

Exercises

Durga Prasad

22 December 2019

Triangle exercise

1. $\triangle ABC$ and $\triangle AMP$ are two right triangles, right angled at B and M respectively. M lies on AC and AB is extended to meet P . Prove that:

1.1 $\triangle ABC \sim \triangle AMP$

1.2 $\frac{CA}{PA} = \frac{BC}{MP}$

Solution:

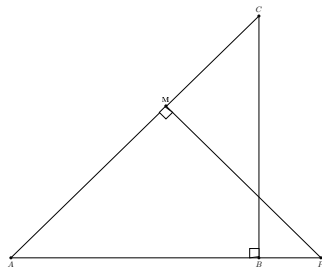


Figure 0-1: right angled triangles

From the above figure

$$\angle CAB = \angle MAP \quad (1)$$

$$\angle ABC = \angle AMP \quad (2)$$

From 1 and 2

$$\triangle ABC \sim \triangle AMP \quad (3)$$

► As corresponding sides are proportional $\frac{CA}{PA} = \frac{BC}{MP} = \frac{AB}{AM}$

$$\frac{CA}{PA} = \frac{BC}{MP}$$

Triangle construction

2. In $\triangle ABC$, $a=8$, $\angle B = 45^\circ$ and $c-b=3.5$. Sketch $\triangle ABC$

Solution:

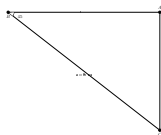


Figure 0-2: Triangle

Given $a=8\text{cm}$, $c-b=k$ ($k=3.5\text{cm}$) Apply cosine rule

$$\cos(B) = \frac{a^2 + c^2 - b^2}{2ac}$$
$$b = \frac{2ak \cos B - a^2 - k^2}{2k + \cos B}$$

Python code for Figure 0-2: <https://github.com/d-DP/Codes>

Quadrilateral exercise

3. ABCD is a rhombus and P, Q, R and S are the mid-points of the sides AB, BC, CD and DA respectively. Show that the quadrilateral PQRS is a rectangle.

Solution:

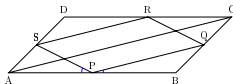


Figure 0-3: Rhombus

From $\triangle ABC$ and $\triangle ADC$

$$PQ \parallel AC \text{ and } PQ = \frac{1}{2}AC \quad (4)$$

$$RS \parallel AC \text{ and } RS = \frac{1}{2}AC \quad (5)$$

from 4 and 5 $PQ=RS$, $PQ \parallel RS$

$$\text{As } PB = PQ, \angle 2 = \angle 1 \quad (6)$$

From $\triangle APS$ and $\triangle CQR$

- ▶ $AP=CQ, AS=CR, PS=QR$
- ▶ From SSS rule $\triangle APS \cong \triangle CQR$

$$\angle 3 = \angle 4 \quad (7)$$

For AB, BC

$$\angle 3 + \angle SPQ + \angle 1 = 180^\circ \quad (8)$$

$$\angle 2 + \angle PQR + \angle 4 = 180^\circ$$

from 6 and 7

$$\angle 1 + \angle PQR + \angle 3 = 180^\circ \quad (9)$$

$$PS \parallel PR \quad \angle SPQ + \angle PQR = 180^\circ \implies \angle SPQ = 90^\circ$$

Circle exercises

4. Two circles intersect at two points B and C. Through B, two line segments ABD and PBQ are drawn to intersect the circles at A, D and P, Q respectively. Prove that $\angle ACP = \angle QCD$

Solution:

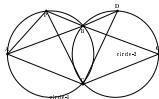


Figure 0-4: Circle

Solution:

From the above figure

$$\angle PBA = \angle ACP \quad (10)$$

$$\angle DBQ = \angle QCD \quad (11)$$

$$\angle PBA = \angle DBQ \quad (12)$$

circle constructions

5. Draw a circle with centre B and radius 6. If C be a point 10 units away from its centre, construct the pair of tangents AC and CD to the circle.

Solution:

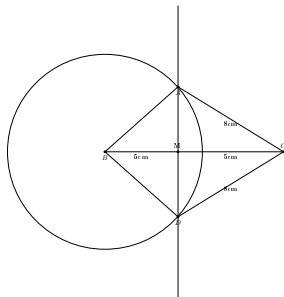


Figure 0-5: Circle

python code : <https://github.com/d-DP/Codes>

Miscellaneous

6. The lengths of two parallel chords of a circle are 6 cm and 8 cm. If the smaller chord is at distance 4 cm from the centre, what is the distance of the other chord from the centre?

Solution:

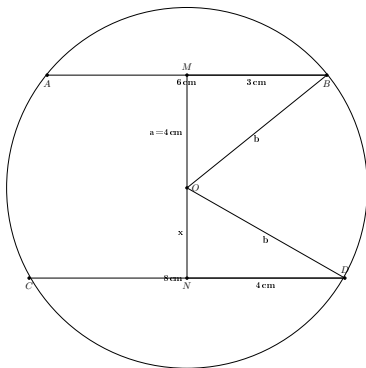


Figure 0-6: Circle

Apply Baudhayana theorem for $\triangle MOB$ and $\triangle NOD$

$$a^2 + b^2 = (3)^2$$

$$x^2 + b^2 = (4)^2$$