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Ln: 1. Relation and Functions

5-marks.

1. let $A = \{x \in N \mid 1 < x < 4\}$, $B = \{x \in W \mid 0 \le x < 2\}$ and $C = \{x \in N \mid x < 3\}$ Then verify that $A \times (B \cup C) = (A \times B) \cup (A \times C)$

2. Represent each of the given relation by (a) an arrow diagram (b) a graph and (c) a set in roster form, wherever possible.
(i) $\{(x, y) \mid x = 2y,\ x \in \{2, 3, 4, 5\},\ y \in \{1, 2, 3, 4\}\}$
(ii) $\{(x, y) \mid y = x + 3,\ x, y$ are natural numbers $< 10\}$

3. A function f is defined by $f(x) = 2x - 3$
(i) find $\frac{f(0) + f(1)}{2}$
(ii) find x such that $f(x) = 0$
(iii) find x such that $f(x) = x$
(iv) find x such that $f(x) = f(1 - x)$.

4. let $A = \{1, 2, 3, 4\}$ and $B = \{2, 5, 8, 11, 14\}$ be two sets. Let $f: A \to B$ be a function given by $f(x) = 3x - 1$. Represent this function.
(i) by arrow diagram (ii) in a table form
(iii) as a set of ordered pairs (iv) in a graphical form.

5. If the function $f: R \to R$ is defined by $f(x) = \begin{cases} 2x + 7, & x < -2 \\ x^2 - 2, & -2 \le x < 3 \\ 3x - 2, & x \ge 3 \end{cases}$ then find the values of
(i) $f(4)$ (ii) $f(-2)$ (iii) $f(4) + 2f(1)$
(iv) $\frac{f(1) - 3f(4)}{f(-3)}$.

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6. The function 't' which maps temperature in Celsius (C) values in into temperature in Fahrenheit (F) is defined by $t(c) = F$ where $F = \frac{9}{5}c + 32$ Find.
(i) $t(0)$ (ii) $t(28)$ (iii) $t(-10)$ (iv) the value of c when $t(c) = 212$
(v) the temperature when the celsius value is equal to the Farenheit Value.

7. If $f(x) = 2x+3$, $g(x) = 1-2x$ and $h(x) = 3x$ prove that $f\circ(g\circ h) = (f\circ g)\circ h$.

8. Find x if $gff(x) = fgg(x)$ given $f(x) = 3x+1$ and $g(x) = x+3$.

9. The functions f and g are defined by $f(x) = 6x+8$, $g(x) = \frac{x-2}{3}$
(i) Calculate the value of $gg(\frac{1}{2})$
(ii) Write an expression for $gf(x)$ in its simplest form.

10. Forensic scientists can determine the height (in cm) of a person based on the length of the thigh bone. They usually do so using the function $h(b) = 2.47b + 54.10$ where b is the length of the thigh bone.
(i) Verify the function h is one-one (or) not
(ii) Also find the height of a person if the length of his thigh bone is 50 cm
(iii) Find the length of the thigh bone if the height of a person is 147.96 cm.

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Ln: 2. Numbers And Sequences.

5 - Marks.

1. In an A.P. sum of four consecutive terms is 28 and their sum of their squares is 276. Find the four numbers.

2. The 13^{th} term of an A.P is 3 and the sum of first 13 terms is 234. Find the common difference and the sum of first 21 terms.

3. A brick staircase has a total of 30 steps. The bottom step requires 100 bricks. successive step requires two bricks less than the previous step.
(i) How many bricks are required for the top most step?
(ii) How many bricks are required to build the the stair case?

4. In a geometric progression, the 4^{th} term is $\frac{8}{9}$ and the 7^{th} term is $\frac{64}{243}$. Find the Geometric progression.

5. The product of three consecutive terms of a Geometric progression is 343 and their sum is $\frac{91}{3}$. Find the three terms.

6. A man joined a company as Assistant Manager. The company gave him a starting salary of ₹ 60,000 and agreed to increase his salary 5% annually. what will be his salary after 5 years?

7. Find the sum to n terms of the series
$5 + 55 + 555 + \cdots$

8. Find the sum of $16 + 17 + 18 + \cdots + 75$.

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9. Reetha has 15 square colour papers of sizes 10cm, 11cm, 12cm ..... 24cm. How much area can be decorated with these colour papers?

10. Find the sum of the series $(2^3-1^3)+(4^3-3^3)+(6^3-5^3)+\dots$ to (i) n terms (ii) 8 terms.

11. If $(m+1)^{th}$ term of an A.P is twice of $(n+1)^{th}$ term, then prove that $(3m+1)^{th}$ term is twice the $(m+n+1)^{th}$ term.

12. If a, b, c are three consecutive terms of an A.P and x, y, z are three consecutive terms of a G.P the prove that $x^{b-c} \times y^{c-a} \times z^{a-b} = 1$.

13. If $S_1, S_2, S_3 \dots S_m$ are the sums of n terms of m A.P's, whose first terms are 1, 2, 3 .... m and whose common difference are (1, 3, 5 ... (2m-1)) respectively, then show that
$$S_1+S_2+S_3+\dots+S_m = \frac{1}{2}mn[mn+1]$$

14. Find the sum of $\left[\frac{a-b}{a+b} + \frac{3a-2b}{a+b} + \frac{5a-3b}{a+b} + \dots \text{ to 12 terms}\right]$.

15. Find the least positive value of x such that
(i) $67+x \equiv 1 \pmod 4$
(ii) $98 \equiv (x+4) \pmod 5$.

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Ln: 3. Algebra.

5-Marks.

1. Solve $\frac{x}{2}-1=\frac{y}{6}+1=\frac{z}{7}+2$; $\frac{y}{3}+\frac{z}{2}=13$

2. The sum of the digits of a three-digit number is 11. If the digits are reversed, the new number is 46 more than five the former number. If the hundred digit plus twice the tens digits is equal to the unite digit. then find the original three digit number?

3. Find the GCD of the polynomial x^3+x^2-x+2 and $2x^3-5x^2+5x-3$.

4. Simplify: $\frac{2a^2+5a+3}{2a^2+7a+6} \div \frac{a^2+6a+5}{-5a^2-35a-50}$

5. If $A=\frac{x}{x+1}$, $B=\frac{1}{x+1}$ then prove that $\frac{(A+B)^2+(A-B)^2}{A\div B}=\frac{2(x^2+1)}{x(x+1)^2}$

6. Find the square root of $\left[\sqrt{15}x^2+(\sqrt{3}+\sqrt{10})x+\sqrt{2}\right]\left[\sqrt{5}x^2+(2\sqrt{5}+1)x+2\right]\left[\sqrt{3}x^2+(\sqrt{2}+2\sqrt{3})x+2\sqrt{2}\right]$

7. Find the square root of $121x^4-198x^3-183x^2+216x+144$

8. Find the value of a and b if $9x^4+12x^3+28x^2+ax+b$ is a perfect square.

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9. Solve: $pqx^2 + (p+q)x^2 + (p+q)^2 = 0$

10. A passenger train takes 1 hr more than an express train to travel a distance of 240km from Chennai to virudhachalam. The speed of passenger train is less than that of an express train by 20km per hour. Find the average speed of both the trains.

11. prove that the equation $x^2(p^2+q^2) + 2x(pr+qs) + r^2+s^2 = 0$ has no real roots. If $ps = qr$ then show that the roots are real and equal.

12. If $A = \begin{bmatrix} 1 & -1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & -1 \\ 2 & 1 \\ 1 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 2 \\ 2 & -1 \end{bmatrix}$ Show that $(AB)C = A(BC)$.

13. If $A = \begin{bmatrix} 1 & 1 \\ -1 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 \\ -4 & 2 \end{bmatrix}$, $C = \begin{bmatrix} -7 & 6 \\ 3 & 2 \end{bmatrix}$ Verify $A(B+C) = AB + AC$.

14. If $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & -1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 \\ -1 & 4 \\ 0 & 2 \end{bmatrix}$ Show that $(AB)^T = B^T A^T$.

15. If $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ show that $A^2 - (a+d)A = (bc - ad)I_2$.

16. If $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$ show that $A^2 - 5A + 7I_2 = 0$

17. If α, β are the roots of the equation $3x^2 + 7x - 2 = 0$ find the values of (i) $\frac{\alpha}{\beta} + \frac{\beta}{\alpha}$ (ii) $\frac{\alpha^2}{\beta} + \frac{\beta^2}{\alpha}$

18. The roots of the equation $x^2 + 6x - 4 = 0$ are α, β. Find the equation whose roots are. (quadratic)
(i) α^2 and β^2 (ii) $\frac{2}{\alpha}$ and $\frac{2}{\beta}$ (iii) $\alpha^2\beta$ and $\beta^2\alpha$.

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Ln: 4. : Geometry.

5-Marks:

1. Two poles of height 'a' metres and 'b' metres are 'p' meters apart. prove that the height of the point of intersection of the lines joining the top of each pole to the foot of the opposite pole is given by $\frac{ab}{a+b}$ metres.
2. State and prove the "Basic Proportionality Theorem".
3. In trapezium ABCD, AB∥DC, E and F are points on non-parallel sides AD and BC respectively, such that EF∥AB. Show that $\frac{AE}{ED} = \frac{BF}{FC}$.
4. State and prove "Angle bisector Theorem".
5. State and prove "Pythagoras Theorem".
6. P and Q are the mid-points of the sides CA and CB respectively of a ΔABC, right angled at C. Prove that $4(AQ^2 + BP^2) = 5AB^2$.
7. An Aeroplane leaves an airport and flies due north at a speed of 1000km/hr. At the same time, another aeroplane leaves the same airport and flies due west at a speed of 1200 km/hr. How far apart will be the two planes after $1\frac{1}{2}$ hours?
8. The hypotenuse of a right triangle is 6m more than twice of the shortest side. If the third side is 2m less than the hypotenuse, find the sides of the triangle.
9. The perpendicular PS on the base QR of a ΔPQR intersects QR at S, such that QS = 3SR. prove that $2PQ^2 = 2PR^2 + QR^2$.

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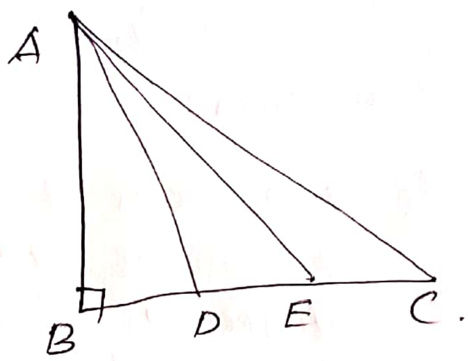
10. In the adjacent figure. ABC is a right angled triangle with right angle at B and points. D, E trisect BC. prove that $8AE^2 = 3AC^2 + 5AD^2$



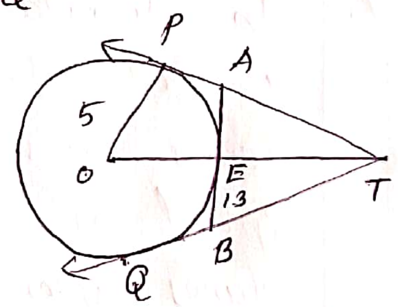
11. State and prove "Alternate Segment Theorem".

12. PQ is a Chord of length 8 cm to a circle of radius 5cm. The tangents at P and Q intersect at a point T. Find the Length of the tangent TP.

13. Show that in a triangle the medians are concurrent.

14. suppose AB, AC and BC have lengths 13, 14 and 15 respectively. If $\frac{AF}{FB} = \frac{2}{5}$ and $\frac{CE}{EA} = \frac{5}{8}$. Find BD and DC.

15. In figure, O is the centre of the circle with radius 5 cm. T is a point such that OT = 13cm and OT intersects the circle E, if AB is the tangent to the circle ~~at~~ E. find the length of AB.



16. Show that the angle bisectors of a triangle are concurrent.

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Ln: 5 Coordinate Geometry.

5 - Marks.

1. Find the area of the quadrilateral formed by the points (8, 6), (5, 11), (−5, 12) and (−4, 3).

2. Find the value of k if the area of a quadrilateral is 28 sq. units whose vertices are (−4, −2), (−3, k) (3, −2) and (2, 3).

3. Without using Pythagoras Theorem, show that the points (1, −4), (2, −3) and (4, −7) form a right angled triangle.

4. prove analytically that the line segment joining the mid points of two sides of a triangle is parallel to the third side and is equal to half of its length.

5. If the points A(2, 2), B(−2, −3), C(1, −3) and D(x, y) form a parallelogram then find the value of x and y.

6. A quadrilateral has vertices at A(−4, −2), B(5, −1) C(6, 5) and D(−7, 6). show that the mid-points of its sides form a parallelogram.

7. A mobile phone is put to use when the battery power is 100%. The percent of battery power 'y' (in decimal) remaining after using the mobile phone for x hours is assumed as $y = -0.25x + 1$
   (i) Draw a graph of the equation
   (ii) Find the number of hours elapsed if the battery power is 40%.
   (iii) How much time does it take so that the battery has no power?

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8. A line makes positive intercepts on coordinate axes whose sum is '7' and it passes through $(-3, 8)$. Find its equation.

9. Find the equation of a straight line parallel to Y axis and passing through the point of intersects of the lines $4x+5y=13$ and $x-8y+9=0$.

10. The line joining the points $A(0,5)$ and $B(4,1)$ is a tangent to a circle whose centre 'C' is at the point $(4,4)$ find
(i) The equation of the line AB.
(ii) the equation of the line through C which is perpendicular to the line AB.
(iii) the coordinates of the point of contact of tangent line AB with the circle.

11. Find the equation of a straight line joining the point of intersection of $3x+y+2=0$ and $x-2y-4=0$ to the point of intersection of $7x-3y=-12$ and $2y=x+3$.

12. Find the equation of a straight line through the point of intersection of the lines $8x+3y=18$, and $4x+5y=9$ and bisecting the line segment joining the points $(5,-4)$ and $(-7,6)$.

13. Find the area of a triangle formed by the lines $3x+y-2=0$, $5x+2y-3=0$ and $2x-y-3=0$

14. Find the equations of the lines, whose sum and product are 1 and -6 respectively.

15. Find the equation of the median and altitude of ΔABC through A where the vertices are $A(6,2)$ $B(-5,-1)$, and $C(1,9)$.

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Ln: 6. Trigonometry.

5 - Marks

1. Prove that $\frac{\sin A}{\sec A+\tan A-1}+\frac{\cos A}{\operatorname{cosec} A+\cot A-1}=1$.

2. If $\frac{\cos^2\theta}{\sin\theta}=p$ and $\frac{\sin^2\theta}{\cos\theta}=q$, then prove that $p^2q^2(p^2+q^2+3)=1$.

3. If $\frac{\cos\alpha}{\cos\beta}=m$ and $\frac{\cos\alpha}{\sin\beta}=n$, then prove that $(m^2+n^2)\cos^2\beta=n^2$

4. If $\cot\theta+\tan\theta=x$ and $\sec\theta-\cos\theta=y$, then prove that $(x^2)^{2/3}-(xy^2)^{2/3}=1$.

5. If $\sin\theta(1+\sin^2\theta)=\cos^2\theta$, then prove that $\cos^6\theta-4\cos^4\theta+8\cos^2\theta=4$.

6. If $\frac{\cos\theta}{1+\sin\theta}=\frac{1}{a}$, then prove that $\frac{a^2-1}{a^2+1}=\sin\theta$

7. Two ships are sailing in the sea on either sides of a lighthouse. The angle of elevation of the top of the lighthouse as observed from the ships are $30°$ and $45°$ respectively. If the lighthouse is 200m high, find the distance between the two ships ($\sqrt{3}=1.732$).

8. From the top of a tower 50m high, the angles of depression of the top and bottom of a tree are observed to be $30°$ and $45°$ respectively. Find the height of the tree ($\sqrt{3}=1.732$).

9. From the top of a lighthouse, the angle of depression of two ships on the opposite sides of it are observed to be $30°$ and $60°$. If the height of the lighthouse is h metres and the line joining the ships passes through the foot of the lighthouse, show that the distance between the ships is $\frac{4h}{\sqrt{3}}$ m.

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10. From a window (h metres height above the ground) of a house in a street, the angles of elevation and depression of the top and the foot of another house on the opposite side of the street are θ_1 and θ_2 respectively. Show that the height of the opposite house is $h\left[1+\frac{\cot\theta_2}{\cot\theta_1}\right]$.

11. The angles of elevation and depression of the top and bottom of a lamp post from the top of a 66m high apartment are 60° and 30° respectively. Find
(i) The height of the lamp post
(ii) The difference between height of the lamp post and the apartment.
(iii) The distance between the lamp post and apartment ($\sqrt{3}=1.732$).

12. Two ships are sailing in the sea on either side of the lighthouse. The angles of depression of two ships as observed from the top of the lighthouse are 60° and 45° respectively. If the distance between the ships is $200\left(\frac{\sqrt{3}+1}{\sqrt{3}}\right)$ meters, find the height of the lighthouse.

13. If $a\cos\theta - b\sin\theta = c$ then prove that $(a\sin\theta + b\cos\theta)$
$= \pm\sqrt{a^2+b^2-c^2}$

14. An aeroplane at an altitude of 1800m finds that two boats are sailing towards it in the same direction. The angles of depression of the boats as observed from the aeroplane are 60° and 30° respectively. Find the distance between the two boats ($\sqrt{3}=1.732$).

15. From the top of a tower 50m high, the angles of depression of the top and bottom of a tree are observed to be 30° and 45° respectively. Find the height of the tree ($\sqrt{3}=1.732$).

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Ln: 7. Mensuration.

5-Marks.

1. From a solid cylinder whose height is 2.4 cm and diameter 1.4cm, a conical cavity of the same height and base is hollowed out. Find the total surface area of the remaining solid.
2. An industrial metallic buckett, is in the shape of the frustum of a right circular cone whose top and bottom diameters are 10m and 4m and whose height is 4m. Find the curved and total surface area of the bucket.
3. Calculate the weight of a hollow brass sphere if the inner diameter is 14cm and thickness is 1mm, and whose density is 17.3 g/cm^3.
4. If the radii of the circular ends of a frustum which is 45cm heigh are 28cm and 7cm, find the volumes of the frustum.
5. A toy is in the shape of a cylinder surmounted by a hemisphere. The height of the toy is 25cm. Find the total surface area of the toy if its common diameter is 12cm.
6. A capsule in the shape of a cylinder with two hemisphore stuck to each of its ends. If the length of the entire capsule is 12mm and the diameter of the capsule is 3mm, how much medicine it can hold?
7. A right circular cylindrical container of base radius 6cm and height is 15cm is full of ice cream. The ice cream is to be filled in cones of height 9cm and base radius 3cm, having a hemispherical cap. Find the number of cones needed to empty the container.
8. A metallic sphere of radius 16cm is melted and recast into small spheres each of radius 2cm. How many small spheres can be obtained?

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9. Arul has to make arrangement for the accommodation of 150 persons for his family function. For this purpose he plans to build a tent which in the shape of cylinder surmounted by a cone. Each person occupies 4 sq m. of the space on ground and 40 cu. meter of air to breathe. What should be the height of the conical part of the tent if the height of cylinderical part is 8 m?

10. A solid sphere of radius 6cm is melted into a hollow cylinder of uniform thickness. If the external radius of the base of the cylinder is 5 cm and its height is 32 cm., then find the thickness of the cylinder.

11. A hemi-spherical tank of radius 1.75m full of water. It is connected with a pipe which empties the tank at the rate of 7 litre per second. How much time will it take to empty the tank completely?

12. A metallic sheet in the form of a sector of a circle of radius 21cm has central angle of 216°. The sector is made into a cone by bringing the bounding radii together. Find the volume of the cone formed.

13. A funnel consists of a frustum of a cone attached to a cylinderical portion 12cm long attached at the bottom. If the total height be 20cm, diameter of the cylinderical portion be 12cm and the diameter of the top of the funnel be 24cm. Find the outer surface area of the funnel.

14. A cone of height 24cm is made up modeling clay. A child reshaps it in the form of a cylinder of same radius as cone. Find the height of the cylinder.

15. A vessel in in the form of a hemisphoical bowl mounted by a hollow cylinder. The diameter is 14cm and the height of the vessel is 13cm. Find the capacity of the vessel.

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Ln: 8. Statistics and probability

5-Marks.

1. The marks scored by 10 students in a class test are 25, 29, 30, 33, 35, 37, 38, 40, 44, 48. Find the standard deviation.

2. Find the mean and variance of first 'n' natural numbers.

3.

x	6	7	8	9	10	11	12
f	3	6	9	13	8	5	4

Find the standard deviation of the data.

4. The mean and variance of seven observation are 8 and 16 respectively. If five of these are 2, 4, 10, 12 and 14 then find the remaining two observations.

5. For a group of 100 candidates the mean and standard deviation of their marks were found that the scores ~~45 and 72~~ to be 60 and 15 respectively. later on it was found that the scores 45 and 72 were wrongly entered as 40 and 27. Find the correct mean and standard deviation.

6.

Diameter	21-24	25-28	29-32	33-36	37-40	41-44
Number of plates	15	18	20	16	8	7

Find the standard deviation.

7. A coin is tossed thrice. Find the probability of getting exactly two heads or atleast one tail or two consecutive heads.

8. Three unbiased coins are tossed once. Find the probability of getting atmost 2 tails or atleast 2 heads.

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9. From a well-shuffled pack of 52 cards, a card is drawn at random. Find the probability of it being either a red king or black queen.

10. If A, B, C are any three events such that probability of B is twice as that of probability of A, probability of C is thrice as that of probability of A and if $P(A\cap B) = 1/6$, $P(B\cap C) = 1/4$, $P(A\cap C) = 1/8$, $P(A\cup B\cup C) = \frac{9}{10}$, $P(A\cap B\cap C) = 1/15$ then find $P(A)$, $P(B)$ and $P(C)$?

11. Two dice are rolled once. Find the probability of getting an even number on the first die or a total of face sum 8.

12. In a class of 50 students, 28 opted for NCC, 30 opted for NSS and 18 opted both NCC & NSS. One of the students is selected at random. Find the probability that
(i) The student opted for NCC but not NSS.
(ii) The student opted for NSS but not NCC.
(iii) The student opted for exactly one of them.

13. A card is drawn from a pack of 52 cards. Find the probability of getting a king or a heart or a red card.

14. Two dice are rolled together. Find the probability of getting a doublet or sum of faces as 4.

15. Three fair coins are tossed together. Find the probability of getting
(i) all heads (ii) atleast one tail
(iii) atmost one head (iv) atmost two tails.

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