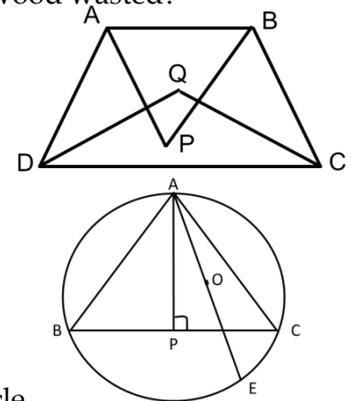


**TALENT DEVELOPMENT CENTRE**  
**INDIAN INSTITUTE OF SCIENCE, KUDAPURA**  
**Challakere, Chitradurga District, Karnataka-577536**  
**MATHS ASSIGNMENT: 04**

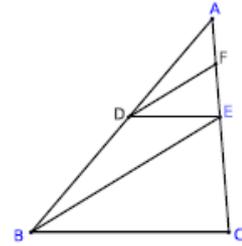
- If the volume and the surface area of a sphere are numerically equal, find its radius.
- A cylinder and a cone have equal radii of their bases and equal heights. Suppose their curved surface areas are in the ratio 8 : 5. Find the ratio of the radius and height of the cylinder.
- A solid metallic cylinder of base radius 3 cm and height 5 cm is melted to make  $n$  solid cones of  
radius 1 cm and height 1 cm. Find the value of  $n$ .
- A right-circular cone, a hemi-sphere and a cylinder stand on same bases and have equal height. Find the ratio of their whole surface areas.
- Suppose the areas of three adjacent surfaces of a cuboid is  $x, y, z$ . Find the sides of the cuboid.
- A cone of height 7 cm and base radius 3 cm is carved from a rectangular wooden block of dimension 10 cm  $\times$  5 cm  $\times$  2 cm. What is the approximate percentage of wood wasted?
- The angles bisects of  $\angle A$  and  $\angle B$  of an isosceles trapezium ABCD meet at P and that of  $\angle C$  and  $\angle D$  meet at Q.  
Prove that  $\angle P + \angle Q = 180^\circ$ . What if trapezium ABCD is not isosceles?
- In  $\triangle ABC$ , AD is a median. Prove that  $AB + AC > 2AD$
- In the fig, AE is diameter and  $AP \perp BC$ , prove that  $AB \cdot AC = AP \cdot AE$
- Prove that a line drawn parallel to the parallel sides of a trapezium divides the nonparallel sides proportionally.
- If AB and CD, AD and BC are parallel tangents drawn to the same circle, prove that ABCD is a rhombus.
- If AP and BP are tangents drawn from a point P to a circle with centre O and  $\angle AOB = 100^\circ$ , find  $\angle APO$ .
- A right-angled triangle of sides 35, 84, 91 is revolved on the side 35 cm. What is the solid generated? Find its volume and curved surface area.
- A cylindrical vessel closed at both the ends has diameter 28 cm and height 30 cm. and its inner and outer surfaces have to be painted. If the rate of painting is 25 per  $\text{cm}^2$ , find the cost of painting.
- We know that equiangular triangles are similar. Is there some such simple property which makes two triangles similar? (Think of a property similar to SAS.)
- Can two similar but unequal (non-congruent) triangles have (a) one vertex common? (b) Two vertices (i.e., one side) common? (c) Exactly two side lengths common?
- Suppose two chords of a circle are unequal in length. Prove that the chord of larger length is nearer to the centre than the chord of smaller length.
- Suppose A and B are two villages on the same side of a road. Where should a bus shelter P be located on the road so that the cost of laying roads AP and BP is minimum



19. Give a proof of Heron's formula

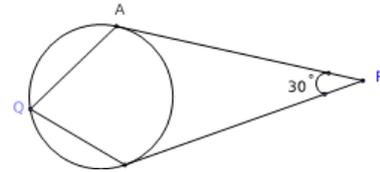
$$[ABC] = \sqrt{s(s-a)(s-b)(s-c)} \text{ using Pythagoras theorem}$$

20. In triangle ABC, DF  $\parallel$  BE and DE  $\parallel$  BC. If AF = 2 cm, FE = 3 cm and AD = 4 cm, find the length of AC.



21. In the figure, PA and PB are tangent to the circle, and  $\angle APB = 30^\circ$ . Find

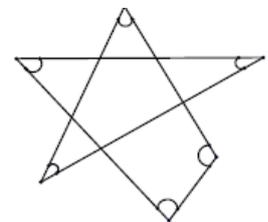
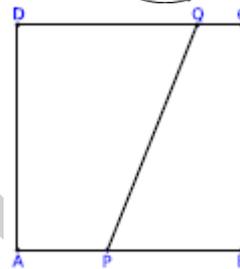
- $\angle AQB$
- $\frac{\text{length of the minor arc AB}}{\text{length of the major arc AB}}$



22. Suppose ABCD is a square of side length 5;

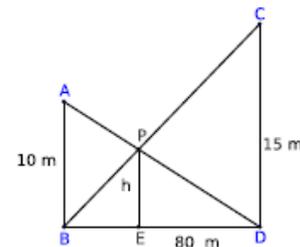
P is a point on AB such that AP = 2; and Q is a point on CD such that CQ = 1.

Determine  $\frac{\text{area}(APQD)}{\text{area}(BCQP)}$ .



23. Prove that the sum of all six corner angles in the adjacent figure is  $360^\circ$ .

24. In the figure, AB and CD are two poles 10 m, 15 m high are 80 m distant apart. Ropes AD, BC intersect at P. Find the height h of P above the ground. If the distance between AB and CD is 50 cm or 100 cm, what is the value of h. What is your observation?



25. In a triangle ABC, it is given that AB = 7. Suppose D is a point on BC such that BD = 5 and DC = 6. If AD = 5, find AC.

26. Suppose an isosceles trapezium has an incircle. Prove that its height is the geometric mean of its two parallel sides.

27. Prove that the area of an equilateral triangle described on one side of a square is half the area of an equilateral triangle described on one of its diagonals.

28. Find the perimeter of an isosceles triangle with base 6 cm and in radius 1.5 cm.

29. In a quadrilateral ABCD, AB = 5, BC = 17, CD = 5 and DA = 9. It is also known that BD is an integer. Find BD.

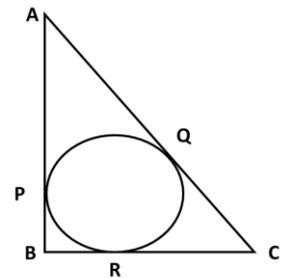
30. A square and an equilateral triangle have the same perimeter. The diagonal of the square is  $12\sqrt{2}$  cm. What is the circumradius of the triangle?

31. If we increase a pair of parallel sides of a parallelogram by 20% and decrease the other pair of parallel sides by 20%, what is the change in the area of the parallelogram?

32. Suppose when one of the legs of a right-angled triangle is increased by 5 and the other is

decreased by 5, the area of the triangle increases by 5. Determine whether the area of the square on the hypotenuse increases or decreases.

33. PA and PB are tangents drawn from an external point P to a circle with centre O in which OP is equal to the diameter of the circle. Prove that APB is an equilateral triangle
34. Let ABC be an equilateral triangle. Let X; Y;Z be points on BC;CA;AB respectively such that XYZ is also equilateral. Prove that  $AY + AZ = BC$ .
35. Let AB be a line segment and let X be a point on AB such that  $AX^2 = AB \cdot BX$ . Find the ratio  $\frac{AX}{XB}$ .
36. You are given a triangular sheet of paper. By folding it suitably, locate its circumcentre, incentre, orthocentre and centroid.
37. (i) Given line segments of lengths  $a$  and  $b$ , and a line segment of unit length, construct line segments of lengths  $(a + b)$ ,  $(a - b)$ ,  $ab$  &  $a : b$  (Assume  $a > b$ .)  
(ii) Given an arc of a circle, how do you locate the centre of corresponding circle?
38. Derive the an expression to find the CSA and TSA of a frustum of a cone.
39. In the figure, ABC is a right triangle with  $\angle B = 90^\circ$ . If  $BC = 7\text{cm}$  and  $AB = 24\text{ cm}$ , find the radius of the incircle.
40. Suppose ABC is an equilateral triangle and D is a point on BC such that  $BD = \frac{1}{3}BC$ . Prove that  $7AB^2 = 9AD^2$ .
- (b). In a kite ABCD, it is known that  $AB = AD = 25$ ,  $CB = CD = 52$  and  $BD = 40$ . Find AC.



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