I. Vectors

1) The distance of the point $(-3, 4)$ from the $x-axis$ is
   a) 3
   b) -3
   c) 4
   d) 5

2) In Figure 1, $P(5, -3)$ and $Q(3, y)$ are the points of trisection of the line segment joining $A(7, -2)$ and $B(1, -5)$.Then y is equals

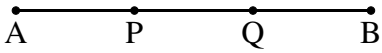

Figure 1

   a) 2
   b) 4
   c) -4
   d) $\frac{-5}{2}$

3) The coordinates of the point P dividing the line segment joining the points $A(1, 3)$ and $B(4, 6)$, in the ratio $2 : 1$ are:
   a) $(2, 4)$
   b) $(3, 5)$
   c) $(4, 2)$
   d) $(5, 3)$

4) If the coordinates of one end of a diameter of a circle are $(2, 3)$ and the coordinates of its centre are $(-2, 5)$, then the coordinates of the other end of the diameter are:
   a) $(-6, 7)$
   b) $(6, -7)$
   c) $(6, 7)$
   d) $(-6, -7)$

5) The area of a triangle whose vertices are $(5, 0)$, $(8, 0)$ and $(8, 4)$ (in sq. units) is
   a) 20

b) 12

c) 6

d) 16

6) If $A(1,3)$, $B(-1,2)$, $C(2,5)$ and $D(x,4)$ are the vertices of a parallelogram $ABCD$, then the value of x is

a) 3

b) 4

c) 0

d) $\frac{3}{2}$

7) Find the value of k, if the point $P(2,4)$ is equidistant from the points $A(5,k)$ and $B(k,7)$.

8) Find the coordinates of a point P, which lies on the line segment joining the points $A(-2,2)$ and $B(2,-4)$ such that $AP = \frac{3}{7}AB$.

9) If a point $A(0,2)$ is equidistant from the points $B(3,p)$ and $C(p,5)$, then find the value of p.

10) A point P divides the line segment joining the points $A(3,-5)$ and $B(-4,8)$ such that $\frac{AP}{PB} = \frac{K}{1}$. If P lies on the line $x + y = 0$, then find the value of K.

11) Find the ratio in which the line segment joining the points $(1,-3)$ and $(4,5)$ is divided by x-axis.

12) Find the ratio in which the y-axis divides the line segment joining the points $(5,-6)$*and* $(-1,-4)$. Also find the coordinates of the point of intersection.

13) For what value of k, $(k > 0)$, s the area of the triangle with vertices $(-2,5)$, $(k,-4)$, *and* $(2k+1,10)$ equal to 52 sq. units?

14) If the vertices of a triangle are $(1,-3)$, $(4,p)$ and $(-9,7)$ and its area is 15 sq. units, find the value(s) of p.

15) Find the area of quadrilateral $ABCD$ whose vertices are $A(-3,-1)$, $B(-2,-4)$, $C(4,-1)$ and $D(3,4)$.

16) If the point $A(x,y)$, $B(3,6)$ and $C(-3,4)$ are collinear, show that $x - 3y + 15 = 0$.

II. Circles

1) From a point Q, 13 cm away from the centre of a circle, the length of tangent PQ to the circle is 12 cm. The radius of circle (in *cm*)

a) 25

b) $\sqrt{313}$

c) 5

d) 1

2) In Figure 1, AP, AQ and BC are tangents to the circle. If AB = 5cm, AC = 6 cm and BC = 4 cm, then the length of AP (in cm) is

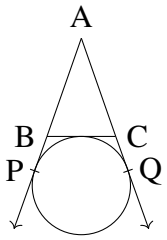

Figure 1

a) 7.5

b) 15

c) 10

d) 9

3) The circumference of a circle is 22 cm. The area of its quadrant $\left(\text{in } cm^2\right)$

a) $\frac{77}{2}$

b) $\frac{77}{4}$

c) $\frac{77}{8}$

d) $\frac{77}{16}$

4) In Figure 2, a right triangle ABC, circumscribe a circle of radius r. If AB and BC are of lengths 8 cm and 6 cm respectively, find the value of r.

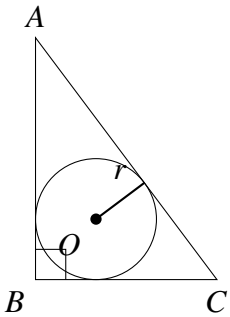

Figure 2

5) In Figure 3, PQ and PR are tangents to a circle with centre A. If $\angle QPA = 27°$, then $\angle QAR$ equals

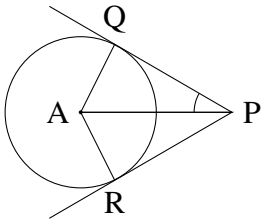

Figure 3

a) 63°

b) 153°

c) 126°

d) 117°

6) In Figure 4, AB and AC are tangents to a circle with centre O and radius 8 cm. If OA = 17 cm, then the length of AC (in cm) is

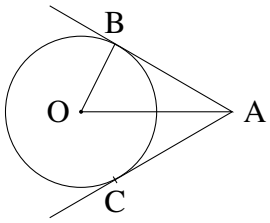

Figure 4

a) $\sqrt{353}$

b) 15

c) 9

d) 25

7) In Figure 5, three sectors of a circle of radius 7 cm, making angles of 60°, 80°, 40° at the centre are shaded. The area of the shaded region $\left(in\ \text{cm}^2\right)$ is $\left(\text{Using } \pi = \frac{22}{7}\right)$

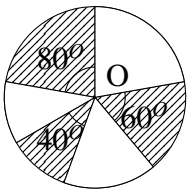

Figure 5

a) 77

b) 154

c) 44

d) 22

8) In Figure 6, the sides AB, BC and CA of a triangle ABC, touch a circle at P, Q and R respectively. If $PA = 4$ cm, $BP = 3$ cm and $AC = 11$ cm, then the length of BC (in cm) is

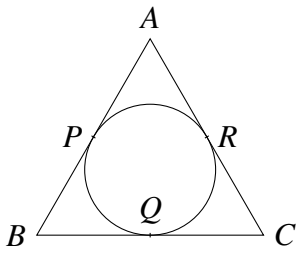

Figure 6

a) 11

b) 10

c) 14

d) 15

9) In Figure 7, a circle touches the side DF of $\triangle EDF$ at H and touches ED and EF produced at K and M respectively. If $EK = 9$ cm, then the perimeter of $\triangle EDF$ (in cm) is

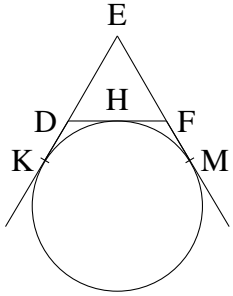

Figure 7

a) 18

b) 13.5

c) 12

d) 9

10) If the area of a circle is equal to sum of the areas of two circles of diameters 10 cm and 24 cm, then the diameter of the larger circle (in cm) is

a) 34

b) 26

c) 17

d) 14

11) Prove that the tangents drawn at the ends of a diameter of a circle are parallel.

12) In Figure 8, *ABCD* is a square of side 4 cm. A quadrant of a circle of radius 1 cm is drawn at each vertex of the square and a circle of diameter 2 cm is also drawn. Find the area of the shaded region. (Use $\pi = 3.14$)

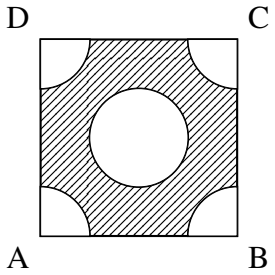

Figure 8

13) From a rectangular sheet of paper *ABCD* with $AB = 40$ cm and $AD = 28$ cm, a semi-circular portion with *BC* as diameter is cut off. Find the area of the remaining paper. $\left(\text{Use } \pi = \frac{22}{7}\right)$

14) In Figure 9, a circle is inscribed in a triangle *PQR* with $PQ = 10$ cm, $QR = 8$ cm and $PR = 12$ cm. Find the lengths of *QM*, *RN* and *PL*.

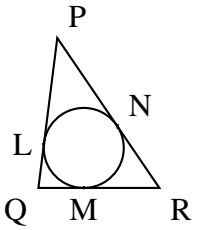

Figure 9

15) In Figure 10, *O* is the centre of the circle with $AC = 24$ cm, $AB = 7$ cm and $\angle BOD = 90°$. Find the area of shaded region.(Use $\pi = 3.14$)

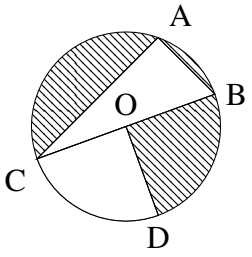

Figure 10

16) In Figure 11, find the area of shaded region, if $ABCD$ is a square of side 14 cm and APD and BPC are semicircles.

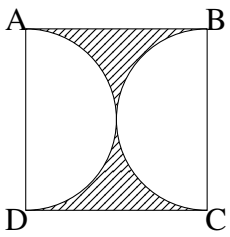

Figure 11

17) Prove that the length of tangents drawn from an external point to a circle are equal.

18) Tangents PA and PB are drawn from an external point P to two concentric circles with centre O and radii 8 cm and 5 cm respectively, as shown in Figure 12. If AP = 15 cm, then find the length of BP.

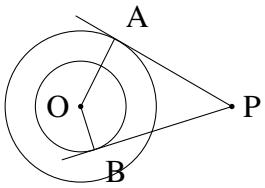

Figure 12

19) In Figure 13, an isosceles triangle ABC, with $AB = AC$, circumscribe a circle. Prove that the point of contact P bisects the base BC.

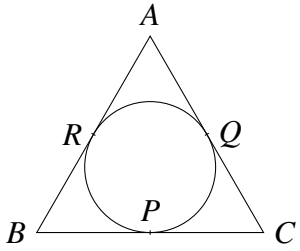

Figure 13

20) In Figure 14, the chord AB of the larger of the two concentric circles, with centre O, touches the smaller circle at C. Prove that $AC = CB$.

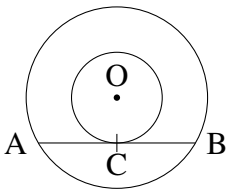

Figure 14

21) In Figure 15, $OABC$ is a square of side 7 cm. If $OAPC$ is a quadrant of a circle with centre O, then find the area of the shaded region. (Use $\pi = 3.14$)

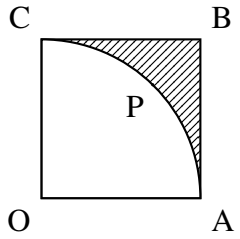

Figure 15

22) Prove that the parallelogram circumscribing a circle is rhombus.

23) Prove that opposite sides of a quadrilateral circumscribing a circle subtend supplementary angles at the centre of the circle.

24) In Figure 16, PQ and AB are respectively the arcs of two concentric circles of radii 7 cm and 3.5 cm and centre O. If $\angle POQ = 30°$, then find the area of the shaded region. $\left(\text{Use } \pi = \frac{22}{7}\right)$

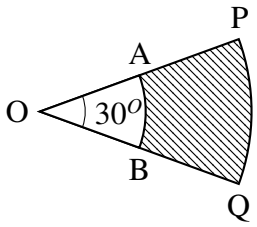

Figure 16

25) Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

26) A quadrilateral $ABCD$ is drawn to circumscribe a circle. Prove that $AB + CD = AD + BC$.

27) The incircle of an isosceles triangle ABC, with $AB = AC$, touches the sides AB, BC and CA at D, E and F respectively. Prove that E bisects BC.

28) Prove that in two concentric circles. the chord of the larger circle, which touches the smaller circle, is bisected at the point of contact.

29) In Figure 17, the shape of the top of the table is that of a sector of a circle with centre O and $\angle OAB = 90°$. If $AO = OB = 42$ cm, then find the perimeter of the top of the table.

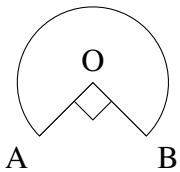

Figure 17

30) Find the area of the shaded region in Figure 18, if $ABCD$ is a square of side 28 cm and APD and BPC are semicircles.

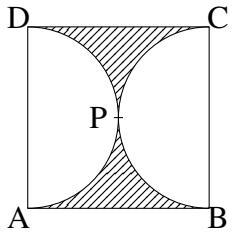

Figure 18

31) Two tangents TP and TQ are drawn to a circle with centre O from an external point T. Prove that $\angle TPQ = 2\angle OPQ$.

32) In Figure 19, XY and $X'Y'$ are two parallel tangents to a circle with centre O and another tangent AB with point of contact C intersects XY at A and $X'Y'$ at B. Prove that $\angle AOB = 90°$

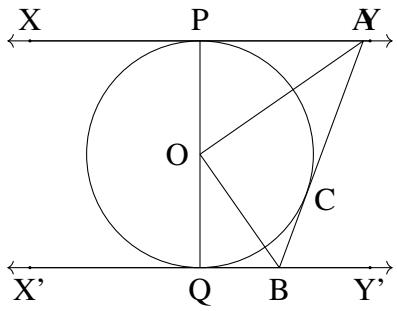

Figure 19

33) In Figure 20, $ABCD$ is a square of side 7 cm. $DBPA$ and $DQBC$ are quadrants of circles, each of radius 7 cm. Find the area of the shaded region.$\left(\text{Use } \pi = \frac{22}{7}\right)$

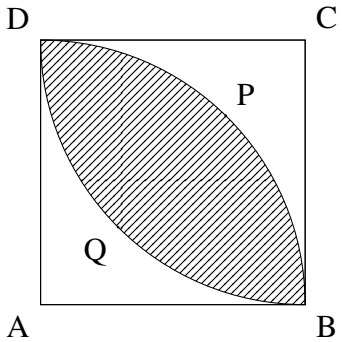

Figure 20

34) The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 10 minutes. $\left(\text{Use } \pi = \frac{22}{7}\right)$

35) Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.

III. Probability

1) Cards bearing numbers $2, 3, 4, \ldots, 11$ are kept in a bag. A card is drawn at random from the bag. The probability of getting a card with a prime number is

   a) $\frac{1}{2}$

   b) $\frac{2}{5}$

   c) $\frac{3}{10}$

   d) $\frac{5}{9}$

2) Two dices are thrown together. The probability of getting the same number on both dices is :

   a) $\frac{1}{2}$

   b) $\frac{1}{3}$

   c) $\frac{1}{6}$

   d) $\frac{1}{12}$

3) The probability of a non-leap year having 53 Mondays is

   a) $\frac{2}{7}$

   b) $\frac{1}{7}$

   c) $\frac{5}{7}$

   d) $\frac{6}{7}$

4) A card is drawn at random from a well shuffled pack of 52 cards. Find the probability of getting

   I. a red king.

   II. a queen or a jack.

5) All kings, queens and aces are removed from a pack of 52 cards. The remaining cards are well shuffled and then a card is drawn from it. Find the probability that the drawn card is

   I. a black face card.

   II. a red card.

6) A number is selected at random from first 50 natural numbers. Find the probability that it is a multiple of 3 and 4.

7) A box contains 100 red cards, 200 yellow cards and 50 blue cards. If a card is drawn at random from the box, then find the probability that it will be

I. a blue card
II. not a yellow card
III. neither a yellow nor a blue card.

8) A child has a die whose six faces show the letters as given below.The die is thrown once. Find the probability of getting

A	B	C	A	D	A

I. A

II. D

9) Cards marked with numbers $1, 3, 5, \ldots, 101$ are placed in a bag and mixed thoroughly. A card is then drawn at random from the bag. Find the probability that the number on the drawn card is

I. less than 19.
II. a prime number less than 20.

IV. Construction

1) Draw a triangle ABC with $BC = 7$ cm, $\angle B = 45°$ and $\angle C = 60°$. Then construct another triangle, whose sides are $\frac{3}{5}$ times the corresponding sides of $\triangle ABC$.

2) Construct a right triangle in which the sides , (other than the hypotenuse) are of length 6 cm and 8 cm. Then construct another triangle, whose sides are $\frac{3}{5}$ times the corresponding sides of the given triangle.

3) Draw a right triangle in which the sides (other than the hypotenuse) are of lengths 6 cm and 8 cm. then construct another triangle whose sides are $\frac{3}{5}$ times the corresponding sides of the given triangle.

V. Algebra

1) The roots of the quadratic equation $2x^2 - x - 6 = 0$ are

a) $-2, \frac{3}{2}$
b) $2, -\frac{3}{2}$
c) $-2, -\frac{3}{2}$
d) $2, \frac{3}{2}$

2) If 1 is a root of the equations $ay^2 + ay + 3 = 0$ and $y^2 + y + b = 0$, then ab equals :

a) 3

b) $-\frac{7}{2}$

c) 6

d) -3

3) If the quadratic equation $mx^2 + 2x + m = 0$ has two equal roots, then the values of m are :

a) ± 1

b) $0, 2$

c) $0, 1$

d) $-1, 0$

4) Find the value of p for which the roots of the equation $px(x-2) + 6 = 0$, are equal.

5) Solve the following quadratic equation for x :

$$x^2 - 4ax - b^2 + 4a^2 = 0 \tag{1}$$

(2)

6) Find the value(s) of k so that the quadratic equation $x^2 - 4kx + k = 0$ has equal roots.

7) Solve for x: $4x^2 - 4ax + \left(a^2 - b^2\right) = 0$

8) Solve for x: $3x^2 - 2\sqrt{6}x + 2 = 0$

9) Find the value of k for which the roots of the quadratic equation $(k-4)\,x^2 + 2\,(k-4)\,x + 2 = 0$ are equal.

10) Solve for x:
$4\sqrt{3}x^2 + 5x - 2\sqrt{3} = 0$

VI. Geometry

1) A solid right circular cone is cut into two parts at the middle of its height by a plane parallel to its base. The ratio of the volume of the smaller cone to the whole cone is

a) 1 : 2

b) 1 : 4

c) 1 : 6

d) 1 : 8

2) If the radius of the base of a right circular cylinder is halved, keeping the height the same, then the ratio of the volume of the cylinder thus obtained to the volume of original cylinder is :

   a) 1 : 2

   b) 1 : 4

   c) 2 : 1

   d) 4 : 1

3) The radii of a circular ends of a bucket of height 40 cm are 24 cm and 15 cm. The slant height (in cm) of the bucket is

   a) 51

   b) 49

   c) 43

   d) 41

4) A solid sphere of radius 10.5 cm is melted and recast into smaller solid cones, each of radius 3.5 cm and height 3 cm. Find the number of cones so formed. $\left(\text{Use } \pi = \frac{22}{7}\right)$

5) A hemispherical bowl of internal radius 9 cm is full of water. Its contents are emptied in a cylindrical vessel of internal radius 6 cm. Find the height of water in the cylindrical vessel.

6) A hemispherical tank, full of water, is emptied by a pipe at the rate of $\frac{22}{7}$ litres per sec. How much time will it take to empty half the tank if the diameter of the base of the tank is 3 m?

7) A drinking glass in the shape of the frustum of a cone of height 14 cm. The diameters of the two circular ends are 4 cm and 2 cm. Find the capacity of the glass. (Use $\pi = 3.14$)

8) A military tent of height 8.25 m is in the form of a right circular cylinder of base diameter 30 m and height 5.5 m surmounted by a right circular cone of same base radius. Find the length of the canvas use in making tent, if the breadth of the canvas is 1.5 m.

9) The volume of a hemisphere is $2425\frac{1}{2}$ cm^3. Find the curved surface area. (Use $\pi = 3.14$)

10) From a solid cylinder of height 7 cm and base diameter 12 cm, a conical cavity of same height and same base diameter is hollowed out. Find the total surface area of the remaining solid. $\left(\text{Use } \pi = \frac{22}{7}\right)$

11) A cylindrical bucket, 32 cm high and with radius of base is 18 cm, is filled with sand. This bucket is emptied on the ground and a conical heap of sand is formed. If the height of the conical heap is 24 cm, then find the radius sand slant height of the heap.

12) A solid is in the shape of a cone surmounted on a hemisphere, the radius of each of them being 3.5 cm and the total height of solid is 9.5 cm. Find the volume of the solid. $\left(\text{Use } \pi = \frac{22}{7}\right)$

13) A bucket is in the form of a frustum of a cone and it can hold 28.499 litres of water. If the radii of its circular ends are 28 cm and 21 cm, find the height of the bucket. $\left(\text{Use } \pi = \frac{22}{7}\right)$

14) A solid is in the shape of a cone mounted on a hemisphere of same base radius. If the curved surface area of the hemispherical part and the conical part are equal, then find the ratio of the radius and the height of the conical part.

15) A sphere of diameter 6 cm is dropped into a cylindrical vessel, partly filled with water, whose diameter is 12 cm. If the sphere is completely submerged in water, by how much will the surface of water be raised in cylindrical vessel ?

16) 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 cm^3 and its diameter is 7 cm, then find the height of the toy. $\left(\text{Use } \pi = \frac{22}{7}\right)$

17) The radii of internal and external surfaces of a hollow spherical shell are 3 cm and 5 cm respectively. It is melted and recast into a solid cylinder of diameter 14 cm. Find the height of the cylinder.

18) A drinking glass is in the shape of a frustum of a cone of height 14 cm. The diameters of its two circular ends are 16 cm and 12 cm. Find the capacity of the glass. $\left(\text{Use } \pi = \frac{22}{7}\right)$

VII. Discrete

1) If the n^{th} term of an $A.P$ is $(2n + 1)$, then sum of its first three terms is

   a) $6n + 3$

   b) 15

   c) 12

   d) 21

2) The next terms of $A.P.$ $\sqrt{18}, \sqrt{50}, \sqrt{98}, \ldots$ is

   a) $\sqrt{146}$

   b) $\sqrt{128}$

   c) $\sqrt{162}$

   d) $\sqrt{200}$

3) Find the common difference of an $A.P$ whose first term is 5 and the sum of its first four terms is half the sum of the next four terms.

4) The $17th$ term of an AP is 5 more than twice its $8th$ term. If the $11th$ term of the AP is 43, then find the nth term.

5) Sum of the first 14 terms of an AP is 1505 and its first term is 10. find its $25th$ term.

6) In an $A.P.$, the first term is 12 and the common difference is 6. If the last term of the $A.P.$ is 252, find its middle term.

7) If 4 times the fourth term of an $A.P.$ is equal to 18 times its 18^{th} term, then find its 22^{th} term.

8) The sum of 4^{th} and 8^{th} term terms of an $A.P.$ is 24 and the sum of its 6^{th} and 10^{th} terms is 44. Find the sum of first ten terms of the $A.P.$

VIII. Number Systems

1) The sum of first 20 odd natural numbers is :

   a) 100

   b) 210

   c) 400

   d) 420

2) How many two-digit numbers are divisible by 3?

3) If the sum of two natural numbers is 8 and their product is 15, find the numbers.

4) Find the sum of all multiples of 7 lying between 500 and 900.

5) The number of a fraction is 3 less than its denominator. If 1 is added to the denominator, the fraction is decreased by $\frac{1}{15}$. Find the fraction.

6) Find the sum of all three digit natural numbers, which are multiples of 11.

7) A shopkeeper buys some books for 80. If he had bought 4 more books for the same amount, each book would have to cost 1 less. Find the number of books he bought.

8) The sum of two numbers is 9 and the sum of their reciprocals is $\frac{1}{2}$. Find the numbers.

9) Find the sum of first 40 positive integers divisible by 6.

10) A two-digit number is such that the product of its digits is 14. When 45 is added to the number, the digits interchange their places. Find the number.

11) Find two consecutive natural numbers, the sum of whose squares is 145.

IX. Trigonometry

1) A kite is flying at a height of 30 m from the ground. The length of string from the kite to the ground is 60 m. Assuming that there is no slack in the string, the angle of elevation of the kite at the ground is

a) 45°

b) 30°

c) 60°

d) 90°

2) From a point on the ground, which is 15 m away from the foot of a vertical tower, the angle of elevation of the top of the tower, is found to be 60°. The height of the tower in (in metres) is

a) $5\sqrt{3}$

b) $15\sqrt{3}$

c) 15

d) 7.5

3) The length of shadow of a tower on the plane ground is $\sqrt{3}$ m times the height of the tower. The angle of elevation of sun is :

a) 45°

b) 30°

c) 60°

d) 90°

4) The angles of depression of the top and bottom of a tower as seen from the top of a $60\sqrt{3}$ m high cliff are 45° and 60° respectively. Find the height of the tower.

5) In a flight of 2800 km, an aircraft was slowed down due to bad weather. Its average speed is reduced by 100 km/h and time is increased by 30 minutes. Find the original duration of flight.

6) The angles of elevation and depression of the top and bottom of a light-house from the top of a 60 m high building are 30° and 60° respectively. Find

I. the difference between the heights of the light-house and the building.

II. the distance between light-house and building.

7) The angles of depression of two ships from the top of a light house and on the same side of it are found to be 45° and 30°. if the ships are 200 km apart, find the height of the light house.

8) The angle of elevation of the top of a hill at the foot of a tower is 60° and the angle of depression from

the top of the tower of the foot of the hill is 30°. If the tower is 50 m high, find the height of the hill.

9) From the top of a tower 50 m high, the angle of depression of the top of a pole is 45° and from the foot of the pole, the angle of elevation of the top of the tower is 60°. find the height of the pole if the pole and tower stand on the same plane.

10) The angle of depression from the top of a tower of a point A on the ground is 30°. On moving a distance of 20 m from the point A towards the foot of the tower to a point B the angle of elevation of the top of the tower from point B is 60°. Find the height of the tower and its distance from point A.