Geometry through Practice

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Abstract—This manual provides a unified approach for teaching primary and middle school mathematics by employing geometry for learning arithmetic. This is likely to speed up math learning besides helping the student apply mathematics in daily life. For best results, teachers and parents will have to create many examples similar to those available in the text. Also, students should be asked to draw all the figures themselves.

Problem 1. *The following figure is a* rectangle *with sides AB = 3cm and BC = 4cm. Draw the rectangle using a scale and protractor. Note that all angles in the rectangle are* $90°$
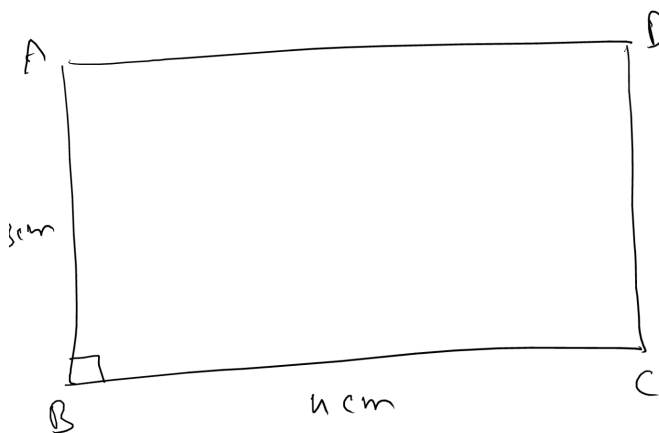

Fig. 1: Area of the rectange $= AB \times BC$.

Problem 2. *The area of the rectangle ABCD $\triangleq$ AB$\times$ BC. Draw rectangles of different sizes and find their area.*

Problem 3. *Cut the rectangle in Fig. 1 across the line AC to get the* trianlge *ABC as shown in Fig. 3.*

Problem 4. *Verify that the area of $\triangle ABC \triangleq \frac{1}{2}AB \times BC$. Draw various such triangles and find their area.*
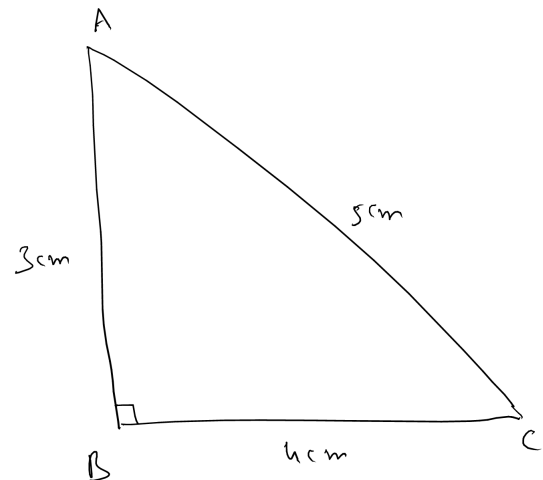
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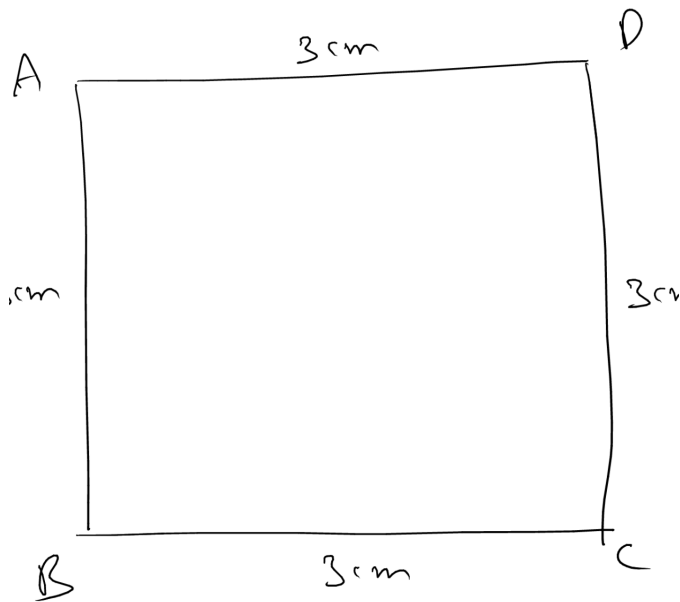
Fig. 3: Area of $\triangle ABC = AB \times BC$.

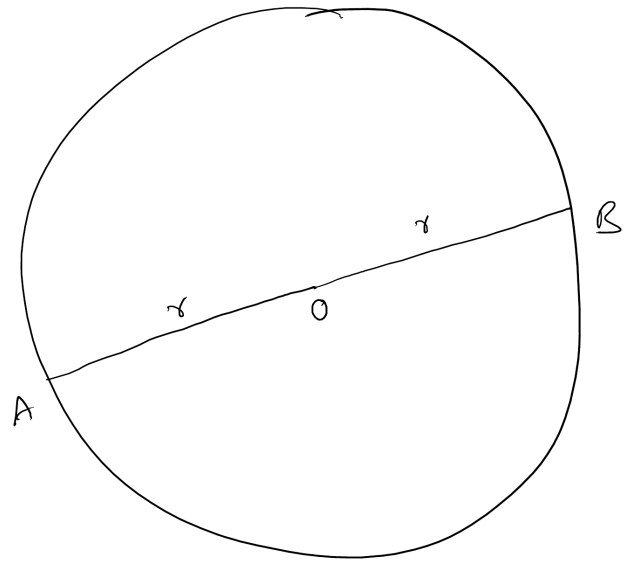**Problem 5.** *The following figure is a* square *where all the sides are equal. Draw it using a scale and protractor. Note that all angles in the square are* $90°$

Problem 6. *In $\triangle ABC$ in Fig. 3, verify that the area of the square on the side AC = area of the square on the side AB+area of the square on the side BC, or*

$$AC^2 = AB^2 + BC^2 \tag{0.1}$$

Problem 7. *In the following figure, BCDF is a rectangle. Chose points A and E on the line DF such that AE = BC. Join AB and CE. The figure ABCE is known as a* parallelogram, *denoted as ∥gm.*

Problem 8. *Verify that the area of ∥gm ABCE = area of rectangle BCDF.*

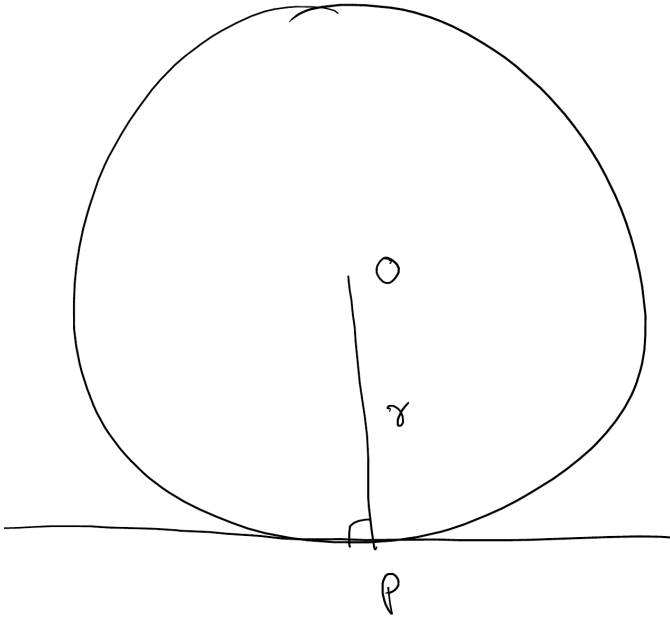**Problem 9.** *Obtain a formula for finding the area of a parallelogram.*
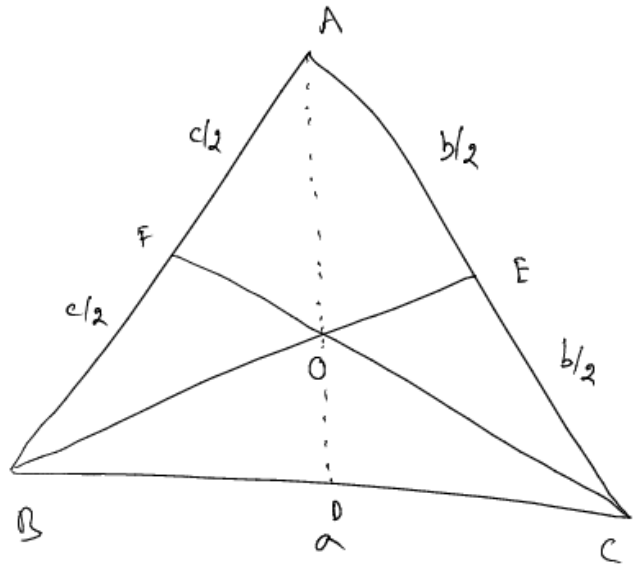
Fig. 12: Tangent to the circle.

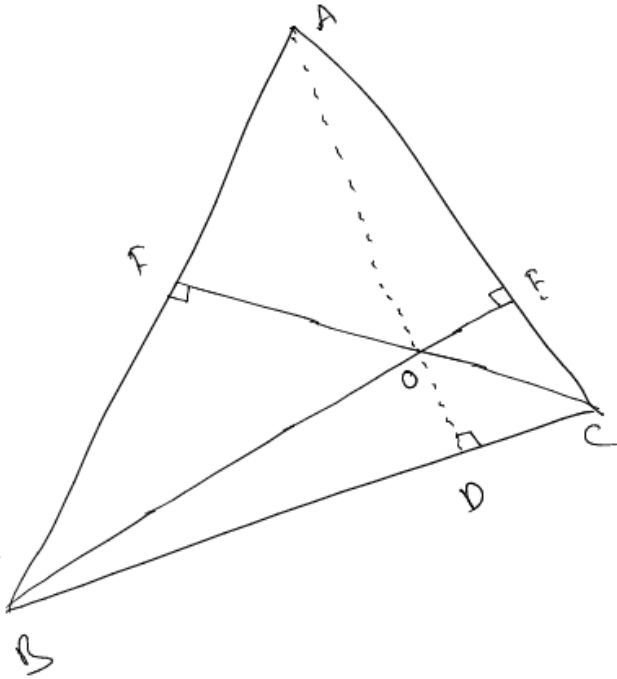Fig. 15: Medians of a triangle meet in a point.

Fig. 13: Altitudes of a triangle meet in a point.

the side AC into two equal parts in $\triangle ABC$ as shown in Fig. 15. BE is known as the median. CF is another median. BE and CF meet at O. Verify that

$$\frac{OE}{OB} = \frac{OF}{OC} = \frac{1}{2} \qquad (0.3)$$

Problem 16. *Extend the line AO in Fig. 15 to meet BC at D. Verify that AD is also a median.*

Problem 17. *In $\triangle ABC$ in Fig. 17, mark the mid points of BC, AC and AB respectively as D, E and F. Verify that*

1) $\frac{EF}{BC} = \frac{DE}{AB} = \frac{DF}{AC} = \frac{1}{2}$
2) $\frac{Area\ of\ \triangle DEF}{Area\ of\ \triangle ABC} = \frac{1}{4}$
3) $\angle EDC = \angle DEF$
4) $EF \parallel BC = DE \parallel AB = DF \parallel AC$
5) $\triangle DEF \sim \triangle ABC$.

Problem 18. *Draw any circle with diameter AB as shown in Fig. 10 and verify that*

$$\frac{circumference}{diameter} = \pi \approx \frac{22}{7} \qquad (0.4)$$

Repeat this exercise for circles of different radii.

Problem 19. *The area of a circle is given by πr^2. Calculate the areas of various circles of different radii.*

Problem 20. *Draw the chords AB and CD meeting at P as shown in Fig. 20. Join AC and BD and verify that $\triangle PAC \sim \triangle PBD$.*

Problem 21. *Now join the lines OB and OC in Fig. 20 and verify that*

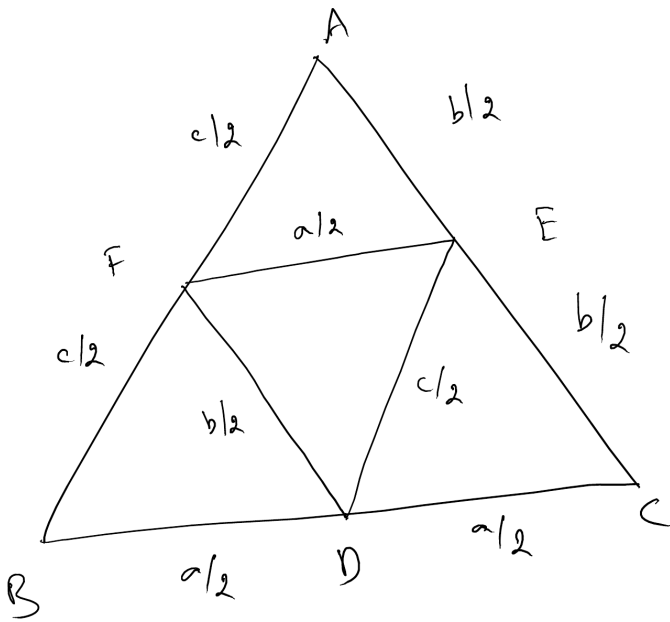$$\angle BOC = 2\angle BDC = 2\angle BAC \qquad (0.5)$$
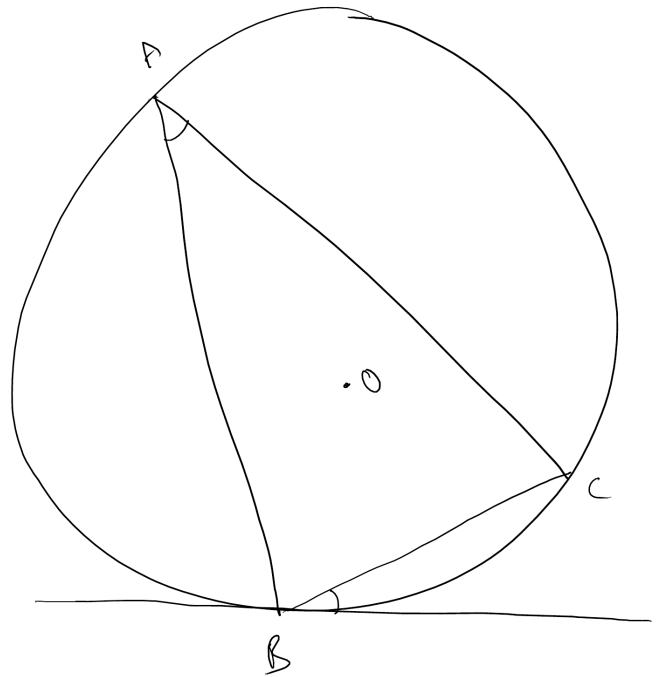
Fig. 17: Similar Triangles
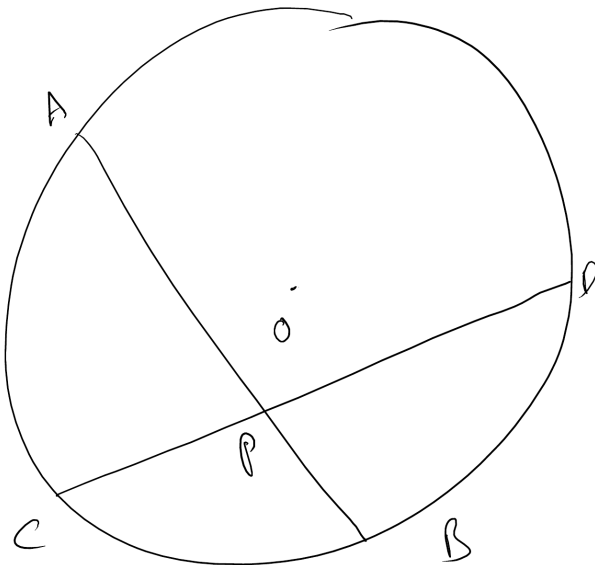

Fig. 22: Angles in the figure are equal.

Fig. 20: $\Delta PAC \sim \Delta PBD$

Fig. 23: Angles in the figure are equal.

Problem 22. *Draw the tangent through the point B and ΔABC as in Fig. 22. Verify that the marked angles are equal.*

Problem 23. *Draw the tangent PT to the circle as shown in Fig. 23 and a line PAB intersecting the circle at points A and B. Verify that*

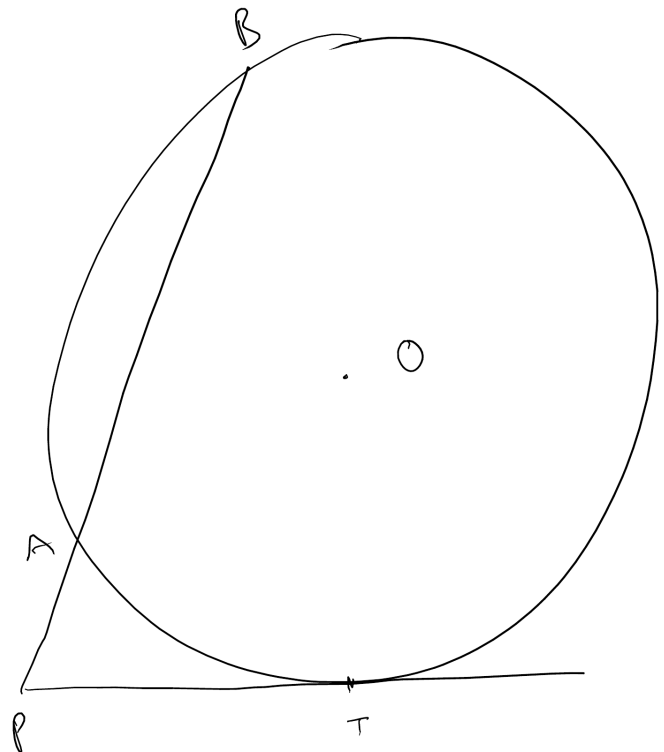$$PA \times PB = PT^2 \qquad (0.6)$$

to the circle. Verify that PA = PB.

Problem 24. *In Fig. 24 draw tangents PA and PB*

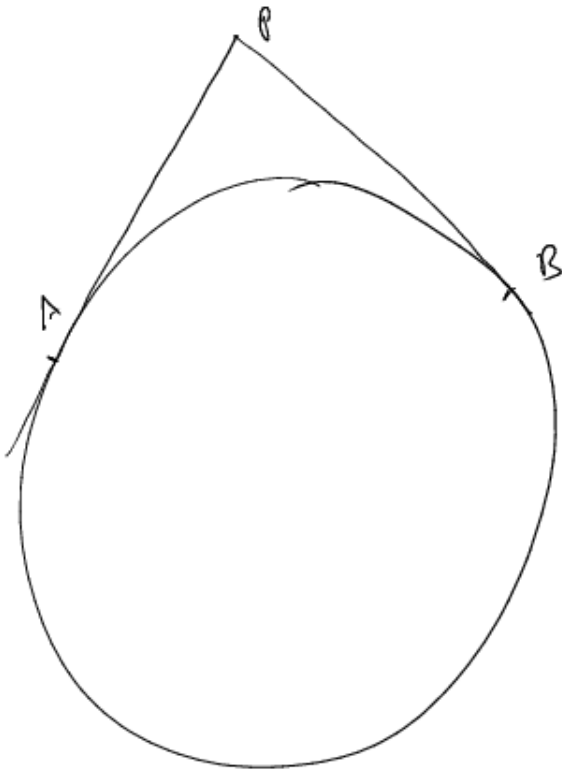**Problem 25.** *In Fig. 25 draw the* angle bisectors
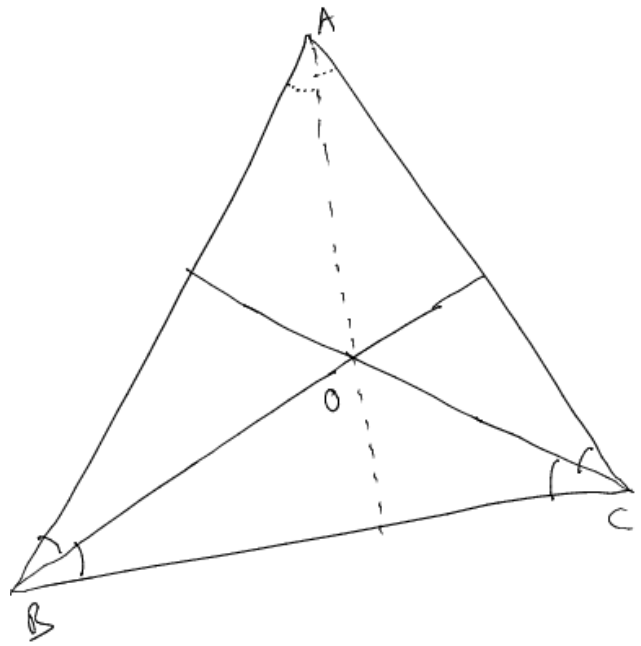
Fig. 24: Angles in the figure are equal.

Fig. 25: Angles bisectors meet at a point.

BD and CE such that

$$\angle ABE = \angle CBE \qquad (0.7)$$
$$\angle ACF = \angle BCF \qquad (0.8)$$

Verify that the line AO is also an angle bisector.

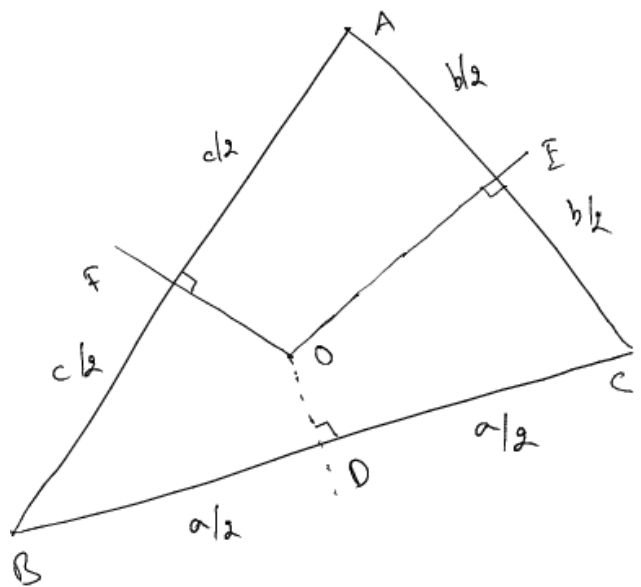**Problem 26.** *In Fig. 26 draw the* perpendicular bisectors *BD and CE meeting at the point O. Draw OD perpendicular to BC. Verify that BD = DC.*

Fig. 26: Perpendicular bisectors meet at a point.