d) 1 : 8

6. In the adjoining figure  $D$  is a point on  $BC$  such that  $\angle ABD = \angle CAD$ . If  $AB = 5$  cm  $AC = 3$  cm and  $AD = 4$  cm. Find  $BC$ .



- (a) 3.5 cm                      (b) 4 cm  
(c) 2.75 cm                      (d) 3.75 cm

7. In the adjoining figure  $ABCD$  is a parallelogram  $E$  is the midpoint of  $BC$ .  $DE$  produced meets  $AB$  produced at  $F$ . Then the area of  $\triangle OEC$  : area of the  $\triangle OAD$  is



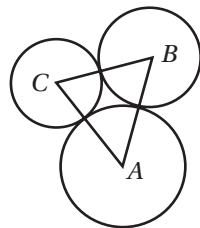
- (a) 1 : 3                      (b) 1 : 4  
(c) 2 : 3                      (d) 1 : 2

8. The chords  $AB$  and  $CD$  of a circle are parallel,  $AB = 10$  cm,  $CD = 24$  cm and the distance between  $AB$  and  $CD$  is 17 cm. The radius of the circle is

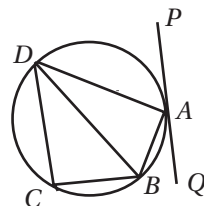
- (a) 12 cm                      (b) 5 cm  
(c) 10 cm                      (d) 13 cm

9.  $PQRS$  is a cyclic quadrilateral.  $PS$  is a diameter, if  $\angle SPR = 15^\circ$ , the measure of  $\angle PQR$  is  
 (a)  $105^\circ$       (b)  $110^\circ$       (c)  $125^\circ$       (d)  $100^\circ$
10. The three successive angles of a cyclic quadrilateral are in the ratio  $1 : 2 : 3$ . Find the ratio of the second angle to the fourth  
 (a)  $1 : 2$       (b)  $1 : 1$       (c)  $2 : 1$       (d)  $2 : 3$
11. What is the maximum number of common tangents that can be drawn to two given circles.  
 (a) 1      (b) 2      (c) 3      (d) 4
12. Two circles have touched each other internally. The larger circle has to radius 6 cm and the distance between the centres of the circles is 2 cm what will be the radius of the other circle.  
 (a) 6 cm      (b) 1 cm      (c) 2 cm      (d) 4 cm
13. One has to draw a tangent of length 8 cm from an external point of the circle. If the radius of the circle is 6 cm, find the distance of the point from the centre of the circle.  
 (a) 10 cm      (b)  $2\sqrt{7}$  cm      (c)  $4\sqrt{7}$  cm      (d) 7 cm

14. In the adjoining figure  $ABC$  is a triangle with  $AB = 10$  cm,  $BC = 8$  cm and  $CA = 6$  cm (drawn not to scale). Three circles are drawn touching each other with the vertices  $A, B, C$  as their centres. Find the radius of the largest circle.



- (a) 4 cm      (b) 6 cm      (c) 8 cm      (d) 10 cm
15. In the adjoining figure  $ABCD$  is a cyclic quadrilateral,  $PQ$  is a tangent at  $A$ ,  $BD$  is a diameter,  $\angle ADB = 30^\circ$ ,  $\angle CBD = 60^\circ$ . Find  $\angle PAD$ .



- (a)  $30^\circ$       (b)  $45^\circ$   
 (c)  $60^\circ$       (d)  $75^\circ$

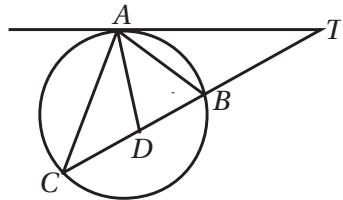
16. In  $\triangle ABC$ ,  $P$  is a point on  $AB$ ,  $PO$  is parallel to  $BC$  and is extended to  $Q$  so that  $CQ$  is parallel to  $BA$ . If  $AP : PB = 2 : 3$ , Find  $\triangle APO : \triangle CQO$ .

- (a) 9 : 25      (b) 1 : 4      (c) 9 : 16      (d) 4 : 9

17.  $ABC$  is a triangle,  $D$  and  $E$  are points on  $AB$  and  $AC$  respectively such that  $DE \parallel BC$  and  $AD : DB = 5 : 4$ , find  $\triangle DOE : \triangle BOC$ .

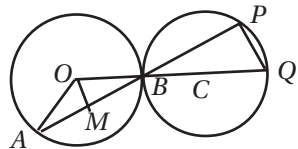
- (a) 5 : 9      (b) 25 : 81      (c) 25 : 36      (d) 36 : 64

18. In the adjoining figure  $TA$  is a tangent to a circle from the point  $T$  and  $TBC$  is a secant to the circle. If  $AD$  is the bisector of  $\angle BAC$  then  $\triangle ADT$  is



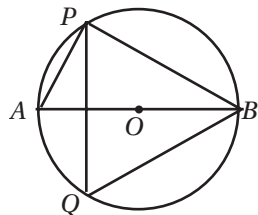
- (a) equilateral      (b) right angled  
(c) scalene      (d) isosceles

19. In the adjoining figure two circles with centres at  $O$  and  $C$  touch externally at  $B$ . If  $M$  be the mid-point of  $AB$ ,  $AB = 8$  cm, and  $OA = 5$  cm. The ratio  $PQ : QB$  is



- (a) 3 : 5      (b) 3 : 4      (c) 4 : 5      (d) 2 : 5

20. In the adjoining figure  $AB$  is a diameter of a circle with centre at  $O$ ;  $AP$ ,  $PB$  and  $BQ$  are three chords and  $\angle ABP = 42^\circ$ . The measure of  $\angle PQB$  is



- (a)  $42^\circ$       (b)  $48^\circ$   
(c)  $52^\circ$       (d)  $58^\circ$



29. Out of 135 students of a class the ratio of the number of boys to that of the girls is 5 : 4; if 5 more boys get admitted what will be the ratio of the boys to that of the girls.

- (a) 5 : 4      (b) 3 : 2      (c) 5 : 3      (d) 4 : 3

30. In 15 litres of dilute sulphuric acid the ratio of water and acid is 1 : 4. What volume of acid is to be added to it to make the ratio of water and acid as 1 : 6.

- (a) 8 litres      (b) 6 litres      (c) 4 litres      (d) 1 litre

31. The sum of two numbers is equal to the sum of their reciprocals, The product of the numbers is

- (a)  $\frac{1}{2}$       (b) 4      (c)  $\frac{1}{4}$       (d) 1

32. If  $p + \frac{1}{p} = \sqrt{3}$  then  $p^3 + \frac{1}{p^3} =$

- (a)  $3\sqrt{3}$       (b)  $3 - \sqrt{3}$       (c) 1      (d) 0

33. If  $a + b + c = 0$  then the value of

$$\frac{1}{(a+b)(a+c)} + \frac{1}{(b+c)(b+a)} + \frac{1}{(c+a)(c+b)} \text{ is}$$

- (a) 1      (b) 0      (c) 3      (d) -1

34. If  $x : y = (a + 2) : (a - 2)$  then the value of  $(x^2 + y^2) : (x^2 - y^2) =$

- (a)  $(a^2 + 4) : a$       (b)  $4a : (a^2 + 4)$   
(c)  $(a^2 + 4) : 4a$       (d)  $(a^2 + 1) : 4a$

35. Syrup and water are in the ratio 3 : 2 and 4 : 5 respectively in two pots. What volume of the second mixture is to be mixed with 3 litres of the first mixture so that the volume of syrup and water in the new mixture becomes equal?

- (a)  $5\frac{2}{5}$  litres      (b) 5 litres      (c)  $5\frac{1}{5}$  litres      (d)  $5\frac{1}{2}$  litres



43. The compound interest on ₹ 2800 for  $1\frac{1}{2}$  years at 10% per annum is—
- (a) ₹ 441.35    (b) ₹ 437    (c) ₹ 434    (d) ₹ 420
44. *A*, *B* and *C* entered into a partnership. *A* invested ₹ 2560 and *B* invested ₹ 2000. At the end of the year they gained ₹ 1105, out of which *A* gets ₹ 320; *C*'s capital was
- (a) ₹ 4280    (b) ₹ 4820    (c) ₹ 2840    (d) ₹ 4028
45. Habu, Gobu and Tatu started a shop by investing ₹ 27,000, ₹ 81,000 and ₹ 72,000 respectively. At the end of one year Gobu's share of total profit was ₹ 36000. What was the total profit?
- (a) ₹ 1,08,000    (b) ₹ 1,16,000  
(c) ₹ 80,000    (d) ₹ 92,000
46. Find the median of the following set of number  
25, 11, 15, 10, 17, 6, 12, 5
- (a) 13.5    (b) 11    (c) 10    (d) 11.5
47. Uday scored 15, 17, 16, 7, 10, 12, 14, 16, 19, 12 and 16 marks in various class tests, each test being marked out of 20. What is the modal marks?
- (a) 12    (b) 15    (c) 16    (d) 15.5
48. In a shooting competition, a marksman can give 0 to 5 points in each shot. After firing 20 shots, a competitor's score was as follows.

<b>Score</b>	0	1	2	3	4	5
<b>No. of Shots</b>	2	3	2	4	6	3

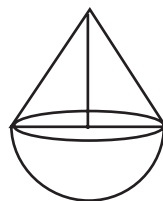
Find the mean score per shot.

- (a) 3    (b) 2.5    (c) 2.9    (d) 2



49. The mean of two numbers is  $xy$ . If one number is  $x$ , the other number is  
(a)  $y\sqrt{2}$       (b)  $y$       (c)  $(2xy - x)$       (d)  $xy - x$
50. The mode of the following set of numbers:  
7, 2, 8, 5, 7, 9,  $x$ , 8, 10, 5,  $x$  is 7;  
find the value of  $x$   
(a) 8      (b) 7      (c) 5      (d) 2
51. The perimeter of a semicircle is 72 m. The area of the semicircle is  
(a)  $316 \text{ m}^2$       (b)  $88 \text{ m}^2$       (c)  $308 \text{ m}^2$       (d)  $616 \text{ m}^2$
52. The area of a circular ring is  $418 \text{ cm}^2$  if the radius of the smaller circle is 6 cm, the radius of the larger circle is  
(a) 13 cm      (b) 26 cm      (c)  $6\frac{1}{2}$  cm      (d) 11 cm
53. A tent is in the form of a right circular cone. Its height is 4 m and the base-diameter is 10.5 m. If it can accommodate 15 persons, how many cubic metres of air is available for each person?  
(a)  $7 \text{ m}^3$       (b)  $7.7 \text{ m}^3$       (c)  $7.77 \text{ m}^3$       (d)  $7.5 \text{ m}^3$
54. A sphere has a radius of 10.5 cm, find its surface area.  
(a)  $4851 \text{ cm}^2$       (b)  $4410 \text{ cm}^2$       (c)  $2772 \text{ cm}^2$       (d)  $1386 \text{ cm}^2$
55. A spherical ball of iron, 6 cm in diameter is melted and recast into three spherical balls. The diameters of two balls are 3 cm and 4 cm, what is the diameter of the third ball?  
(a) 3.5 cm      (b) 5 cm      (c) 6 cm      (d) 7 cm
56. Each wheel of a car has a diameter of 35 cm and makes 10 revolutions in 3 seconds. The speed of the car in km/hr is  
(a) 132 km/hr      (b) 264 km/hr      (c) 164 km/hr      (d) none of these

57. The given figure represents a hemisphere surmounted by a conical block of wood. The diameter of their bases is 10 cm each, the volume of the solid is [correct to two places of decimal].



- (a)  $602.22 \text{ cm}^3$                       (b)  $602.38 \text{ cm}^3$   
 (c)  $600.24 \text{ cm}^3$                       (d)  $620.24 \text{ cm}^3$
58. From a solid cylinder whose height is 8 cm and radius 6 cm a conical cavity of height 8 cm and base radius 6 cm to hollowed out. Find the volume of the remaining solid.
- (a)  $192 \pi \text{ cc}$     (b)  $288 \pi \text{ cc}$     (c)  $72 \pi \text{ cc}$     (d)  $576 \pi \text{ cc}$
59. The circumference of the base of a cone is 44 cm and the slant height is 25 cm. The volume of the cone is
- (a)  $550 \text{ cm}^3$     (b)  $1232 \text{ cm}^3$     (c)  $3696 \text{ cm}^3$     (d)  $1848 \text{ cc}$
60. The curved surface area and the total surface area of a right circular cylinder are in the ratio 1 : 2. If the total surface area of the cylinder is  $616 \text{ cm}^2$ , then its volume is
- (a)  $1078 \text{ cc}$     (b)  $1232 \text{ cc}$     (c)  $1848 \text{ cc}$     (d)  $1278 \text{ cc}$
61.  $\tan^2 \theta + \cot^2 \theta + 2 =$
- (a)  $\sin^2 \theta \cos^2 \theta$                       (b)  $\sec^2 \theta \cdot \operatorname{cosec}^2 \theta$   
 (c) 1    (d)  $\frac{1}{2}$
62.  $(\sin A - \cos A)(\tan A + \cot A) =$
- (a)  $\sin A \cos A$                               (b)  $\sec A \cdot \operatorname{cosec} A$   
 (c)  $\sec^2 A - \operatorname{cosec}^2 A$                       (d)  $\sec A - \operatorname{cosec} A$
63. If  $\theta$  is an positive acute angle, where  $\sin \theta - \cos \theta = 0$ , find  $\sec \theta + \operatorname{cosec} \theta$ .
- (a) 0                      (b) 2                      (c) 4                      (d)  $2\sqrt{2}$

64. If  $4 \sin^2 \theta = 3$ , where  $\theta$  is a positive acute angle then  $\theta =$
- (a)  $\frac{\pi}{4}$       (b)  $\frac{\pi}{3}$       (c)  $\frac{\pi}{6}$       (d) none of these
65. If  $3 \cos \theta = 2 \sin \theta$ , and  $\theta$  is an acute angle, find  $\sec \theta$ .
- (a)  $\frac{2}{3}$       (b)  $\frac{4}{9}$       (c)  $\frac{13}{4}$       (d)  $\frac{\sqrt{13}}{2}$
66. The numerical value of  $\frac{4}{\sec^2 \theta} + \frac{1}{1 + \cot^2 \theta} + 3 \sin^2 \theta$  is
- (a) 1      (b) 2      (c) 4      (d) 8
67. If  $\sin 10 \theta = \cos 8 \theta$ , find  $\tan 6 \theta$ .
- (a)  $\frac{1}{\sqrt{3}}$       (b)  $\sqrt{3}$       (c)  $\frac{\sqrt{3}}{2}$       (d) 1
68. if  $\cot \theta = \tan (n - 1) \theta$ , then the circular measure of  $\theta$  is
- (a)  $\frac{\pi^c}{2n}$       (b)  $\frac{\pi^c}{n}$       (c)  $\frac{2\pi^c}{n}$       (d)  $\frac{2n^c}{\pi}$
69.  $AB$  is the diameter of a circle having its centre at  $O$ ,  $P$  is a point on the circumference of the circle. If  $\angle POA = 120^\circ$  then find the value of  $\tan \angle BPO$ .
- (a) 1      (b)  $\frac{1}{\sqrt{3}}$       (c)  $\sqrt{3}$       (d) none of these
70. The shadow of a vertical tower on level ground decreases by 10 m when the altitude of the sun changes from  $30^\circ$  to  $45^\circ$ . Find the height of the tower.
- (a) 13.66 m      (b) 13.50 m      (c) 15 m      (d) 13.75 m

**GROUP-B**  
**[For the students reading in W.B. Board]**

71. The volume of two spheres are in the ratio 8 : 27, the ratio of their surface areas is

- (a) 2 : 3      (b) 8 : 27      (c) 4 : 9      (d) 16 : 81

72. If  $\frac{1}{4}$  of A's money is equal to  $\frac{1}{6}$  of B's money. If both of them together have Rs 600, what is the difference between their amounts?

- (a) ₹ 100      (b) ₹ 60      (c) ₹ 240      (d) ₹ 120

73. If  $ab + bc + ca = 0$  then  $\left( \frac{1}{a^2 - bc} + \frac{1}{b^2 - ca} + \frac{1}{c^2 - ab} \right) =$

- (a) 1      (b) 0      (c)  $\frac{1}{3}$       (d)  $a + b + c$

74. How many digits are required for numbering the pages of a book having 300 pages.

- (a) 792      (b) 789      (c) 299      (d) 492

75. 
$$\frac{(x-y)^3 + (y-z)^3 + (z-x)^3}{(x^2 - y^2)^3 + (y^2 - z^2)^3 + (z^2 - x^2)^3} =$$

- (a) 0      (b) 1

- (c)  $\frac{1}{x + y + z}$       (d)  $\frac{1}{(y + z)(z + x)(x + y)}$

76.  $\frac{1}{1+\sqrt{2}} + \frac{1}{\sqrt{2}+\sqrt{3}} + \frac{1}{\sqrt{3}+\sqrt{4}} + \frac{1}{\sqrt{4}+\sqrt{5}} + \dots \dots \dots + \frac{1}{\sqrt{99}+\sqrt{100}} =$

- (a) 10                      (b) 9                      (c) 1                      (d) 0

77. A batsman makes a score of 98 runs in the 19th innings and thus increases his average by 4. What is his average after 19th innings.

- (a) 26                      (b) 28                      (c) 22                      (d) 24

78. If the system of equations  $4x + 7y = 10$  and  $10x + ky = 25$  has infinite number of solutions then  $k =$

- (a)  $8\frac{1}{2}$                       (b) 5  
 (c)  $13\frac{1}{2}$                       (d)  $17\frac{1}{2}$

79. The slope of the straight line passing through the points (2, 5) and (x, 3) is 2, the value of x is

- (a) 1                      (b) 2                      (c) -1                      (d) -2

80. The fifth term of the series  $11\frac{1}{9}, 12\frac{1}{2}, 14\frac{2}{7}, 16\frac{2}{3}, \dots, \dots, \dots$  is

- (a)  $8\frac{1}{3}$                       (b)  $19\frac{1}{2}$   
 (c) 20                      (d)  $22\frac{1}{3}$

## GROUP-C

[For the students reading in ICSE or CBSE syllabus]

71. The 10th term and 18th term of an A.P. are 41 and 73 respectively. Find the 27th term—

- (a) 104            (b) 113            (c) 109            (d) 105

72. Find the matrix  $X$  of order  $2 \times 2$  which satisfies the equation—

$$\begin{bmatrix} 4 & 1 \\ 3 & -2 \end{bmatrix} \begin{bmatrix} 0 & -1 \\ 2 & 3 \end{bmatrix} + 2X = \begin{bmatrix} 4 & 5 \\ -7 & 1 \end{bmatrix}$$

(a)  $\begin{bmatrix} 1 & 3 \\ -3 & 10 \end{bmatrix}$

(b)  $\begin{bmatrix} -1 & -3 \\ \frac{3}{2} & 5 \end{bmatrix}$

(c)  $\begin{bmatrix} 1 & 3 \\ -3 & -5 \end{bmatrix}$

(d)  $\begin{bmatrix} 1 & 3 \\ -\frac{3}{2} & 5 \end{bmatrix}$

73. If the first term of an A.P. is 5 and the sum of first 12 terms be 258, find the 12th term.

- (a) 43            (b) 38            (c) 48            (d) 33

74. If  $x \in W$ , solution set of  $5(x + 1) < 4(x + 2)$  is—

(a)  $\{0, 1, 2\}$             (b)  $\{\dots, \dots, -2, -1, 0, 1, 2\}$

(c)  $\{\dots, \dots, -2, -1, 0, 1, 2\}$             (d)  $\{0\}$

75. If  $A = \begin{bmatrix} 2 & -2 \\ -2 & 2 \end{bmatrix}$  then  $A^2 = pA$ , then find  $p$

(a) 2

(b) -2

(c) -4

(d) 4

76. If  $\begin{bmatrix} x+2y & 3y \\ 4x & 2 \end{bmatrix} = \begin{bmatrix} 0 & -3 \\ 8 & 2 \end{bmatrix}$  then the value of  $x - y$  is—

(a) 5

(b) 3

(c) -3

(d) 1

77. If on dividing  $2x^3 + 6x^2 - (2k - 7)x + 5$  by  $(x + 5)$  the remainder is  $(k - 1)$  then the value of  $k$  is—

(a) 3

(b) -3

(c) -2

(d) 2

78. If  $A = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$  then  $A^3 =$

(a)  $\begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$

(b)  $\begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$

(c)  $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

(d)  $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

79. If  $X = \begin{bmatrix} 1 & -2 \\ 5 & 3 \end{bmatrix}$ ,  $Y = \begin{bmatrix} 3 & 1 \\ 2 & 1 \end{bmatrix}$ , then  $YX$  is—

(a)  $\begin{bmatrix} 8 & -3 \\ 7 & -1 \end{bmatrix}$

(b)  $\begin{bmatrix} 8 & 3 \\ 7 & -1 \end{bmatrix}$

(c)  $\begin{bmatrix} 8 & 3 \\ -7 & -1 \end{bmatrix}$

(d)  $\begin{bmatrix} 8 & -3 \\ 7 & 1 \end{bmatrix}$

80. The  $n$ th term of an A.P. is  $(5n - 3)$ , find the sum of first 16 terms of the A.P.

(a) 633

(b) 630

(c) 632

(d) 631

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