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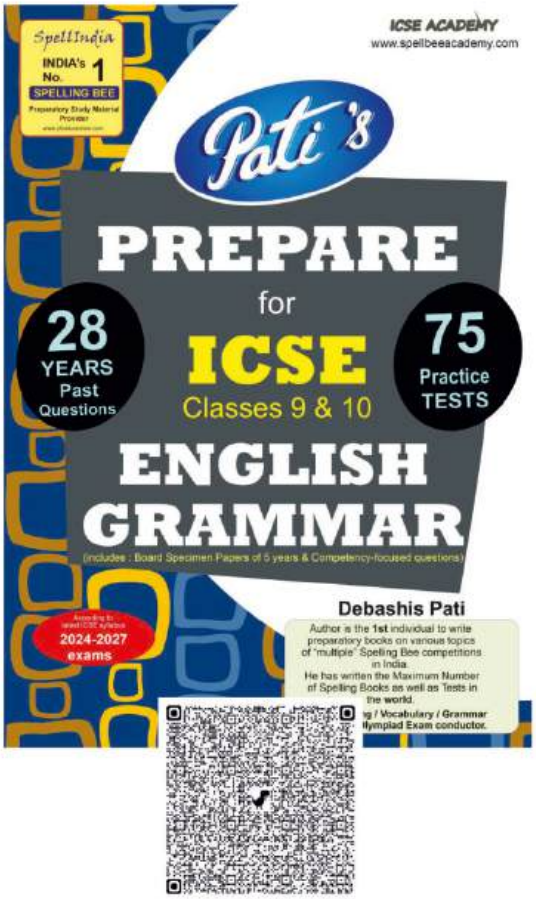

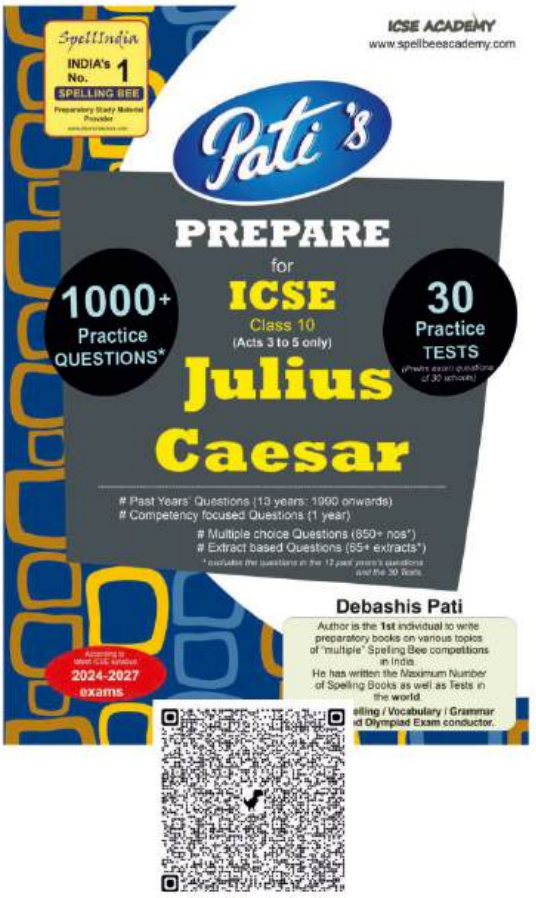

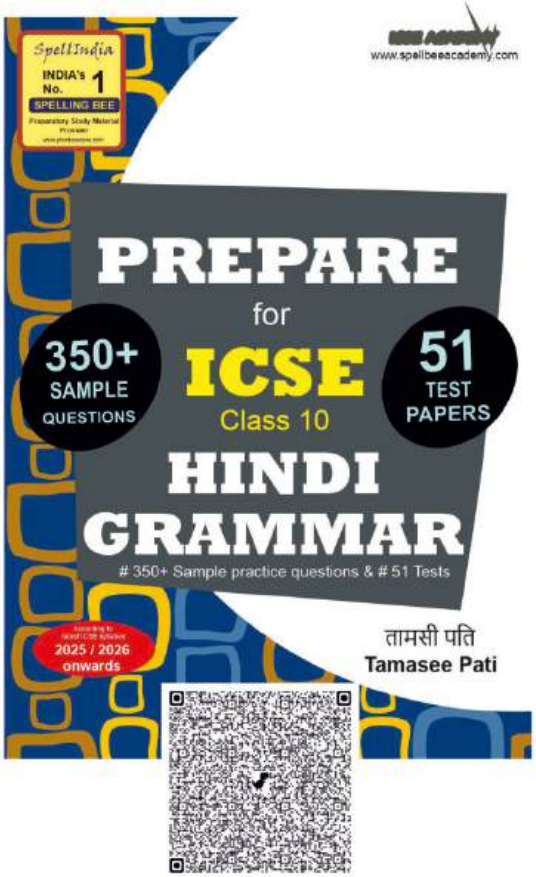

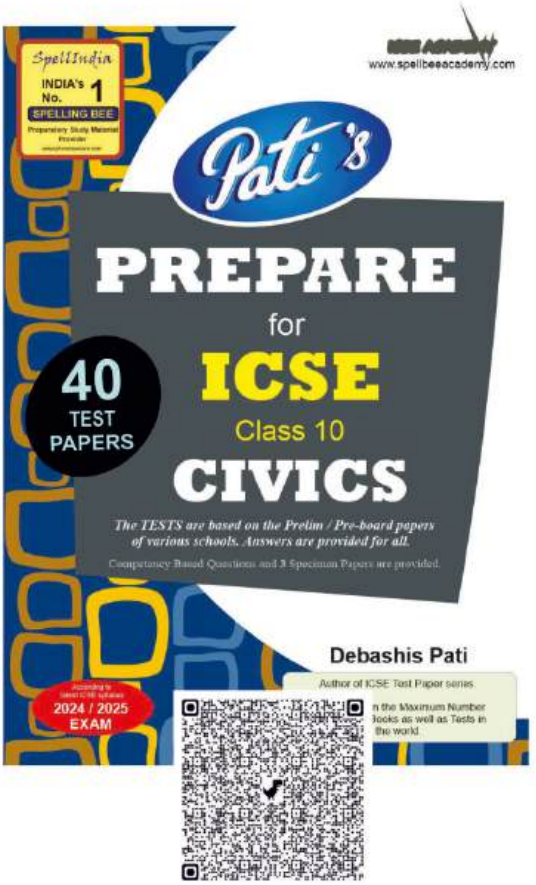

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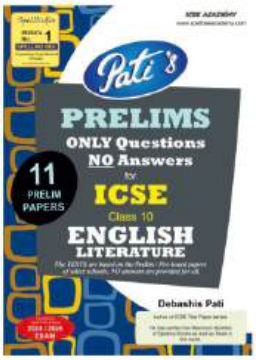

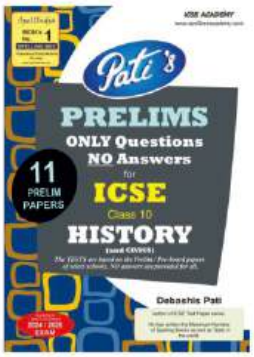

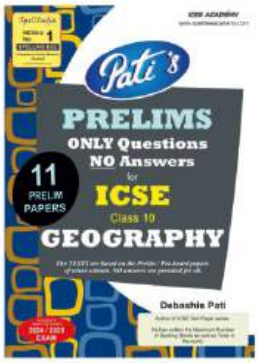

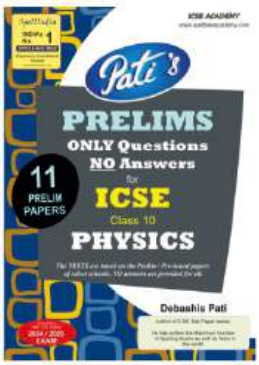

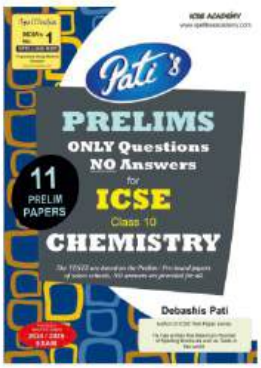

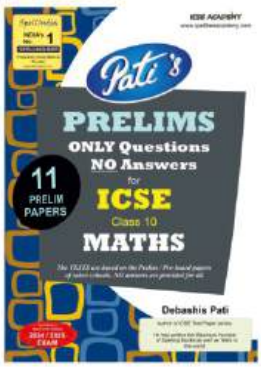

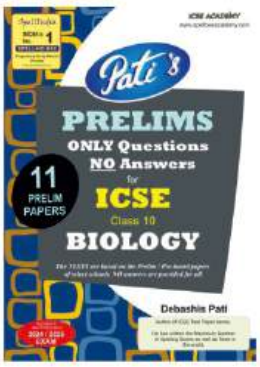

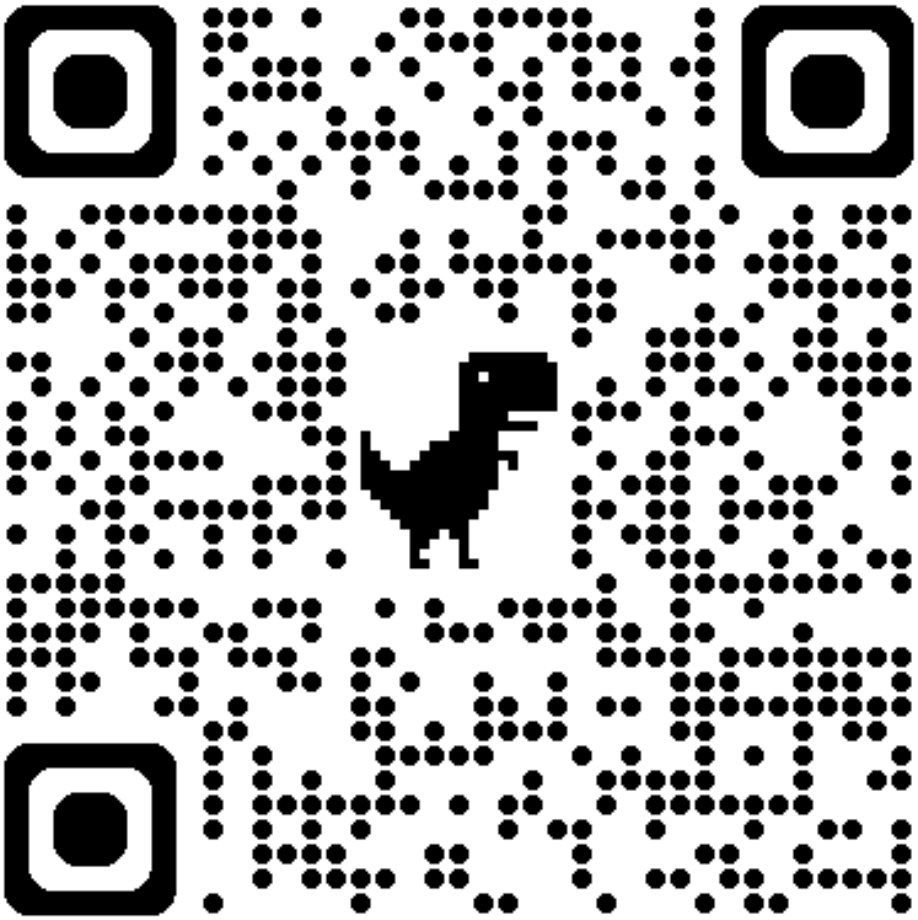

ICSE ACADEMY

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Mathematics

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GRADE X

MATHEMATICS – QUESTION BANK

GST

1. Find the amount of bill for the following intra–state transaction of goods / services. The GST rate is 5%.

Quantity (No. of items)	MRP of each item (in ₹)	Discount %
18	150	10
24	240	20
30	100	30
12	120	20

2. Find the amount of bill for the following intra–state transaction of goods / services.

MRP (in ₹)	12,000	15,000	9,500	18,000
Discount%	30	20	30	40
CGST%	6	9	14	2.5

3. The marked price of an article = ₹9,000 and rate of GST on it = 18%. A shopkeeper buys this article at a reduced price and sells it at its marked price. If the shopkeeper paid ₹162 as CGST to the government, find the amount (inclusive of GST) paid by the shopkeeper.
4. Mohit, Rajiv and Geeta live in the same city. Mohit sells an article to Rajiv for ₹50,000 and Rajiv sells the same article to Geeta at a profit of ₹6,000. If all the transactions are under GST system at the rate of 12% find:
   i) the state–government tax (SGST) paid by Rajiv.
   ii) the total tax received by the central–government (CGST)
   iii) how much does Geeta pay for the article?
5. A shopkeeper sells an article for ₹1,770 with GST = 18%. A customer willing to buy this article, asks the shopkeeper to reduce the price of the article so that he pays only ₹1,888 including GST. If the shopkeeper agrees for this, how much reduction will the shopkeeper give?
6. The marked price of a ceiling fan is ₹3,000. A shopkeeper buys the article from a wholesaler at some discount and sells it to a consumer at the marked price. The sales are intra state and rate of GST is 18%. If the shopkeeper pays ₹135 as tax (under GST) to the state Government find:
   (i) The amount of discount.
   (ii) The percentage of discount.
   (iii) The price inclusive of tax (under GST) of the ceiling fan which the shopkeeper paid to the wholesaler.
7. A manufacturer listed the price of his goods at ₹1,500 per article. He allowed a discount of 25% to a wholesaler who in turn allowed a discount of 20% on the listed price to a

retailer. The retailer sells one article to a consumer at a discount of 5% on the listed price. If all the sales are intrastate and the rate of GST is 5% find:

(i) The price per article inclusive of tax (under GST) which the Wholesaler pays.

(ii) The price per article inclusive of tax (under GST) which the retailer pays.

(iii) Amount which the consumer pays for the article.

(iv) The tax (under GST) paid by retailer to the central government for the article.

(v) The tax (under GST) paid by the wholesaler to the State government for the article.

(vi) The tax received by the state government.

BANKING

8. Ashish deposits a certain sum of money every month in a Recurring Deposit Account for a period of 12 months. If the bank pays interest at the rate of 11% p.a. and Ashish gets ₹12,715 as the maturity value of this account. What sum of money did he pay every month?

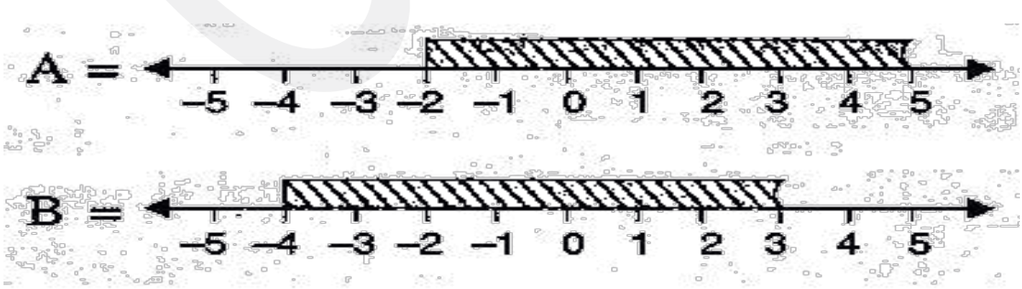
9. Amit deposited ₹150 per month in a bank for 8 months under the Recurring Deposit Scheme. What will be the maturity value of his deposits, if the rate of interest is 8% per annum and interest is calculated at the end of every month?

10. Mrs. Geeta deposited ₹350 per month in a bank for 1 year and 3 months under the Recurring Deposit Scheme. If the maturity value of her deposits is ₹5,565; find the rate of interest per annum.

11. Mr. Gulati has a Recurring Deposit Account of ₹300 per month. If the rate of interest is 12% and the maturity value of this account is ₹8,100; find the time (in years) of this Recurring Deposit Account.

LINEAR INEQUATIONS

12. The diagram represents two inequations A and B on real number lines:



i) Write down A and B in set builder notation.

ii) Represent A ∩ B and A ∩ B′ on two different number lines.

13. P is the solution set of $7x - 2 > 4x + 1$ and Q is the solution set of $9x - 45 \geq 5(x - 5)$: where $x \in R$. Represent:

i) P ∩ Q

ii) P – Q

iii) P ∩ Q′ on different number lines

14. Solve the inequation:

$$-2\frac{1}{2} + 2x \leq \frac{4x}{5} \leq \frac{4}{3} + 2x, x \in W$$

Graph the solution set on the number line.

15. Solve the following inequation and represent the solution set on the number line.

$$-3 < -\frac{1}{2} - \frac{2x}{3} \leq \frac{5}{6}, x \in R$$

16. Solve the following inequation and write the solution set:

$13x - 5 < 15x + 4 < 7x + 12, x \in R$

17. Solve the following inequation and represent solution set on a number line.

$$-8\frac{1}{2} < -\frac{1}{2} - 4x \leq 7\frac{1}{2}, x \in I$$

QUADRATIC EQUATIONS

18. $\frac{2}{3}$ and 1 are the solutions of equation $mx^2 + nx + 6 = 0$. Find the values of m and n.

19. The equation $3x^2 - 12x + (n - 5) = 0$ has equal roots. Find the value of n.

20. Find the value of k for which the equation $3x^2 - 6x + k = 0$ has distinct and real root.

21. If -1 and 3 are the roots of $x^2 + px + q = 0$, find the values of p and q.

22. Solve the following equation for x and give your answer correct to 2 decimal places:

$3x^2 + 5x - 9 = 0$

23. Solve equation for x and give your answer correct to 2 decimal places:

$$4x + \frac{6}{x} + 13 = 0$$

24. Solve equation for x, giving your answer correct to 3 decimal places:

$2x^2 + 11x + 4 = 0$

25. Solve the following equation and give your answer correct to 3 significant figures:

$5x^2 - 3x - 4 = 0$

QUADRATIC EQUATIONS (WP)

26. The sum of the squares of two consecutive natural numbers is 41. Find the numbers.

27. The sum of a number and its reciprocal is 4.25. Find the number.

28. The denominator of a positive fraction is one more than twice the numerator. If the sum of the fraction and its reciprocal is 2.9; find the fraction.

29. A can do a piece of work in 'x' days and B can do the same work in (x + 16) days. If both working together can do it in 15 days; calculate 'x'.

30. A positive number is divided into two parts such that the sum of the squares of the two parts is 20. The square of the larger part is 8 times the smaller part. Taking 'x' as the smaller part of the two parts, find the number.

31. The hypotenuse of a right–angled triangle exceeds one side by 1 cm and the other side by 18 cm; find the lengths of the sides of the triangle.
32. A footpath of uniform width runs round the inside of a rectangular field 32 m long and 24 m wide. If the path occupies 208 m^2, find the width of the footpath.
33. An area is paved with square tiles of a certain size and the number required is 128. If the tiles had been 2 cm smaller each way, 200 tiles would have been needed to pave the same area. Find the size of the larger tiles.
34. A farmer has 70 m of fencing, with which he encloses three sides of a rectangular sheep pen; the fourth side being a wall. If the area of the pen is 600 sq.m., find the length of its shorter side.
35. If the speed of a car is increased by 10 km per hr, it takes 18 minutes less to cover a distance of 36 km. Find the speed of the car.
36. A girl goes to her friend's house, which is at a distance of 12 km. She covers half of the distance at a speed of x km/hr and the remaining distance at a speed of (x + 2) km/hr. If she takes 2 hrs 30 minutes to cover the whole distance, find 'x'.
37. A car made a run of 390 km in 'x' hours. If the speed had been 4 km/hour more, it would have taken 2 hours less for the journey. Find 'x'.
38. A trader bought an article for ₹x and sold it for ₹52, thereby making a profit of (x – 10) percent on his outlay. Calculate the cost price.
39. The age of a father is twice the square of the age of his son. Eight years hence, the age of the father will be 4 years more than three times the age of the son. Find their present ages.
40. The speed of a boat in still water is 15 km/hr, it can go 30 km upstream and return downstream to the original point in 4 hours 30 minutes. Find the speed of the stream.
41. The total cost price of a certain number of identical articles is ₹4,800. By selling the articles at ₹100 each, a profit equal to the cost price of 15 articles is made. Find the number of articles bought.
42. ₹6,500 was divided equally among a certain number of persons. Had there been 15 persons more, each would have got ₹30 less. Find the original number of persons.
43. In an auditorium, seats were arranged in rows and columns. The number of rows was equal to the number of seats in each row. When the number of rows was doubled and the number of seats in each row was reduced by 10, the total number of seats increased by 300. Find:
    i) The number of rows in the original arrangement.
    ii) The number of seats in the auditorium after re–arrangement.

PROPORTION

44. Quantities a, 2, 10 and b are in continued proportion: find the values of a and b.

45. 6 is the mean proportion between two numbers x and y and 48 is third proportion to x and y. find the numbers.

46. If $\frac{a}{b} = \frac{c}{d}, show\ that : \frac{a^3c+ac^3}{b^3d+bd^3} = \frac{(a+c)^4}{(b+d)^4}$

47. What least number must be subtracted from each of the numbers 7, 17 and 47 so that the remainders are in continued proportion?

48. Given four quantities a, b, c and d are in proportion. Show that:
(a – c) b^2 : (b – d) cd = (a^2 – b^2 – ab) : (c^2 – d^2 – cd)

49. If $\frac{5x+6y}{5u+6v} = \frac{5x-6y}{5u-6v}$ then prove that x : y = u : v

50. If $a = \frac{4\sqrt{6}}{\sqrt{2}+\sqrt{3}}, find\ the\ value\ of : \frac{a+2\sqrt{2}}{a-2\sqrt{2}} + \frac{a+2\sqrt{3}}{a-2\sqrt{3}}$

51. If a, b and c are in continued proportion, prove that:
$$\frac{a^2 + b^2 + c^2}{(a+b+c)^2} = \frac{a-b+c}{a+b+c}$$

52. Using properties of proportion, solve for x: $\frac{3x+\sqrt{9x^2-5}}{3x-\sqrt{9x^2-5}} = 5$

53. If $\frac{a}{b} = \frac{c}{d}$, show that: (a + b) : (c + d) = $\sqrt{a^2 + b^2} : \sqrt{c^2 + d^2}$

54. If $\frac{x}{a} = \frac{y}{b} = \frac{z}{c}$ show that: $\frac{x^3}{a^3} + \frac{y^3}{b^3} + \frac{z^3}{c^3} = \frac{3xyz}{abc}$

55. If $\frac{7m+2n}{7m-2n} = \frac{5}{3}$, use properties of proportion to find:
    i) m : n
    ii) $\frac{m^2+n^2}{m^2-n^2}$

REMAINDER AND FACTOR THEOREM

56. Show that 3x + 2 is a factor of $3x^2$ – x – 2.

57. Find the value of k, if 2x + 1 is a factor of (3k + 2) x^3 + (k – 1).

58. Find the values of m and n so that x – 1 and x + 2 both are factors of x^3 + (3m + 1) x^2 + nx – 18.

59. What number should be subtracted from x^3 + $3x^2$ – 8x + 14 so that on dividing it by x – 2, the remainder is 10?

60. The polynomials $2x^3$ – $7x^2$ + ax – 6 and x^3 – $8x^2$ + (2a + 1)x – 16 leave the same remainder when divided by x – 2. Find the value of 'a'.

61. (3x + 2) is a factor of $3x^3$ + $2x^2$ – 3x – 2. Hence, factorise the expression $3x^3$ + $2x^2$ – 3x – 2 completely.

62. Using the Remainder Theorem, factorise each of the following completely
$4x^3$ + $7x^2$ – 36x – 63

63. Factorise the expression f(x) = $2x^3$ – $7x^2$ – 3x + 18

64. The expression $4x^3 - bx^2 + x - c$ leaves remainders 0 and 30 when divided by $x + 1$ and $2x - 3$ respectively. Calculate the values of b and c. Hence, factorise the expression completely.

MATRICES

65. If A = $\begin{bmatrix} 4 & -4 \\ -3 & 3 \end{bmatrix}$, B = $\begin{bmatrix} 6 & 5 \\ 3 & 0 \end{bmatrix}$ and C = $\begin{bmatrix} 2 & 3 \\ -1 & -2 \end{bmatrix}$ show that AB = AC. Write the conclusion, if any, that you can draw from the result obtained above.

66. If M = $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$ and I is a unit matrix of the same order as that of M; show that: $M^2 = 2M + 3I$.

67. If A = $\begin{bmatrix} a & 0 \\ 0 & 2 \end{bmatrix}$, B = $\begin{bmatrix} 0 & -b \\ 1 & 0 \end{bmatrix}$, M = $\begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$ and BA = M^2, find the values of 'a' and 'b'.

68. Solve for x and y $[x + y \quad x - 4] \begin{bmatrix} -1 & -2 \\ 2 & 2 \end{bmatrix} = [-7 \quad -11]$

69. Find the: $\begin{bmatrix} 1 & 4 \\ 2 & 1 \end{bmatrix} \times M = \begin{bmatrix} 13 \\ 5 \end{bmatrix}$

    i) order of matrix M.

    ii) the matrix M.

70. If A = $\begin{bmatrix} 2 & 1 & -1 \\ 0 & 1 & -2 \end{bmatrix}$ Find:

    i) $A^t \cdot A$

    ii) $A \cdot A^t$

    Where A^t is the transpose of matrix A.

71. Evaluate: $\begin{bmatrix} 2\cos 60° & -2\sin 30° \\ -\tan 45° & cos\ 0° \end{bmatrix} \begin{bmatrix} \cot 45^\circ & cos\ ec\ 30° \\ \sec 60^\circ & \sin 90° \end{bmatrix}$

ARITHMETIC PROGRESSION

72. Find the 12^{th} term from the end in A.P. 13, 18, 23, ... 153, 158.

73. If the p^{th} term of an A.P. is (2p + 3); find the A.P.

74. If t_n represent n^{th} term of an A.P., $t_2 + t_5 - t_3 = 10$ and $t_2 + t_9 = 17$, find its first term and its common difference.

75. Which term of the series: 21, 18, 15, ... is −81? Can any term of this series be zero? If yes, find the number of terms.

76. The sum of the 4^{th} and the 8^{th} terms of an A.P. is 24 and the sum of the 6^{th} and the 10^{th} terms of the same A.P. is 34. Find the first three terms of the A.P.

77. If the third term of an A.P. is 5 and the seventh term is 9, find the 17^{th} term.

78. In an A.P., ten times of its tenth term is equal to thirty times of its 30^{th} term. Find its 40^{th} term.

79. Determine the value of k for which $k^2 + 4k + 8$, $2k^2 + 3k + 6$ and $3k^2 + 4k + 4$ are in A.P.

80. An A.P. consists of 57 terms of which 7^{th} term is 13 and the last term is 108. Find the 45^{th} term of this A.P.

81. Find the sum of 28 terms of an A.P. whose n^{th} term is 8n – 5.
82. The first term of an A.P. is 5, the last term is 45 and the sum of its terms is 1000. Find the number of terms and the common difference of the A.P.
83. Find the sum of all natural numbers between 250 and 1000 which are divisible by 9.
84. If the 8^{th} term of an A.P. is 37 and the 15^{th} term is 15 more than the 12^{th} term, find the A.P. Also find the sum of first 20 terms of this A.P.
85. The fourth term of an A.P. is 11 and the eighth term exceeds twice the fourth term by 5. Find the A.P. and the sum of first 50 terms.
86. The sum of three consecutive terms of an A.P. is 21 and the sum of their squares is 165. Find these terms.
87. Divide 96 into four parts which are in A.P. and the ratio between product of their means to product of their extremes is 15 : 7.
88. Find five numbers in A.P. whose sum is $12\frac{1}{2}$ and the ratio of the first to the last terms is 2 : 3.
89. Insert one arithmetic mean between 3 and 13.

REFLECTION

90. Use graph paper for this question.
    The points A (2, 3), B (4, 5) and C (7, 2) are the vertices of ΔABC
    i) Write down the co–ordinates of A′, B′, C′ if $\Delta A'B'C'$ is the image of ΔABC, when reflected in the origin.
    ii) Write down the co–ordinates of A″, B″, C″ if Δ A″ B″ C″ is the image of ΔABC, when reflected in the x–axis.
    iii) Mention the special name of the quadrilateral BCC″B″ and find its area.
91. The points P (4, 1) and Q (–2, 4) are reflected in line y = 3. Find the co–ordinates of P′, the image of P and Q′, the image of Q.
92. The point P (5, 3) was reflected in the origin to get the image P′.
    i) Write down the co–ordinates of P′.
    ii) If M is the foot of the perpendicular from P to the x–axis, find the co–ordinates of M
    iii) If N is the foot of the perpendicular from P′ to the x–axis, find the co–ordinates of N.
    iv) Name the figure PMP′N.
    v) Find the area of the figure PMP′M.
93. The point P (2, –4) is reflected about the line x = 0 to get the image Q. Find the co–ordinates of Q.
    i) The point Q is reflected about the line y = 0 to get the image R. Find the coordinates of R.
    ii) Name the figure PQR.
    iii) Find the area of figure PQR.

94. Use a graph paper for this question

    Take 2 cm = 1 unit on both x and y axis

    i) Plot the following points: A (0, 4), B (2, 3), C (1, 1) and D (2, 0)

    ii) Reflect points B, C, D on the y−axis and write down their coordinates. Name the images as B′, C′, D′ respectively.

    iii) Join the points A, B, C, D, D′, C′, B′, and A in order, so as to form a closed figure. Write down the equation of the line about which if this closed figure obtained is folded, the two parts of the figure exactly coincide.

SECTION & MIDPOINT FORMULA

95. In what ratio is the line joining (2, −3) and (5, 6) divided by the x−axis?

96. In what ratio is the line joining (2, −4) and (−3, 6) divided by the y−axis?

97. The line joining the points A(−3, −10) and B (−2, 6) is divided by the point P such that $\frac{PB}{AB} = \frac{1}{5}$. Find the co−ordinates of P.

98. Calculate the ratio in which the line joining the points (−3, −1) and (5, 7) is divided by the line x = 2. Also, find the co−ordinates of the point of intersection.

99. Show that the line segment joining the points (−5, 8) and (10, −4) is trisected by the co−ordinate axes.

100. A (2, 5), B (−1, 2) and C (5, 8) are the co−ordinates of the vertices of the Δ ABC. Points P and Q lie on AB and AC respectively, such that: AP : PB = AQ : QC = 1 : 2

    i) Calculate the co−ordinates of P and Q.

    ii) Show that: PQ = $\frac{1}{3}\,BC$

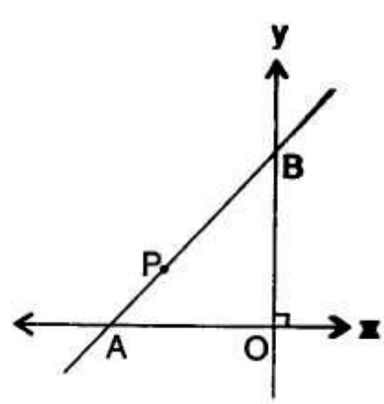
101. The line joining P (−4, 5) and Q (3, 2) intersects the y−axis at point R. PM and QN are perpendiculars from P and Q on the x−axis. Find:

    i) The ratio PR : RQ.

    ii) The co−ordinates of R.

    iii) The area of the quadrilateral PMNQ.

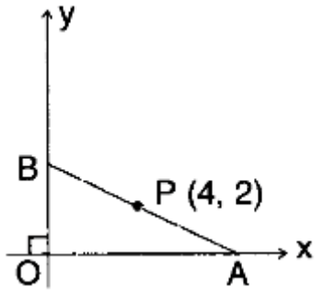
102. In the given figure, line APB meets the x−axis at point A and y−axis at point B, P is the point (−4, 2) and AP : PB = 1 : 2. Find the co−ordinates of A and B.



103. If P (−b, 9a − 2) divides the line segment joining the points A (−3, 3a + 1) and B (5, 8a) in the ratio 3 : 1, find the values of a and b.

104. A (5, 3), B (−1, 1) and C (7, −3) are the vertices of triangle ABC. If L is the mid−point of AB and M is the mid−point of AC, show that: LM = $\frac{1}{2}$ BC

105. In the given figure, P (4, 2) is mid−point of line segment AB. Find the co−ordinates of A and B.



106. A (2, 5), B (1, 0), C (−4, 3) and D (−3, 8) are the vertices of quadrilateral ABCD. Find the co−ordinates of the mid−points of AC and BD. Give a special name to the quadrilateral.

107. The points (2, −1), (−1, 4) and (−2, 2) are mid−points of the sides of a triangle. Find its vertices.

108. Calculate the co−ordinates of the centroid of the triangle ABC, if A = (7, −2), B = (0, 1) and C = (−1, 4).

109. A (5, x), B (−4, 3) and C (y, −2) are the vertices of the triangle ABC whose centroid is the origin. Calculate the values of x and y.

EQUATION OF A LINE

110. Show that the lines 2x + 5y =1, x − 3y = 6 and x + 5y + 2 = 0 are concurrent.

111. The line passing through (0, 2) and (−3, −1) is parallel to the line passing through (−1, 5) and (4, a). Find a.

112. The line passing through (−4, −2) and (2, −3) is perpendicular to the line passing through (a, 5) and (2, −1). Find a.

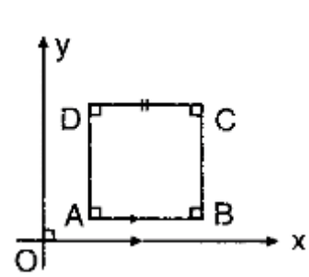
113. Without using the distance formula, show that the points A (4, 5), B (1, 2), C (4, 3) and D (7, 6) are the vertices of a parallelogram.

114. The side AB of a square ABCD is parallel to the x−axis, find the slopes of all its sides.

Also find:

i) The slope of the diagonal AC,

ii) The slope of the diagonal BD.



115. A (5, 4), B (−3, −2) and C (1, −8) are the vertices of a triangle ABC. Find:

i) The slope of the altitude of AB

ii) The slope of the median AD and

iii) The slope of the line parallel to AC

116. The points (K, 3), (2, −4) and (−K + 1, −2) are collinear. Find K.

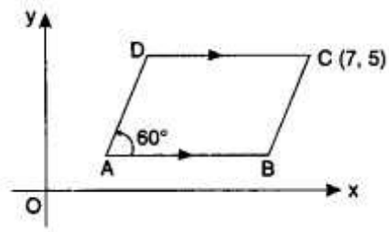
117. The equation of a line is 3x − 4y + 12 = 0. It meets the x−axis at point A and the y−axis at point B. Find:

i) The co−ordinates of points A and B;

ii) The length of intercept AB, cut by the line within the co–ordinate axes.

118. The co–ordinates of two points P and Q are (2, 6) and (–3, 5) respectively. Find:
    i) The gradient of PQ;
    ii) The equation of PQ;
    iii) The co–ordinates of the point where PQ intersects the x–axis.

119. The following figure shows a parallelogram ABCD whose side AB is parallel to the x–axis, $\angle A = 60°$ and vertex C = (7, 5). Find the equations of BC and CD.

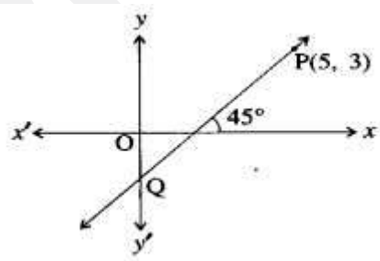


120. A, B and C have co–ordinates (0, 3), (4, 4) and (8, 0) respectively. Find the equation of the line through A and perpendicular to BC.

121. Find the equation of the line, whose x–intercept = –4 and y–intercept = 6.

122. Find the equations of the lines passing through point (–2, 0) and equally inclined to the co–ordinate axes.

123. The line through P(5, 3) intersects y–axis at Q.
    i) Write the slope of the line.
    ii) Write the equation of the line.
    iii) Find the co–ordinates of Q.



124. A (1, 4), B (3, 2) and C (7, 5) are vertices of a triangle ABC. Find:
    i) The co–ordinates of the centroid of triangle ABC.
    ii) The equation of a line, through the centroid and parallel to AB.

125. A (7, –1), B (4, 1) and C (–3, 4) are the vertices of a triangle ABC. Find the equation of a line through the vertex B and the point P in AC; such that AP : CP = 2 : 3.

126. Find the value of p if the lines, whose equations are 2x – y + 5 = 0 and px + 3y = 4 are perpendicular to each other.

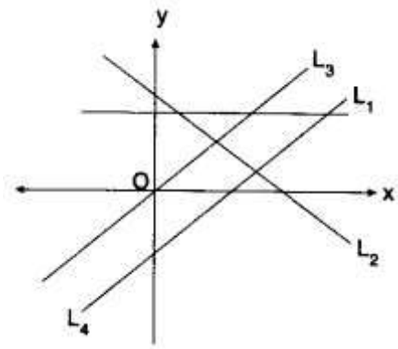
127. If the lines y = 3x + 7 and 2y + px = 3 are perpendicular to each other, find the value of p.

128. B (–5, 6) and D (1, 4) are the vertices of rhombus ABCD. Find the equations of diagonals BD and AC.

129. A (1, –5), B (2, 2) and C (–2, 4) are the vertices of triangle ABC. Find the equation of:
    i) The median of the triangle through A.
    ii) The altitude of the triangle through B.

iii) The line through C and parallel to AB.

130. Match the equations A, B, C and D with the lines L_1, L_2, L_3 and L_4, whose graphs are roughly drawn in the given diagram.



i) A = y = 2x;

ii) B = y – 2x + 2 = 0

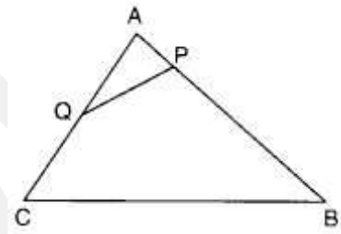
iii) C = 3x + 2y = 6;

iv) D = y = 2

131. Find the value of a for which the points A (a, 3), B (2, 1) and C (5, a) are collinear. Hence, find the equation of the line.

SIMILARITY

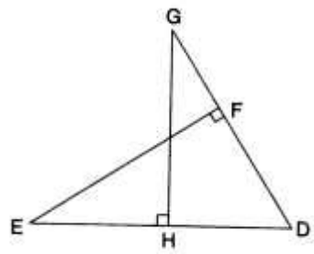
132. In the given figure, AP = 8 cm, BP = 22 cm, AQ = 12 cm and QC = 8 cm.



i) Show that ΔAPQ is similar to ΔACB.

ii) If PQ = 14 cm, find BC.

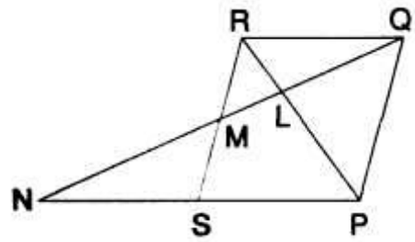
133. Given: $\angle$GHE = $\angle$DFE = 90°, DH = 8, DF = 12, DG = 3x – 1 and DE = 4x + 2. Find the lengths of segments DG and DE.



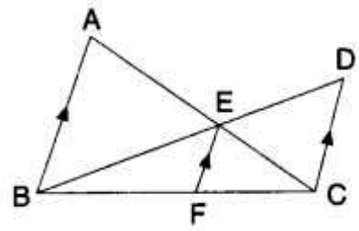
134. In $\Delta ABC, \angle B = 90° and\ BD \perp AC$:

If AC = 9 cm and AB = 7 cm; find AD.

135. In the figure, PQRS is a parallelogram with PQ = 16 cm and QR = 10 cm. L is a point on PR such that RL : LP = 2 : 3. QL produced meets RS at M and PS produced at N. Find the lengths of PN and RM.



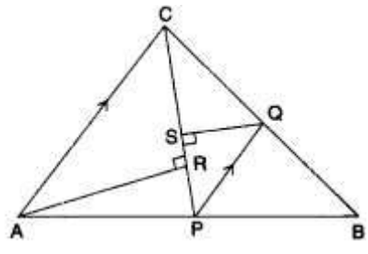
136. In the given figure, $AB\ //\ EF\ //\ DC$; AB = 67.5 cm, DC = 40.5 cm and AE = 52.5 cm.



i) Name the three pairs of similar triangles

ii) Find the lengths of EC and EF.

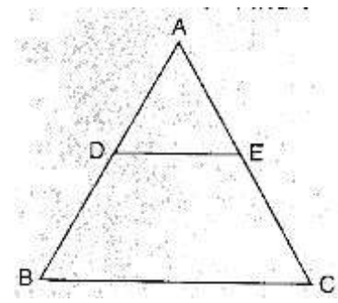
137. In the given figure, P is a point on AB such that AP : PB = 4 : 3. PQ is parallel to AC



i) Calculate the ratio PQ : AC, giving reason for your answer.

ii) In triangle ARC, $\angle$ARC = 90° and in triangle PQS, $\angle$PSQ = 90°. Given QS = 6 cm, calculate the length of AR.

138. In the adjoining figure; DE // BC and D divides AB in the ratio 2 : 3. Find:

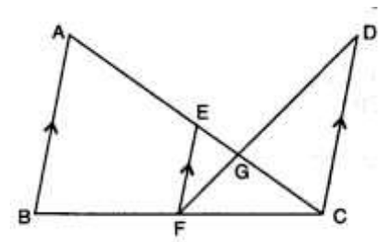


i) $\frac{AE}{EC}$

ii) $\frac{AE}{AC}$

iii) DE, if BC = 7.5 cm.

139. In the given figure; AB // EF // CD; Given that AB = 7.5 cm, EG = 2.5 cm, GC = 5 cm and DC = 9 cm. Calculate:

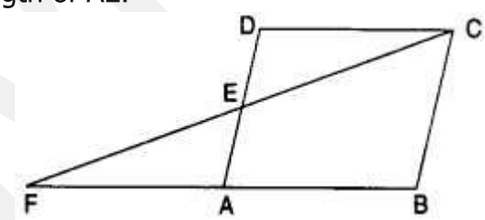


i) EF

ii) AC

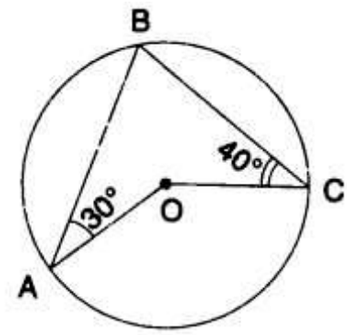
140. A line segment DE is drawn parallel to base BC of ΔABC which cuts AB at point D and AC at point E. If AB = 5 BD and EC = 3.2 cm, find the length of AE.

141. The given figure shows a parallelogram ABCD. E is a point in AD and CE produced meets BA produced at point F. If AE = 4 cm, AF = 8 cm and AB = 12 cm, find the perimeter of the parallelogram ABCD.

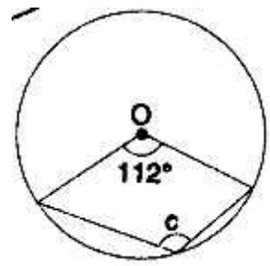


CIRCLES

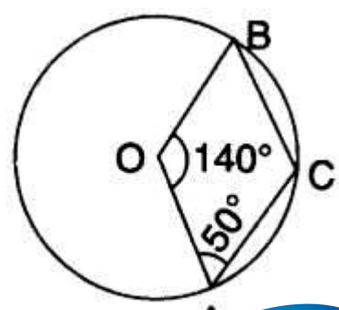
142. In the given figure, O is the centre of the circle. ∠OAB and ∠OCB are 30° and 40° respectively. Find ∠AOC. Show your steps of working.



143. In the following figure, O is the centre of the circle. Find the value of c.



144. In the given figure, O is the centre of the circle. If ∠AOB = 140° and ∠OAC = 50°, find:



i) ∠ACB

ii) ∠OBC

iii) ∠OAB

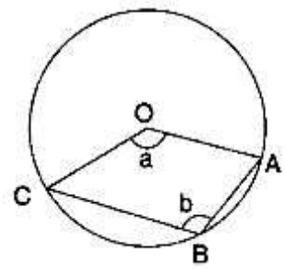
iv) ∠CBA

145. In the figure given below, shows a circle with centre O.

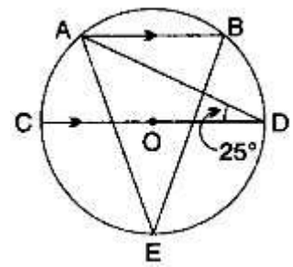
Given: ∠AOC = a and ∠ABC = b

i) Find the relationship between a and b.

ii) Find the measure of angle OAB, if OABC is a parallelogram.

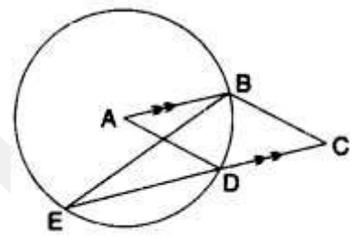


146. In the figure, given alongside, AB // CD and O is the centre of the circle. If ∠ADC = 25°; find the angle AEB. Give reasons in support of your answer.



147. ABCD is a cyclic quadrilateral in which AB and DC on being produced, meet at P such that PA = PD. Prove that AD is parallel to BC.

148. In the given figure, A is the centre of the circle, ABCD is a parallelogram and CDE is a straight line. Prove that: ∠BCD = 2∠ABE.



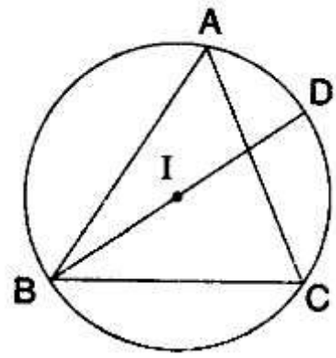
149. In the given figure I is in the centre of a ΔABC. BI when produced meets the circumcircle of ΔABC at D. Given ∠BAC = 55° and ∠ACB = 65°. Calculate:

i) ∠DCA

ii) ∠DAC

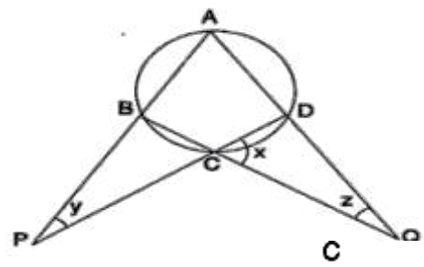
iii) ∠DCI

iv) ∠AIC

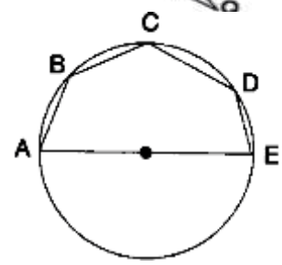


150. Calculate the angles x, y and z if:

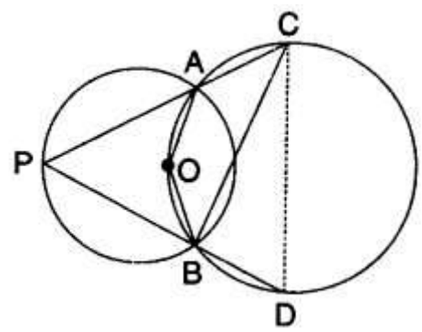
$\frac{x}{3} = \frac{y}{4} = \frac{z}{5}$



151. In the given figure, AE is the diameter of the circle. Write down the numerical value of ∠ABC + ∠CDE. Give reasons for your answer.



152. In the given figure, the centre O of the small circle lies on the circumference of the bigger circle. If ∠APB = 75° and ∠BCD = 40°, find:



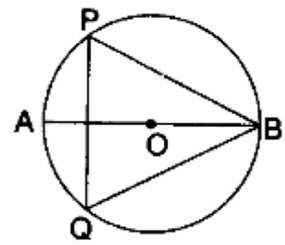
i) ∠AOB

ii) ∠ACB

iii) ∠ABD

iv) ∠ADB

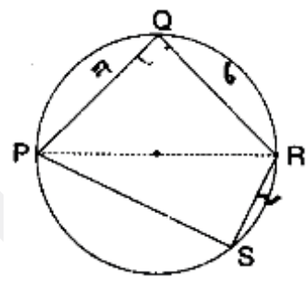
153. The given figure shows a circle with centre O and ∠ABP = 42°. Calculate the measure of:



i) ∠PQB

ii) ∠QPB + ∠PBQ

154. The following figure shows a circle with PR as its diameter. If PQ = 7 cm, QR = 3RS = 6 cm, find the perimeter of the cyclic quadrilateral PQRS.



155. In cyclic quadrilateral ABCD; AD = BC, ∠BAC = 30° and ∠CBD = 70° find:

i) ∠BCD

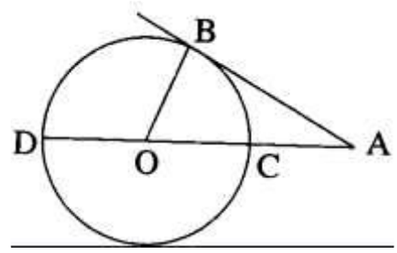
ii) ∠BCA

iii) ∠ABC

iv) ∠ADC

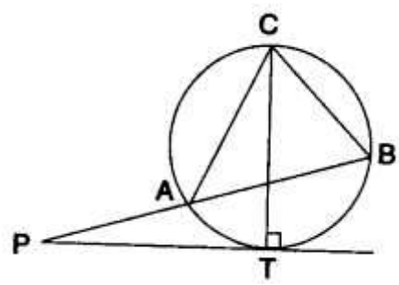
TANGENTS AND INTERSECTING CHORDS

156. In the given figure, O is the centre of the circle and AB is a tangent at B. If AB = 15 cm and AC = 7.5 cm, calculate the radius of the circle.



157. In quadrilateral ABCD; angle D = 90°, BC = 38 cm and DC = 25 cm. A circle is inscribed in this quadrilateral which touches AB at point Q such that QB = 27 cm. Find the radius of the circle.

158. PT is a tangent to the circle at T. If ∠ABC = 70° and ∠ACB = 50°; calculate:

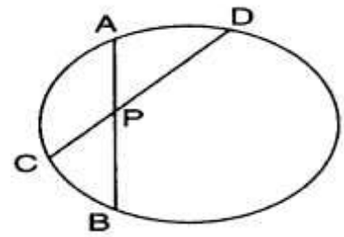


i) ∠CBT

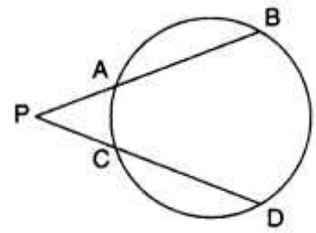
ii) ∠BAT

iii) ∠APT

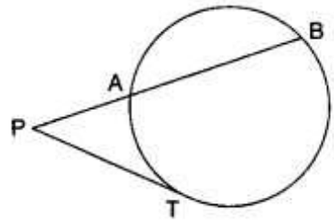
159. In the given figure, 3 × CP = PD = 9 cm and AP = 4.5 cm. Find BP.



160. In the given figure 5 × PA = 3 × AB = 30 cm and PC = 4 cm. Find CD.



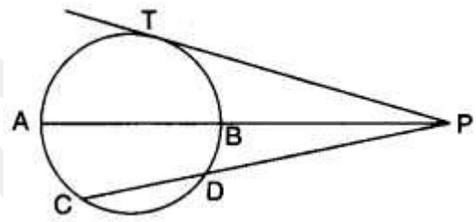
161. In the given figure, tangent PT = 12.5 cm and PA = 10 cm; find AB.



162. In the given figure, diameter AB and chord CD of a circle meet at P. PT is a tangent to the circle at T. CD = 7.8 cm, PD = 5 cm, PB = 4 cm. Find:

i) AB.

ii) the length of tangent PT.

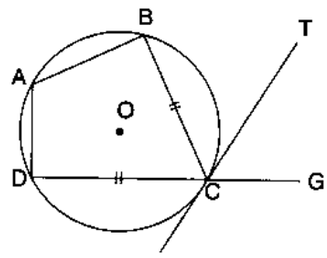


163. Tangent at P to the circumcircle of triangle PQR is drawn. If this tangent is parallel to side QR, show that ΔPQR is isosceles.

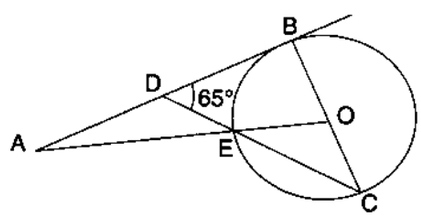
164. In the figure, ABCD is a cyclic quadrilateral with BC = CD. TC is tangent to the circle at point C and DC is produced to point G. If ∠BCG = 108° and O is the centre of the circle, find:

i) angle BCT.

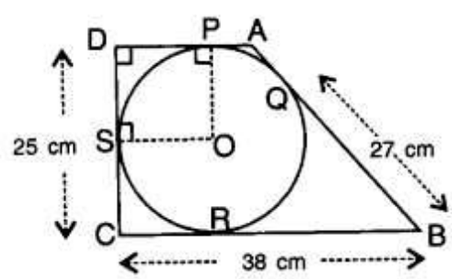
ii) angle DOC.



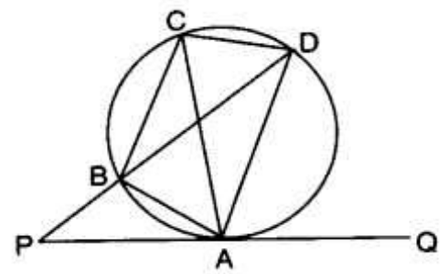
165. In the adjoining figure, O is the centre of the circle and AB is a tangent to it at point B. ∠BDC = 65°. Find ∠BAO.



166. In the following figure, a circle is inscribed in the quadrilateral ABCD. If BC = 38 cm, QB = 27 cm, DC = 25 cm and that AD is perpendicular to DC, find the radius of the circle.



167. In the given figure, QAP is the tangent at point A and PBD is a straight line. If ∠ACB = 36° and ∠APB = 42°, find:



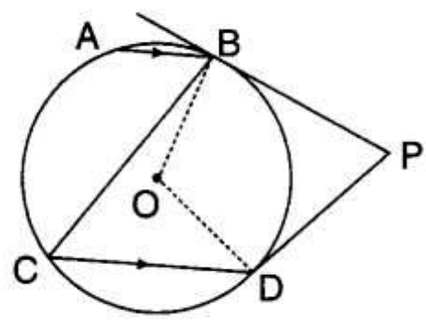
i) ∠BAP

ii) ∠ABD

iii) ∠QAD

iv) ∠BCD

168. In the given figure, O is the centre of the circle. The tangents at B and D intersect each other at point P. If AB is parallel to CD and ∠ABC = 55°, find:



i) ∠BOD

ii) ∠BPD

CONSTRUCTIONS (CIRCLES)

169. Using ruler and compass only, construct a triangle ABC such that BC = 5 cm and AB = 6.5 cm and ∠ ABC = 120°.

i) Construct a circumcircle of triangle ABC.

ii) Construct a cyclic quadrilateral ABCD such that D is equidistant from AB and BC.

170. Use ruler and compass only for answering this question. Draw a circle of radius 4 cm. Mark the centre as O. Mark a point P outside the circle at a distance of 7 cm from the centre. Construct two tangents to the circle from the external point P. Measure and write down the length of any one tangent.

171. Using ruler and compass construct a triangle ABC where AB = 3 cm, BC = 4 cm and ∠ABC = 90°. Hence construct a circle circumscribing the triangle ABC. Measure and write down the radius of the circle.

172. Using ruler and compasses, construct a regular hexagon of side 4.5 cm. Hence construct a circle circumscribing the hexagon. Measure and write down the length of the circum-radius.

173. Construct a triangle ABC with BC = 6.5 cm, AB = 5.5 cm, AC = 5 cm. Construct the incircle of the triangle. Measure and record the radius of the incircle.

174. Draw a circle of radius 4.5 cm. Draw two tangents to this circle so that the angle between the tangents is 60°.

175. Draw an inscribing circle of a regular hexagon of side 5.8 cm.

CYLINDER, CONE AND SPHERE

176. The radius of a solid right circular cylinder decreases by 20% and its height increases by 10%. Find the percentage change in its;

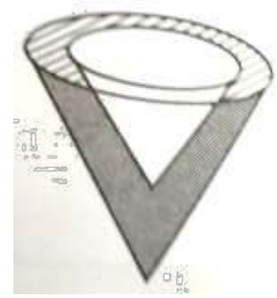
i) volume

ii) curved surface area

177. Find the minimum length in cm and correct to nearest whole number of the thin metal sheet required to make a hollow and closed cylindrical box of diameter 20 cm and height 3.5 cm. Given that the width of the metal sheet is 1 m. Also, find the cost of the sheet at the rate of Rs.56 per m. Find the area of metal sheet required, if 10% of it is wasted in cutting, overlapping, etc.
178. A circular tank of diameter 2 m is dug and the earth removed is spread uniformly all around the tank to form an embankment 2 m in width and 1.6 m in height. Find the depth of the circular tank.
179. Two solid cylinders, one with diameter 60 cm and height 30 cm and the other with radius 30 cm and height 60 cm, are melted and recasted into a third solid cylinder of height 10 cm. Find the diameter of the cylinder formed.
180. A closed cylindrical tank, made of thin iron–sheet, has diameter = 8.4 m and height 5.4 m. How much metal sheet, to the nearest m^2, is used in making this tank, if $\frac{1}{15}$ of the sheet actually used was wasted in making the tank?
181. A heap of wheat is in the form of a cone of diameter 16.8 m and height 3.5 m. Find its volume. How much cloth is required to just cover the heap?
182. A vessel, in the form of an inverted cone, is filled with water to the brim. Its height is 32 cm and diameter of the base is 25.2 cm. Six equal solid cones are dropped in it, so that they are fully submerged. As a result, one–fourth of water in the original cone overflows. What is the volume of each of the solid cones submerged?
183. The internal and external diameters of a hollow hemispherical vessel are 21 cm and 28 cm respectively. Find:
    i) Internal curved surface area
    ii) External curved surface area
    iii) Total surface area
    iv) Volume of material of the vessel
184. The surface area of a solid sphere is increased by 21% without changing its shape. Find the percentage increase in its:
    i) Radius
    ii) Volume
185. The radii of the internal and external surfaces of a metallic spherical shell are 3 cm and 5 cm respectively. It is melted and recast into a solid right circular cone of height 32 cm. Find the diameter of the base of the cone.

186. A hemispherical bowl of internal radius 9 cm is full of liquid. This liquid is to be filled into conical shaped small containers each of diameter 3 cm and height 4 cm. how many containers are necessary to empty the bowl?

187. A solid metallic cone, with radius 6 cm and height 10 cm, is made of some heavy metal A. In order to reduce its weight, a conical hole is made in the cone as shown and it is completely filled with a lighter metal B. The conical hole has a diameter of 6 cm and depth 4 cm. calculate the ratio of the volume of metal A to the volume of the metal B in the solid.



188. The height of a solid cone is 30 cm. A small cone is cut off from the top of it such that the base of the cone cut off and the base of the given cone are parallel to each other. If the volume of the cone cut and the volume of the original cone are in the ratio 1 : 27; find the height of the remaining part of the given cone.

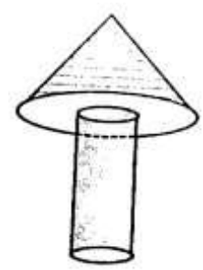
189. A hemi–spherical bowl has negligible thickness and the length of its circumference is 198 cm. Find the capacity of the bowl.

190. A solid metallic hemisphere of diameter 28 cm is melted and recast into a number of identical solid cones, each of diameter 14 cm and height 8 cm. Find the number of cones so formed.

191. From a solid cylinder whose height is 16 cm and radius is 12 cm, a conical cavity of height 8 cm and of base radius 6 cm is hollowed out. Find the volume and total surface area of the remaining solid.

192. A circus tent is cylindrical to a height of 8 m surmounted by a conical part. If total height of the tent is 13 m and the diameter of its base is 24 m; calculate:
   i) total surface area of the tent.
   ii) area of canvas, required to make this tent allowing 10% of the canvas used for folds and stitching.

193. A wooden toy is in the shape of a cone mounted on a cylinder as shown alongside. If the height of the cone is 24 cm, the total height of the toy is 60 cm and the radius of the base of the cone = twice the radius of the base of the cylinder = 10 cm; find the total surface area of the toy. (Take $\pi = 3.14$).



TRIGONOMETRICAL IDENTITIES

194. Prove that sec A (1 – sin A) (sec A + tan A) = 1

195. Prove that (cosec A – sin A) (sec A – cos A) (tan A + cot A) = 1

196. Prove that $\frac{1}{1+\cos A} + \frac{1}{1-\cos A} = 2\ \text{cosec}^2\ A$

197. Prove that $\frac{cot^2\ A}{(cosec\ A+1)^2} = \frac{1-\sin A}{1+\sin A}$

198. Prove that $\sqrt{\frac{1-\sin A}{1+\sin A}} = \frac{\cos A}{1+\sin A}$

199. Prove that $\frac{\cot A+cosec\ A-1}{\cot A-cosec\ A+1}=\frac{1+\cos A}{Sin\ A}$

200. Prove that $\frac{cos^3 A+sin^3 A}{\cos A+\sin A}+\frac{cos^3 A-sin^3 A}{\cos A-\sin A}=2$

201. Prove that $(1 + \tan A \tan B)^2 + (\tan A - \tan B)^2 = \sec^2 A \sec^2 B$

HEIGHTS AND DISTANCES

202. A guard observes an enemy boat, from an observation tower at a height of 180 m above sea level, to be at an angle of depression of 29°.
   i) Calculate, to the nearest metre, the distance of the boat from the foot of the observation tower.
   ii) After some time, it is observed that the boat is 200 m from the foot of the observation tower. Calculate the new angle of depression.

203. Two people standing on the same side of a tower in a straight line with it, measure the angles of elevation of the top of the tower as 25° and 50° respectively. If the height of the tower is 70 m, find the distance between the two people.

204. The upper part of a tree, broken over by the wind, makes an angle of 45° with the ground; and the distance from the root to the point where the top of the tree touches the ground, is 15 m. What was the height of the tree before it was broken?

205. At a particular time, when the sun's altitude is 30°, the length of the shadow of a vertical tower is 45 m. Calculate:
   i) The height of the tower
   ii) The length of the shadow of the same tower, when the sun's altitude is:
      a. 45°
      b. 60°

206. From the top of a cliff 92 m high, the angle of depression of a buoy is 20°. Calculate, to the nearest metre, the distance of the buoy from the foot of the cliff.

207. The length of the shadow of a vertical tower on level ground increases by 10 m, when the altitude of the sun changes from 45° to 30°. Calculate the height of the tower, correct to two decimal places.

208. An observer on the top of a cliff; 200 m above the sea–level, observes the angles of depression of the two ships to be 45° and 30° respectively. Find the distance between the ships, if the ships are:
   i) On the same side of the cliff.
   ii) On the opposite sides of the cliff.

209. From a point on the ground, the angle of elevation of the top of a vertical tower is found to be such that its tangent is $\frac{3}{5}$. On walking 50 m towards the tower, the tangent of the new angle of elevation of the top of the tower is found to be $\frac{4}{5}$. Find the height of the tower.

210. A vertical pole and a vertical tower are on the same level ground. From the top of the pole the angle of elevation of the top of the tower is 60° and the angle of depression of the foot of the tower is 30°. Find the height of the tower if the height of the pole is 20 m.

211. Two pillars of equal heights stand on either side of a roadway, which is 150 m wide. At a point in the roadway between the pillars the elevations of the tops of the pillars are 60° and 30°, find the height of the pillars and the position of the point.

212. A man on a cliff observes a boat, at an angle of depression 30°, which is sailing towards the shore to the point immediately beneath him. Three minutes later, the angle of depression of the boat is found to be 60°. Assuming that the boat sails at a uniform speed, determine:
   i) How much more time it will take to reach the shore?
   ii) The speed of the boat in metre per second, if the height of the cliff is 500 m.

213. An aeroplane flying horizontally 1 km above the ground and going away from the observer is observed at an elevation of 60°. After 10 seconds, its elevation is observed to be 30°; find the uniform speed of the aeroplane in km per hour.

214. A vertical tower is 20 m high. A man standing at some distance from the tower knows that the cosine of the angle of elevation of the top of the tower is 0.53. How far is he standing from the foot of the tower?

215. A 20 m high vertical pole and a vertical tower are on the same level ground in such a way that the angle of elevation of the top of the tower, as seen from the foot of the pole, is 60° and the angle of elevation of the top of the pole as seen from the foot of the tower is 30°. Find:
   i) The height of the tower.
   ii) The horizontal distance between the pole and the tower.

MEASURES OF CENTRAL TENDENCY AND GRAPHICAL REPRESENTATION

216. The weights of 50 apples were recorded as given below. Calculate the mean weight, to the nearest gram, by the Step Deviation Method.

Weight in grams	80–85	85–90	90–95	95–100	100–105	105–110	110–115
No. of apples	5	8	10	12	8	4	3

217. The total number of observations in the following distribution table is 120 and their mean is 50. Find the values of missing frequencies f_1 and f_2.

Class	0–20	20–40	40–60	60–80	80–100
Frequency	17	f_1	32	f_2	19

218. The following are the marks obtained by 70 boys in a class test.

Marks	30–40	40–50	50–60	60–70	70–80	80–90	90–100

No. of boys	10	12	14	12	9	7	6

Calculate the mean by Short–cut Method.

219. If the mean of the following observations is 54, find the value of p.

Class	0–20	20–40	40–60	60–80	80–100
Frequency	7	p	10	9	13

220. From the following frequency distribution table, find:

C.I.	5–10	10–15	15–20	20–25	25–30	30–35
Frequency	3	4	6	9	7	1

i) Lower quartile

ii) Upper quartile

iii) Inter–quartile range

221. The table below shows the distribution of the scores obtained by 120 shooters in a shooting competition. Using a graph sheet, draw an ogive for the distribution.

Score Obtained	Number of Shooters
0 – 10	5
10 – 20	9
20 – 30	16
30 – 40	22
40 – 50	26
50 – 60	18
60 – 70	11
70 – 80	6
80 – 90	4
90 – 100	3

Use your ogive to estimate:

i) The median

ii) The interquartile range

iii) The number of shooters who obtained more than 75% scores

222. Find the mode of the following frequency distribution:

Class	20–30	30–40	40–50	50–60	60–70	70–80
Frequency	4	7	9	11	6	2

223. Use a graph paper for this question. The daily pocket expenses of 200 students in a school are given below:

Pocket expenses (in ₹)	0–5	5–10	10–15	15–20	20–25	25–30	30–35	35–40
No. of Students	10	14	28	42	50	30	14	12

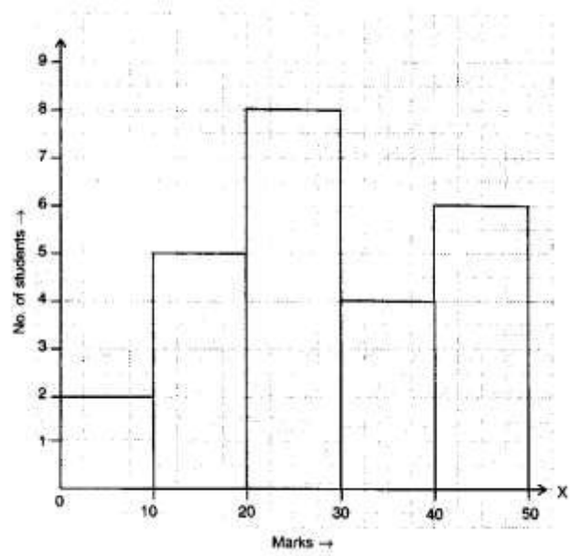
Draw a histogram representing the above distribution and estimate the mode from the graph.

224. The given histogram represents the scores obtained by 25 students in a Mathematics mental test. Use the data to:

i) Frame a frequency distribution table

ii) To calculate mean

iii) To determine the Modal class



PROBABILITY

225. A bag contains 3 red balls, 4 blue balls and one yellow ball, all the balls being identical in shape and size. If a ball is taken out of the bag without looking into it, find the probability that the ball is:

i) yellow

ii) red

iii) not yellow

iv) neither yellow nor red

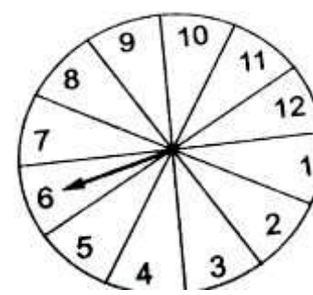
226. A bag contains twenty ₹5 coins, fifty ₹2 coins and thirty ₹1 coins. If it is equally likely that one of the coins will fall down when the bag is turned upside down, what is the probability that the coin:

i) Will be a ₹1 coin?

ii) Will not be a ₹2 coin?

iii) Will neither be a ₹5 coin nor be a ₹1 coin?

227. A game consists of spinning an arrow which comes to rest pointing at one of the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12; as shown alongside. If the outcomes are equally likely, find the probability that the pointer will point at:



i) 6

ii) an even number

iii) a prime number

iv) a number greater than 8

v) A number less than or equal to 9

vi) A number between 3 and 11

228. A bag contains 100 identical marble stones which are numbered from 1 to 100. If one stone is drawn at random from the bag, find the probability that it bears:
    i) A perfect square number
    ii) A number divisible by 4
    iii) A number divisible by 5
    iv) A number divisible by 4 or 5
    v) A number divisible by 4 and 5
229. Three coins are tossed together. Write all the possible outcomes. Now, find the probability of getting:
    i) Exactly two heads
    ii) At least two heads
    iii) Atmost two heads
    iv) All tails
    v) At least one tail
230. Offices in Delhi are open for five days in a week (Monday to Friday). Two employees of an office remain absent for one day in the same particular week. Find the probability that they remain absent on:
    i) The same day
    ii) Consecutive day
    iii) Different days
231. A box contains some black balls and 30 white balls. If the probability of drawing a black ball is two–fifths of a white ball; find the number of black balls in the box.
232. Sixteen cards are labelled as a, b, c, ……. m. n. o. p. They are put in a box and shuffled. A boy is asked to draw a card from the box. What is the probability that the card drawn is:
    i) A vowel
    ii) A consonant
    iii) None of the letters of the word median

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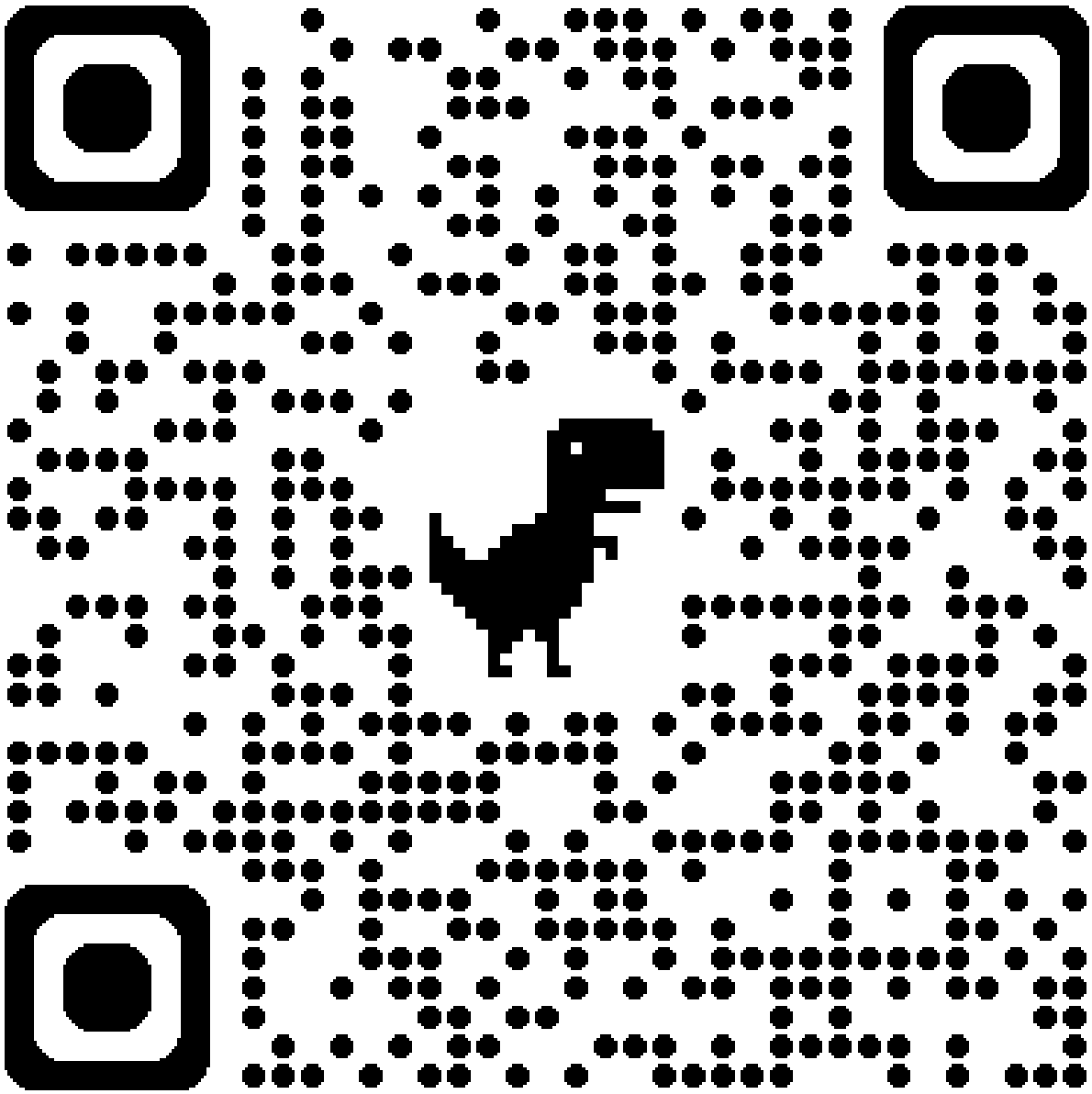

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