

1 SOME APPLICATIONS OF TRIGONOMETRY

1. A 1.6 m tall girl stands at a distance of 3.2m from a lamp post and casts a shadow of 4.8 m on the ground. Find the height of The lamp post (2.60m)
1. A man standing on the deck of a ship, which is 10 m above water level, observes the angle of elevation of the top of a hill is 60° and the angle of depression of the base of the hill is 30° . Calculate the distance of the hill from the ship and the height of the hill (10√3m, 40m)
2. The angle of elevation of a cloud from a point 60m above a lake is 30° and angle of depression of the reflection of Cloud in the Lake is 60° . Find the height of the cloud. (120 m)
4. The angle of elevation of a jet plane from a point A on the ground is 60° . After a flight of 15 sec the angle of elevation Changes to 30° . If the jet plane is flying at a constant height of 1500√3m, then find the speed of jet plane. (720 km /hr)
5. A vertical tower stands on a horizontal plane and is surmounted by a vertical flagstaff of height h. At a point on the Plane, the angles of elevation at the bottom and the top of the flagstaff are α and β respectively. Prove that the height of the tower is $h \tan \alpha / \tan \beta - \tan \alpha$
6. The angle of elevation of the top of a tower from two points at distances a and b metres from the base and in the same Straight line with it are complementary. Prove that height of the tower is \sqrt{ab} metres.
7. The angles of elevation of the top of a rock from the top and foot of a 100 m high tower are 30° and 45° respectively. Find the Height of the rock. (236.5 m)
8. The shadow of a tower standing on a level ground is found to be 40 m longer when the sun's altitude is 30° than when it is 60° . Find the height of the tower . (20√3m)
9. The angle of elevation θ of a vertical tower from a point on ground is such that its tangent is 5/12. On walking 192m Towards The tower in the same straight line, the tangent of the angle of elevation is found to be $\frac{3}{4}$. Find the height of the tower (180 m)
10. A bird is sitting on the top of a tree, which is 80m high. The angle of elevation of the bird, from a point on the ground is 45° . The bird flies away from the point of observation horizontally and remains at a Constant height. After 2 sec the angle of Elevation of the bird from the point of observation becomes 30° . Find the speed of flying of the bird (29.28m/sec)
11. An aero plane at an altitude of 200m observes the angles of depression of opposite points on the two banks of a river to be 45° and 60° . Find the width of the river (315.4m)
12. Two men on either side of a cliff, 60m high, observe the angles of elevation of the top of the cliff to be 45° and 60° respectively. Find the distance between two men (94.6m)
13. From the top of a tower the angle of depression of an object on the horizontal ground is found to be 60° . On descending 20m Vertically downwards from the top of the tower, the angle of depression of the object is found to be 30° . Find the height of the tower (30 m)
14. An observer, 1.7 m tall is $20\sqrt{3}$ m away from a tower. The angle of elevation from the eye of observer to the top of tower is 30° . Find the height of tower (21.7 m)
15. Two ships are approaching a light house from opposite directions. The angles of depression of the two ships from the top of the light house are 30° and 45° . If the distance between the two ships is 100m, find the height of the light house

2 ARITHMETIC PROGRESSIONS.

1. If p^{th} , q^{th} and r^{th} terms of an A.P are a , b , c respectively, then show that $a(q - r) + b(r - p) + c(p - q) = 0$
2. Find the sum of first n odd natural numbers ($S_n = n^2$)
3. Find the seventh term from the end of the A.P: 7, 10, 13,, 184 (166)
4. The 5th term of an A.P is 26 and 10th term is 51. Determine the 15th term of the A.P (76)
5. Write the next term of the A.P . $\sqrt{8}, \sqrt{18}, \sqrt{32}$ ($\sqrt{19}$)
6. How many numbers of two digit numbers are divisible by 7 (13)
7. The ratio of the sum of m and n terms of an A.P is $m^2 : n^2$. Show that ratio of the m^{th} and n^{th} terms is $(2m - 1) : (2n - 1)$
8. If the 10th term of an A.P is 52 and 17th term is 20 more than the 13th term, find the A.P (7, 12, 17, ...)
9. Which term of the A.P 5, 15, 25,..... will be 130 more than its 31st term ($n = 44$)
10. The sum of first 16 terms of an A.P is 112 and the sum of its next fourteen terms is 518. Find the A.P. (- 8, - 6, - 4,.....)
11. If 7 times the 7th term of an A.P is equal to the 11 times the 11th term, show that its 18th term is zero
12. Find the sum of all odd integers between 2 and 100 which are divisible by 3 (867)
13. Find the sum of first 15 terms of an A.P. whose n^{th} term is $3 - 2n$ (- 195)
14. If $2k + 1$, $3k + 3$ and $5k - 1$ be any three consecutive terms of an A.P, find the value of k ($k = 6$)
15. The sum of first, third and seventeenth term of an A.P is 216. Find the sum of the first 13 terms of the A.P (936)
16. The sum of 4th and 8th term of an A.P is 24 and the sum of the 6th and 10th term is 44. Find the A.P (-13, - 8, -3,,)
17. The sum of n , $2n$, $3n$ terms of an A.P are s_1, s_2, s_3 respectively. Prove that $s_3 = 3(s_2 - s_1)$
18. If p^{th} term of an A.P is q and q^{th} term is p . Prove that its n^{th} term is $(p + q - n)$
19. Which term of the A.P 20, $19 \frac{1}{4}$, $18 \frac{1}{2}$, is the first negative term (28)
20. The first term of an A.P is 5, the last term is 45 and the sum of all its terms is 400. Find the number of terms and the common difference of the A.P (16, 8/3)
21. The sum of first n terms of an A.P is $3n^2 - 4n$, then find its n^{th} term ($6n - 7$)
22. Find the sum of 3 digit numbers which are not divisible by 7 (424214)
23. Find the number of terms of the A.P, 63, 60, 57,, so that their sum is 693 ($n = 21, 22$)
24. In an A.P, If $s_5 + s_7 = 167$ and $s_{10} = 235$, find the first term ($a = 1$)
25. The sum of n terms of an A.P is $3n^2 + 5n$. Find its 16th term (98)
26. Find the middle term of the sequence formed by all numbers between 9 and 95, which leave a remainder 1 when divide by 3 (29)
27. If $1 + 6 + 11 + \dots + x = 148$, find the value of x (36)
28. The sum of first six terms of an A.P is 42. The ratio of its 10th term to its 30th is 1: 3. Find the first term of the A.P (2)
29. A manufacturer of TV sets produced 600 sets in the third year and 700 sets in the seventh year. Assuming that the production increases uniformly by a fixed number every year, find the total production in first 7 years ($s_7 = 4375$)

3 STATISTICS.

1. Find the mean, median and mode for the following data :

(26.4, 27.2, 28.8)

class	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	Total
Frequency	8	16	36	34	6	100

2. Write the relationship among mean median and mode. If the mean of the data is 27 and median is 33, then find the mode

(45)

3. Consider the frequency distribution of the heights of 60 students of a class.

Height (in cm)	No of students	Cumulative frequency
150 - 155	16	16
155 - 160	12	28
160 – 165	9	37
165 – 170	7	44
170 – 175	10	54
175 – 180	6	60

Find the sum of the lower limit of the modal class and upper limit of the median class

(315)

4. The following table gives the daily income of 50 workers. Draw both type of ogives and determine the median of the data

(median = 140)

Daily income (in Rs)	No of workers
100 – 120	12
120 – 140	14
140 – 160	8
160 – 180	6
180 – 200	8

5. Find p if the mean of the given data is 15. 45

(p = 10)

Class	0 – 6	6 – 12	12 – 18	18 – 24	24 – 30
Frequency	6	8	p	9	7

6. Find the value of x from the following data if mode is 65, where frequency 6, 8, x and 12 are in ascending order

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	100 – 120	Mode
Frequency	6	8	x	12	6	5	65

(x = 10)

7. The mean of the data is 50. Find the missing frequencies:

(x = 28, y = 24)

Class	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	Total
Frequency	17	x	32	y	19	120

8. Find the missing frequencies where $f_2 : f_3 = 4 : 3$ and mean = 50

(28, 32, 24)

Class interval	0 – 20	20 – 40	40 – 60	60 – 80	80 – 100	Total
Frequency	17	F_1	F_2	F_3	19	120

9. The median of the following data is 52.5. Find the values of x and y if the total frequency is 100

C.I	0 - 10	10 - 20	20 - 30	30 - 40	40 – 50	50 – 60	60- 70	70 – 80	80 – 90	90 - 100
Frequency	2	5	x	12	17	20	y	9	7	4

(x = 9, y = 15)

10. Find the missing values for a, b, c, d for the following data:

Class	0 – 8	8 – 16	16 - 24	24 - 32	32 – 40	40 - 48
Frequency	15	a	b	18	9	c
Cumulative frequency	15	28	43	61	d	80

11. Find the median wage of the workers from the following data:

(median = 115 .46)

Wages	More than 150	More than 140	More than 130	More than 120	More than 110	More than 100	More than 90	More than 80
No of workers	0	10	29	60	104	134	151	160

12. From a frequency distribution table from the following data find its mode

(mode = 55)

Marks (out of 90)	No of students
More than or equal to 80	4
More than or equal to 70	9
More than or equal to 60	15
More than or equal to 50	23
More than or equal to 40	29
More than or equal to 30	33
More than or equal to 20	36
More than or equal to 10	38
More than or equal to 0	40

4 coordinate geometry.

- Find the area of a rhombus if its vertices are A (3, 0), B (4, 5), C (- 1, 4) and D (- 2, - 1) (24 sq units)
- If the points A (a, 0), B (0, b) and C (1, 1) are collinear, prove that $\frac{1}{a} + \frac{1}{b} = 1$
- Find the relation between x and y such that the point (x, y) is equidistant from the point (3, 6) and (- 3, 4) (3x + y = 5)
- Prove that the points (a, b + c) , (b, c + a) and (c, a + b) are collinear
- The points A (2, 9) , B(a, 5) , C (5, 5) are the vertices of a right triangle ABC right angled at B. Find the value of a (2)
- Find the area of the triangle formed by joining the mid points of the sides of the triangle whose vertices are A (2, 1), B (4, 3) and C (2, 5) (1 sq unit)
- Show that four points (0, - 1), (6, 7), (- 2, 3) and (8, 3) are the vertices of a rectangle, also find its area (40)
- Three vertices of a parallelogram ABCD are A (3, - 4), B (- 1, - 3) and C (- 6, 2). Find the coordinates of vertex D and the area of parallelogram ABCD (15 sq units)
- Find the coordinates of the point on y axis which is nearest to the point (- 2, 5) (0, 5)
- If (1, p/3) is the midpoint of the line segment joining the points (2, 0) and (o, 2/9) then show that 5x + 3y + 2 = 0 passes through the point (- 1, 3p) (p = 1/3)
- In what ratio does the x – axis divide the line segment joining the points (- 4, - 6) and (- 1, 7). Find the coordinates of the point of division (ratio = 6 : 7), (- 34/ 13, 0)
- Show that ΔABC with vertices A (- 4, 0), B (0, 2) and C (2, 0) is similar to ΔDEF with vertices D (- 4, 0), F (4, 0) and E (0, 4)
- Find the coordinates of the points of trisection of the line segment joining the points (3, - 2) and (- 3, - 4)
- Prove that the points (2, - 2), (- 2, 1) and (5, 2) are the vertices of a right angled triangle. Also find the area of this triangle (12.5 sq units)
- Find the area of the quadrilateral ABCD, the coordinates of whose vertices are A (1, 2), B (6, 2), C (5, 3) and D (3, 4) (5.5 sq units)

16. Point A lies on the line segment PQ joining P (6, - 6) and Q (- 4, - 1) in such a way that $\frac{PA}{PQ} = \frac{2}{5}$. If point P also lies on the line $3x + k(y + 1) = 0$, find the value of k (K = 18/5)
17. If the area of the triangle formed by points A(x, y), B (1, 2) and C (2, 1) is 6 sq units, then show that $x + y = 15$
18. If A (- 2, - 1), B (a, 0) C (4, b) and D (1,2) are the vertices of a parallelogram, find the value of a and b (a = 1, b = 3)
19. Find the values of p for which the points (3p + 1, p), (p + 2, p - 5) and (p + 1, - p) are collinear (0, 3)
20. If p (9a - 2, - b) divides the line segment joining A (3a + 1, - 3) and B (8a, 5) in the ratio 3: 1. Find the values of a and b (a = 1, b = - 3)
21. The vertices of a Δ are A (- 1, 3), B (1, - 1) & C (5, 1). Find the length of the median through the vertex C (5 units)

5 AREAS RELATED TO CIRCLES.

1. If the circumference of a circle is equal to the perimeter of a square, then find the ratio of their areas (14: 11)
2. Area of a sector of a circle of radius 14 cm is 154 cm^2 . Find the length of the corresponding arc of the sector (22 cm)
3. A chord of a circle of radius 14 cm subtends an angle of 120° at the Centre. Find the area of the corresponding minor segment of the circle ($\pi = 22/7, \sqrt{3} = 1.73$) (120. 56 sqcm)
4. The minute hand of a clock is 12 cm long. Find the area face of the clock described by minute hand between 9 a.m. and 9.35 am (264 sq cm)
5. A chord of a circle of radius 14cm subtends an angle of 120° at the centre. Find the area of the corresponding minor segment of the circle (use $\sqrt{3} = 1.73$) (120. 56 cm^2)
6. The cost of fencing a circular field at the rate of Rs 24 per meter is Rs 5280. The field is to be ploughed at the rate of Rs 0.50 per m^2 . Find the cost of ploughing the field ($\pi = 22/7$) (Rs1925)
7. The area enclosed between the concentric circles is 770 cm^2 . If the radius of the outer circle is 21 cm, find the radius of the inner circle (r = 14 cm)
8. A wheel has diameter 84 cm. Find how many complete revolutions must it take to cover 792 meters (300)
9. The long and short hands of a clock are 6 cm and 4 cm long respectively. Find the sum of the distances travelled by their tips in 24 hrs (use $\pi = 3.14$) [$2(2\pi r) + 24(2\pi R) = 955. 43 \text{ cm}$]
10. Two circles touch internally. The sum of their areas is $116 \pi \text{ cm}^2$ and the distance between their centres is 6 cm. Find the radii of the circles
11. A park is of the shape of a circle of diameter 7m. It is surrounded by a path of width of 0.7m. Find the expenditure of cementing the path, if its cost is Rs110 per sqm
12. Find the perimeter of a sector of angle 45° of a circle of radius 14 cm (39 cm)

6 SURFACE AREAS AND VOLUMES.

1. The height of a cone is 30 cm. A small cone is cut off at the top by a plane parallel to the base. If its volume be $1/27$ of the volume of the given cone, at what height above the base is the section made (h = 20 cm)
2. Water flowing at the rate of 15km/hr through a pipe of diameter 14 cm into a cuboidal pond which is 50 m long and 44 m wide. In which time will the level of water in the pond rise by 21 cm (2 hrs)
3. A hemispherical depression is cut out from one face of a cubical wooden block of edge 21 cm, such that the diameter of the hemisphere is equal to the edge of the cube. Determine the total surface area of the remaining block (2992.5 cm^2)
4. The slant height of the frustum of a cone is 5 cm. If the difference between the radii of its two circular ends is 4 cm. Find the height of the frustum. (h = 3 cm)
5. A solid metallic cuboid of dimensions 9m X 8m X 2m is melted and recast into solid cubes of edge 2m. Find the number of cubes so formed
6. A well of diameter 3m is dug 14 m deep. The soil taken out of it is spread evenly all around it to a width of 5m to form

an embankment. Find the height of the embankment

7. A solid right circular cone of height 60 cm and radius 30 cm is dropped in a right circular cylinder full of water of height 180 cm and radius 60 cm. Find the volume of water left in the cylinder in cubic meters (1.98 m³)
8. A metallic cylinder has radius 3 cm and height 5 cm. To reduce its weight, a conical hole is drilled in the cylinder. The conical hole has a radius of $\frac{3}{2}$ cm and its depth is $\frac{8}{9}$ cm. Calculate the ratio of the volume of metal left in the cylinder to the volume of metal taken out in conical shape
9. The rain water from a 22m X 20m roof drains into a cylindrical vessel of diameter 2m and height 3.5m. If the rain water collected from the roof fills $\frac{4}{5}$ th of the cylindrical vessel, then find the rainfall in cm (h = 2cm)
10. A metal container, open from the top, is in the shape of a frustum of a cone of height 21cm with radii of its lower and upper circular ends as 8 cm and 20 cm respectively. Find the cost of milk which can completely fill the container at the rate of Rs 35/litre (Rs 480. 50)
11. A cylindrical tub, whose diameter is 12 cm and height 15cm is full of ice cream. The whole ice cream is to be divided into 10 children in equal ice cream cones, with conical base surmounted by a hemispherical top. If the height of conical portion is twice the diameter of base, find the diameter of conical part of ice cream cone (6 cm)
12. A bucket open at the top is of the form of a frustum of a cone. The diameters of its upper and lower circular ends are 40 cm and 20 cm respectively. If a total of 17600cm³ of water can be filled in the bucket, find its total surface area (h = 24cm, l = 26cm, T.S.A = 2765.71 cm²)
13. A hollow sphere of internal and external diameters 4 cm and 8 cm is melted to form a cone of base diameter 8 cm. Find the height and the slant height of the cone (h = 14 cm, l = 2√53cm)
14. A solid is in the shape of a cone mounted on a hemisphere of same base radius. If the curved surface areas of the hemispherical part and the conical part are equal, then find the ratio of the radius and the height of the conical part (1 : √3)
15. A toy is in the shape of a cone mounted on a hemisphere of same base radius. If the volume of the toy is 231 cm³ and its diameter is 7 cm, then find the height of the toy (11cm)
16. A farmer connects a pipe of internal diameter 25cm from a canal into a cylindrical tank in his field, which is 12m in diameter and 2.5m deep. If water flows through the pipe at the rate of 3.6 km/hr, in how much time will the tank be filled (96 min)
17. The total surface area of a solid cylinder is 231 cm². If the curved surface area of this solid cylinder is two – third of its total surface area, find its radius and height (r = 3.5 cm, h = 7 cm)
18. The radii of the circular ends of a bucket in the form of a frustum of a cone of height 15 cm are 14 cm and r cm (r < 14). If the capacity of the bucket is 5390 cm³. Find r (r = 7 cm)
19. A metallic right circular cone 20 cm high and whose vertical angle 60° is cut into two parts at the middle of its height by a plane parallel to its base. If the frustum so obtained is drawn into a wire of diameter 2.5 cm, find the length of the wire (4.98 m)
20. A conical vessel with base radius 5 cm height 24 cm, is full of water. This water is emptied into a cylindrical vessel of base radius 10 cm. Find the height to which the water will rise in the cylindrical vessel (h = 2 cm)