

Ln: 1. Relation and Functions

Two Marks:

1. Let $A = \{1, 2, 3, 4, \dots, 45\}$ and R be the relation defined as "is square of" on A . Write R as a subset of $A \times A$. Also, find domain and range of R .
2. Let $f = \{(x, y) \mid x, y \in \mathbb{N} \text{ and } y = 2x\}$ be a relation on \mathbb{N} . Find the domain, co-domain and range. Is this relation a function?
3. A function f is defined by $f(x) = 3 - 2x$. Find x such that $f(x^2) = (f(x))^2$.
4. Let $A, B, C \subseteq \mathbb{N}$ and a function $f: A \rightarrow B$ be defined by $f(x) = 2x + 1$ and $g: B \rightarrow C$ be defined by $g(x) = x^2$. Find the range of $f \circ g$ and $g \circ f$.
5. Let $A = [-1, 1]$ and $B = \{0, 2\}$. If the function $f: A \rightarrow B$ defined by $f(x) = ax + b$ is an onto function? Find a and b .
6. Show that the function $f: \mathbb{N} \rightarrow \mathbb{N}$ defined by $f(x) = 2x + 1$ is one-one but not onto.
7. $f(x) = 1 + x$ and $g(x) = 2x - 1$ show that $f \circ (g(x)) = g \circ f(x)$.
8. Let $f(x) = 2x + 5$, If $x \neq 0$ then find $\frac{f(x+2) - f(2)}{x}$.
9. Find the value of k , such that $f \circ g = g \circ f$
 - (i) $f(x) = 3x + 2$, $g(x) = 6x - k$
 - (ii) $f(x) = 2x - k$, $g(x) = 4x + 5$
10. If $f(x) = x^2 - 1$, $g(x) = x - 2$ find a , if $g \circ f(a) = 1$.

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11. $A = \{1, 2\}$ and $B = \{1, 2, 3, 4\}$, $C = \{5, 6\}$ and $D = \{5, 6, 7, 8\}$. Verify whether $A \times C$ is a subset of $B \times D$?
12. If $f: \mathbb{R} \rightarrow \mathbb{R}$ and $g: \mathbb{R} \rightarrow \mathbb{R}$ are defined by $f(x) = x^5$ and $g(x) = x^4$ then check if f, g are one-one and $f \circ g$ is one-one?
13. If $B \times A = \{(-2, 3), (-2, 4), (0, 3), (3, 3), (3, 4)\}$ find A and B .
14. Let $A = \{5, 6, 7, 8\}$, $B = \{-11, 4, 7, -10, -7, -9, -13\}$ and $f(x) = \{(x, y) : y = 3 - 2x, x \in A, y \in B\}$
 (i) write down the elements of f .
 (ii) what is the range?
15. An open box is to be made from a square piece of material, 24 cm on a side, by cutting equal squares from the corners and turning up the sides as shown in figure. Express the volume V of the box as a function of x .
16. If $A \times B = \{(2, 3), (4, 5), (2, 6), (4, 4)\}$ then find A and B .
17. If $f(x) = x^2 - 2x + 1$ find the value $f(2)$ and $f(-3)$
18. If $f(x) = x + 1$ and $g(x) = 2x^2 + 2$ find $f \circ g$
19. If $f(x) = x^2 + 1$ and $g(x) = 4x + 1$ find $g \circ f$
20. Define for one-one function & onto function.

Ln: 2 Numbers And Sequences

Two Marks:

1. Prove that the product of two consecutive positive integers is divisible by 2.
2. If $13824 = 2^a \times 3^b$ then find a and b .
3. If x is congruent to 13 modulo 17 then $7x-3$ is congruent to which number modulo 17?
4. Find a_n and a_{15} whose n th term is

$$a_n = \begin{cases} \frac{n^2-1}{n+3} & , n \text{ is even} , n \in \mathbb{N} \\ \frac{n^2}{2n+1} & , n \text{ is odd} , n \in \mathbb{N} \end{cases}$$
5. If nine times ninth term is equal to the fifteen times fifteenth term, show that six times twenty fourth term is zero.
6. Find the sum of all odd positive integers less than 450.
7. Find x so that $x+6$, $x+12$ and $x+15$ are consecutive terms of a geometric progression.
8. Find the first term of the G.P whose common ratio 5 and whose sum to first 6 terms is 46872.
9. The sum of the squares of the first n natural numbers is 285, while the sum of their cubes is 2025. Find the value of n .

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10. In a flower bed, there are 23 rose plants in the first row, 21 in the second row, 19 in the third and so on. There are 5 Rose plants in the last row. How many rows are there in the flower bed?
11. A geometric Series consists of four terms and has a positive Common ratio. The sum of the first two term is 8 and the sum of the last two terms is 72. Find the Series.
12. Suppose that five people are ill during the first week of an epidemic and each is sick person spreads the contagious disease to four other people by the end of the second week and so on. By the end of 15th week, how many people will be affected by the epidemic?
13. If a clock strikes once at 1 o'clock, twice at 2 o'clock and so on, how many times will it strike in a day?
14. Find the sum of the first 25 terms of the geometric Series $16 - 48 + 144 - 432 + \dots$
15. Find the value of k , if $1^3 + 2^3 + 3^3 + \dots + k^3 = 4356$.
16. Find the sum of $12 + 13 + 14 + \dots + 25$
17. Find the sum of $1^2 + 2^2 + 3^2 + \dots + 25^2$
18. Find the sum of $1 + 3 + 5 + \dots$ to 40 terms
19. Find the sum of $7 + 14 + 21 + \dots + 700$
20. Find the sum of $1^3 + 2^3 + \dots + 30^3$.

Ln: 3 Algebra & Matrices

Two Marks:

1. Simplify: $\frac{5t^3}{4t-8} \times \frac{6t-12}{10t}$
2. Pari needs 4 hours to complete a work. His friend Yuvan needs 6 hours to complete the same work. How long will it take to complete if they work together?
3. Find the sum and product of the roots of the equation $2x^2 + 5x + 7 = 0$
4. Solve: $2x^2 - 2\sqrt{6}x + 3 = 0$ using factorize method.
5. Solve $2x^2 - x - 1$ using completing square method.
6. Solve $3p^2 + 2\sqrt{5}p - 5 = 0$ using by formula method.
7. If the difference between a number and its reciprocal is $\frac{24}{5}$, find the number.
8. Determine the nature of roots of $2x^2 - 2x + 9 = 0$
9. Find the value of 'k' if $(k+9)x^2 + (k+1)x + 1 = 0$ has no real roots.
10. If α and β are the roots of $x^2 + 7x + 10 = 0$ find the values of (i) $\alpha - \beta$ (ii) $\alpha^2 + \beta^2$
11. Construct a 3×3 matrix whose elements are given by $a_{ij} = \frac{(i+j)^3}{3}$
12. If $A = \begin{bmatrix} 5 & 2 & 2 \\ -\sqrt{17} & 0.7 & \frac{5}{2} \\ 8 & 3 & 1 \end{bmatrix}$ then verify $(A^T)^T = A$

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13. If $A = \begin{bmatrix} 7 & 8 & 6 \\ 1 & 3 & 9 \\ -4 & 3 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 4 & 11 & -3 \\ -1 & 2 & 4 \\ 7 & 3 & 0 \end{bmatrix}$

Then find $2A+B$.

14. Find x and y if $x+y = \begin{bmatrix} 7 & 0 \\ 3 & 5 \end{bmatrix}$ and
 $x-y = \begin{bmatrix} 3 & 0 \\ 0 & 4 \end{bmatrix}$

15. Find x, y, z if $\begin{bmatrix} x-3 & 3x-z \\ x+y+1 & x+y+z \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

16. Solve x, y : $\begin{bmatrix} x^2 \\ y^2 \end{bmatrix} + 2 \begin{bmatrix} -2x \\ -y \end{bmatrix} = \begin{bmatrix} -5 \\ 8 \end{bmatrix}$

17. If $A = \begin{bmatrix} 2 & 5 \\ 4 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 1 & -3 \\ 2 & 5 \end{bmatrix}$ find AB , BA and
 Check $AB = BA$?

18. If $A = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$ prove that $AA^T = I$

19. If $A = \begin{bmatrix} p & 0 \\ 0 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 0 & -2 \\ 1 & 0 \end{bmatrix}$, $C = \begin{bmatrix} 2 & -2 \\ 2 & 2 \end{bmatrix}$
 and $BA = C^2$ find p and q .

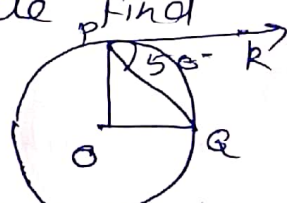
20. Find a, b, c and d . $\begin{bmatrix} a-b & 2a+c \\ 2a-b & 3c+d \end{bmatrix} = \begin{bmatrix} 1 & 5 \\ 0 & 2 \end{bmatrix}$

Ln: 4: Geometry

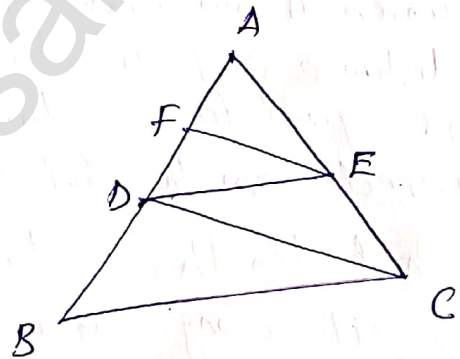
Two Marks:

1. A boy of height 90cm is walking away from the base of a lamp post at a speed of 1.2 m/sec. If the lamp post is 3.6 m above the ground, find the length of his shadow cast after 4 seconds.
2. In $\triangle ABC$ if $DE \parallel BC$, $AD = x$, $BD = x - 2$ and $EC = x - 1$ then find the lengths of the side AB and AC .
3. In $\triangle ABC$ AD is the bisector of $\angle A$ meeting side BC at D , if $AB = 10\text{cm}$, $AC = 14\text{cm}$ and $BC = 6\text{cm}$ find BD and DC .
4. An insect 8 m away initially from the foot of a lamp post which is 6 m tall crawls towards it moving through a distance. If its distance from the top of the lamp post is equal to the distance it has moved, how far is the insect from the foot of the lamp post?
5. What length of ladder is needed to reach a height of 7 ft along the wall when the base of the ladder is 4 ft from the wall? Round off your answer to the next tenth place.
6. A man goes 18 m due east and then 24 m due north. Find the distance of his current position from the starting point?
7. In the rectangle $WXYZ$, $XY + YZ = 17\text{cm}$ and $XZ + YW = 26\text{cm}$ calculate the length and breadth of the rectangle?
8. Find the length of the tangent drawn from a point whose distance from the centre of a circle is 5 cm and radius of the circle is 3 cm.

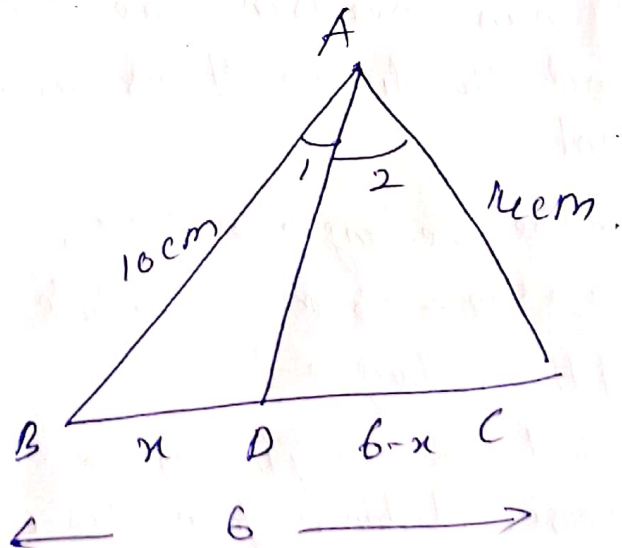
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9. In the figure O is the centre of a circle. Find $\angle POQ$
- 
10. If radii of two concentric circles are 4cm and 5cm then find the length of the chord of one circle which is a tangent to the other circle.
11. PQ is a tangent from a point P to a circle with centre O and QOR is a diameter of the circle such that $\angle PQR = 120^\circ$. Find $\angle OPQ$
12. The length of the tangent to a circle from a point P , which is 25cm away from the centre is 24cm. What is the radius of the circle?
13. State the converse of "Thales Theorem"

14. In figure, $DE \parallel BC$ and $CD \parallel EF$. Prove that $AD^2 = AB \times AF$



15. In the figure, AD is the bisector of $\angle BAC$, if $AB = 10$, $AC = 14$ cm and $BC = 6$ cm. Find BD and DC .



Two Marks. Ln: 5 coordinate geometry.

1. If the area of the triangle formed by the vertices $A(-1, 2)$, $B(k, -2)$ and $C(7, 4)$ (taken in order) is 22 sq. units, find the value of k .
2. If the points $A(-3, 9)$, $B(a, b)$ and $C(4, -5)$ are collinear and if $a+b=1$, then find a and b .
3. The line 'r' passes through the points $(-2, 2)$ and $(5, 8)$ and the line 's' passes through the points $(-8, 7)$ and $(-2, 0)$. Is the line r perpendicular to s?
4. Find the slope of $(\sin \theta, -\cos \theta)$ and $(-\sin \theta, \cos \theta)$
5. The line through the points $(-2, a)$ and $(9, 3)$ has slope $-\frac{1}{2}$. Find the value of a .
6. Calculate the slope and y-intercept of the straight line $8x - 7y + 6 = 0$
7. Find the equation of a line passing through the point $(3, -4)$ and having slope $-\frac{5}{7}$.
8. Find the slope and y-intercept of $\sqrt{3}x + (1 - \sqrt{3})y = 3$.
9. A cat is located at the point $(-6, -4)$ in xy plane. A bottle of milk is kept at $(5, 11)$. The cat wish to consume the milk travelling through shortest possible distance. Find the equation of the path it needs to take its milk.
10. Find the value of 'a' if the line through $(-2, 3)$ and $(8, 5)$ is perpendicular to $y = ax + 2$.

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11. Show that the straight lines $2x + 3y - 8 = 0$ and $4x + 6y + 18 = 0$ are parallel.
12. Show that the straight lines $5x + 23y + 14 = 0$ and $23x - 5y + 9 = 0$ are perpendicular or parallel.
13. If the straight lines $12y = -(p+3)x + 12$, $12x - 7y = 16$ are perpendicular then find p .
14. Find the equation of a straight line which is parallel to the line $3x - 7y = 12$ and passing through the point $(6, 4)$.
15. Find the equation of a straight line perpendicular to the line $y = \frac{4}{3}x - 7$ and passing through the point $(7, -1)$.
16. Show that the points $(-2, 5)$, $(6, -1)$, and $(2, 2)$ are collinear.
17. (i) What is the slope of a line whose inclination is 30° ?
(ii) What is the inclination of a line whose slope is $\sqrt{3}$?
18. Without using Pythagoras Theorem, show that the points $(1, -4)$, $(2, -3)$, and $(4, 9)$ form a right angled triangle.
19. The line through the points $(-2, 6)$ and $(4, 8)$ is perpendicular to the line through the points $(8, 12)$ and $(x, 24)$. Find the value of x .
20. The floor of a hall is covered with identical tiles which are in the shapes of triangles. One such triangle has the vertices at $(-3, 2)$, $(-1, -1)$ and $(1, 2)$. If the floor of the hall is completely covered by 110 tiles, find the area of the floor.

Ln: 6. Trigonometry.

Two Marks.

1. Prove that $\frac{\cos \theta}{1 + \sin \theta} = \sec \theta - \tan \theta$
2. Prove that $\sec^6 \theta = \tan^6 \theta + 3 \tan^2 \theta \sec^2 \theta + 1$
3. Prove that $\sec^4 \theta (1 - \sin^4 \theta) - 2 \tan^2 \theta = 1$
4. Prove that $\sqrt{\frac{1 + \sin \theta}{1 - \sin \theta}} = \sec \theta + \tan \theta$
5. If $\sin \theta + \cos \theta = \sqrt{3}$ then prove that $\tan \theta + \cot \theta = 1$
6. Prove that $\frac{\cot \theta - \cos \theta}{\cot \theta + \cos \theta} = \frac{\operatorname{cosec} \theta - 1}{\operatorname{cosec} \theta + 1}$
7. Find the angle of elevation of the top of a tower from a point on the ground, which is 30m away from the foot of a tower of height $10\sqrt{3}$ m.
8. A road is flanked on either side by continuous rows of houses of height $4\sqrt{3}$ m with no space in between them. A pedestrian is standing on the median of the road facing a row house. The angle of elevation from the pedestrian to the top of the house is 30° . Find the width of the road.
9. From the top of a rock $50\sqrt{3}$ m high, the angle of depression of a car on the ground is observed to be 30° . Find the distance of the car from the rock.
10. P.T. $(1 + \tan \theta + \sec \theta)(1 + \cot \theta - \operatorname{cosec} \theta) = 2$.

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11. From the top of a tree of height 13m the angle of elevation and depression of the top and bottom of another tree are 45° and 30° respectively. Find the height of the second tree $\sqrt{3} = 1.732$.
12. The horizontal distance between two buildings is 70m. The angle of depression of the top of the first building when seen from the top of the second building is 45° . If the height of the second building is 120m, find the height of the first building.
13. Prove that: $\frac{1 + \sec \theta}{\sec \theta} = \frac{\sin^2 \theta}{1 - \cos \theta}$
14. Prove that: $(\sin^6 \theta + \cos^6 \theta) = 1 - 3 \sin^2 \theta \cdot \cos^2 \theta$
15. Prove that $\frac{\sin \theta - 2 \sin^3 \theta}{2 \cos^3 \theta - \cos \theta} = \tan \theta$
16. P.T $(\sin \theta + \csc \theta)^2 + (\cos \theta + \sec \theta)^2 = 7 + \tan^2 \theta + \cot^2 \theta$
17. P.T $\frac{\sec \theta - \tan \theta}{\sec \theta + \tan \theta} = 1 - 2 \sec \theta \cdot \tan \theta + 2 \tan^2 \theta$
18. P.T $\sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}} = \csc \theta - \cot \theta$
19. P.T $\frac{\sin \theta}{\csc \theta} + \frac{\cos \theta}{\sec \theta} = 1$
20. A ladder leaning against a vertical wall, makes an angle of 60° with the ground. The foot of the ladder is 3.5m away from the wall. Find the length of the ladder.

Ln: 7. Mensuration

Two Marks!

1. A cylindrical drum has a height of 20cm and base radius 14cm. Find its curved surface area and the total surface area.
2. The curved surface area of a right circular cylinder of height 14cm is 88 cm^2 . Find the diameter of the cylinder.
3. A garden roller whose length is 3m long and whose diameter is 2.8m is rolled to level a garden. How much area will it cover in 8 revolutions?
4. If the total surface area of a cone of radius 7cm is 704 cm^2 then find its slant height.
5. Find the diameter of a sphere whose surface area is 154 m^2 .
6. The radius of a spherical balloon increases from 12cm to 16cm as air being pumped into it. Find the total surface area of the balloons in the two cases.
7. If the base area of a hemispherical solid is 1386 sq. m . then find its total surface area?
8. The internal and external radii of a hollow hemispherical shell are 3m and 5m respectively. Find the T.S.A and C.S.A of the shell.
9. The slant height of a frustum of a cone is 5cm and the radii of its ends are 4cm and 1cm. Find CSA.
10. 4 persons live in a conical tent whose slant height is 19cm. If each person require 22 cm^2 of the floor area, then find the height of the tent.
11. Find the volume of a cylinder whose height is 2m whose base area is 250 m^2 .

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12. The volume of a cylinder water tank is 1.078×10^6 litres. If the diameter of the tank is 7m. find its height.
13. Find the volume of the iron used to make a hollow cylinder of height 9cm and whose internal and external radii are 21cm and 28cm respectively.
14. The volume of a solid right circular cone is 11088 cm^3 . If its height is 24cm then find the radius of the cone.
15. If the circumference of a conical wooden piece is 484cm then find its volume when its height is 105cm.
16. The volumes of two cones of same base radius are 3600 cm^3 and 5040 cm^3 . Find the ratio of heights.
17. If the ratio of radii of two spheres is 4:7, find the ratio of their volumes.
18. A conical flask is full of water. The flask has base radius 'r' units and height 'h' units, the water poured into cylindrical flask of base radius $\frac{r}{2}$ units. Find the height of water in the cylindrical flask.
19. The radius of a conical tent is 7m and height is 24cm find the CSA and TSA.
20. If the radii of the circular ends of a frustum which is 45cm high are 28cm and 7cm find the volume of the frustum.

Ln: 8 statistics and Probability

Two Marks.

1. Find the range and coefficient of range of the data 63, 89, 98, 125, 79, 108, 117, 68
2. If the standard deviation of a data is 3.6 and each value of the data is divided by 3. then find the new variance and new S.D?
3. Find the S.D of first 10 natural numbers.
4. A wall clock strikes the bell at 1' o' clock once, 2 times at 2' o' clock and so on. How many times will it strike in a particular day. Find the S.D.
5. If S.D and Mean of a data are 6.5 and 12.5 respectively. Find the coefficient of variation.
6. If $n=5$, $\bar{x}=6$, $\sum x^2=765$, then calculate the coefficient of variation.
7. If $\bar{x}=15$ and C.V = 48 find the standard deviation.
8. The largest of 50 measurement is 3.84 kg. If the range is 0.46 kg, find the smallest measurement.
9. If $n=10$, $\bar{x}=12$ and $\sum x^2=1530$ then find C.V.?
10. A group of 100 candidates have their average height 163.8 cm with coefficient of variation 3.2. What is the standard deviation of their heights?

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11. A die is thrown twice. Find the probability of getting a total of 9.
12. Two coins are tossed together. What is the probability of getting at most one head.
13. Three coins are tossed simultaneously. Find the probability of getting at least one head.
14. A bag contains 6 white balls numbered from 1 to 6 and 4 red balls numbered from 7 to 10. A ball is drawn at random. Find the probability of getting (i) an even-numbered ball (ii) a white ball.
15. Three dice are thrown simultaneously. Find the probability of getting the same number on all the three dice.
16. One card is drawn randomly from a well shuffled deck of 52 playing cards. Find the probability that the drawn card is (i) a Diamond (ii) Ace
17. If $P(A) = \frac{1}{2}$, $P(B) = \frac{7}{10}$, $P(A \cup B) = 1$, find (i) $P(A \cap B)$ (ii) $P(A' \cup B')$
18. If $P(A) = \frac{1}{4}$ and $P(B) = \frac{2}{5}$ and $P(A \cup B) = \frac{1}{2}$ find $P(A \cap B)$
19. If $P(A) = 0.25$, $P(B) = 0.05$ and $P(A \cap B) = 0.14$ then find $P(A \cup B)$.
20. There are 6 defective items in a sample of 20 items. One item is drawn at random. Find the probability of non-defective items.