College of the Redwoods
Mathematics Department
Math 25—Trigonometry

Fundamentals of Geometry

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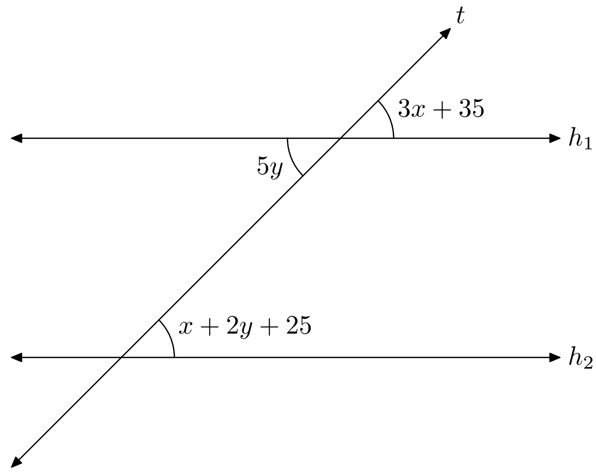
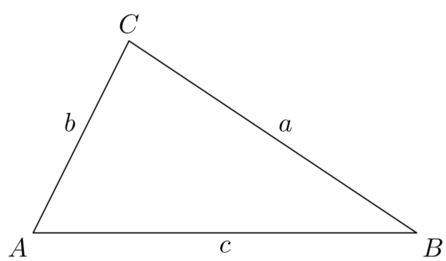
EXERCISE 1. Given that h_1 is parallel to h_2, find the values of x and y.



EXERCISE 2. On page 44 in Cohen, do problems 49 and 63.

EXERCISE 3. Using a compass, ruler, and protractor, construct $\triangle ABC$,

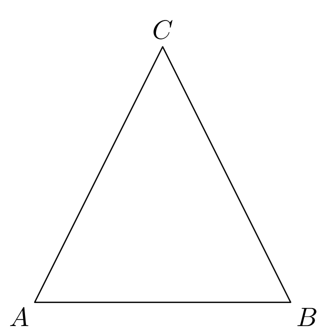


having

(a) $a = 7\,\text{cm}$, $b = 5\,\text{cm}$, $c = 6\,\text{cm}$
(b) $A = 60°$, $B = 20°$, $C = 10\,\text{cm}$
(c) $A = 40°$, $b = 8\,\text{cm}$, $C = 10\,\text{cm}$

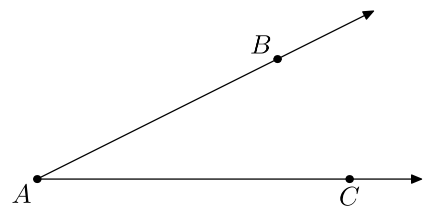
EXERCISE 4. Construct a right triangle having hypotenuse of length 10 cm and one leg with length 7 cm.

EXERCISE 5. In triangle $\triangle ABC$,



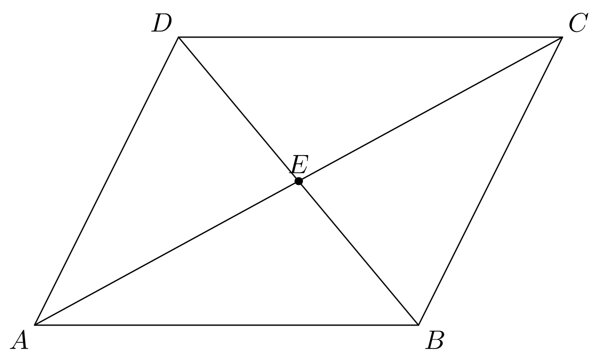
you are given that $\angle A = \angle B$. Prove that $AC = BC$.

EXERCISE 6. Using only compass and straight edge (no ruler, no protractor) construct the bisector of an arbitrary angle.



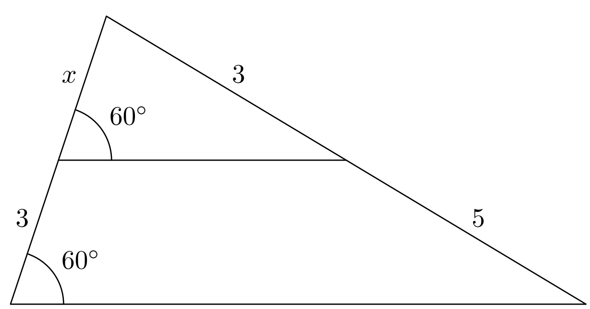
That is, draw ray $\overrightarrow{AD}$ so that $\angle BAD = \angle DAC$. After completing the construction, provide an analytical proof that $\angle BAD = \angle DAC$.

EXERCISE 7. Consider the quadrilateral $ABCD$.

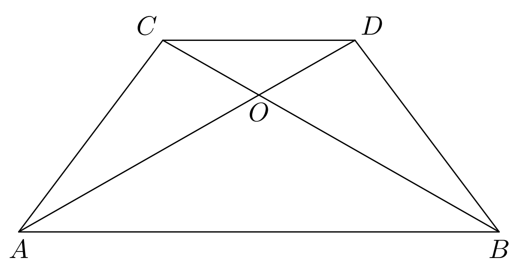


Given that $DE = EB$ and $AE = EC$, prove that $ABCD$ is a parallelogram

EXERCISE 8. Find: x

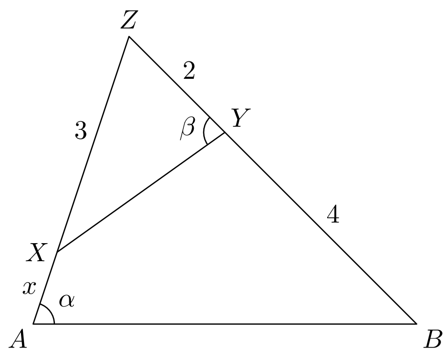


EXERCISE 9.



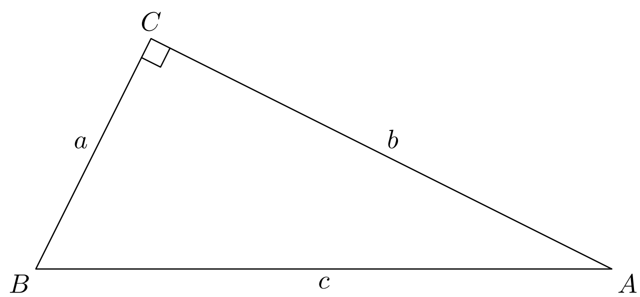
Given: $\overline{CD} \parallel \overline{AB}$
Prove: $OB \cdot OD = OA \cdot OC$

Exercise 10.

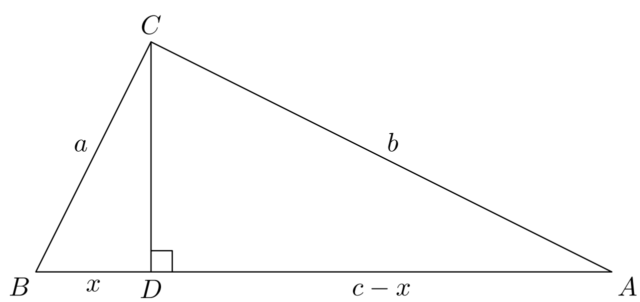


Given: $\angle\alpha = \angle\beta$
Find: x

Exercise 11. Given right triangle $\triangle ABC$



draw a line through C perpendicular to AB



(a) Show that $\triangle BDC \sim \triangle BCA$ and

$$\frac{x}{a} = \frac{a}{c}.$$

(b) Show that $\triangle CDA \sim \triangle BCA$ and

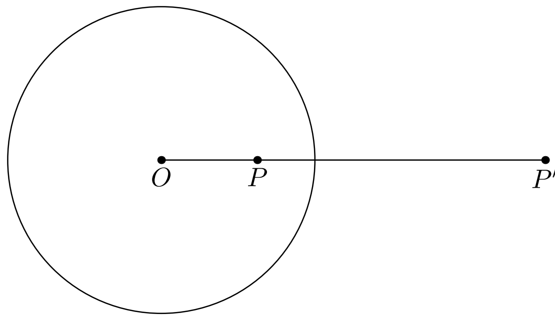
$$\frac{b}{c-x} = \frac{c}{b}.$$

(c) Use parts (a) and (b) to show that

$$a^2 + b^2 = c^2.$$

Voila! Another proof of the Pythagorean Theorem.

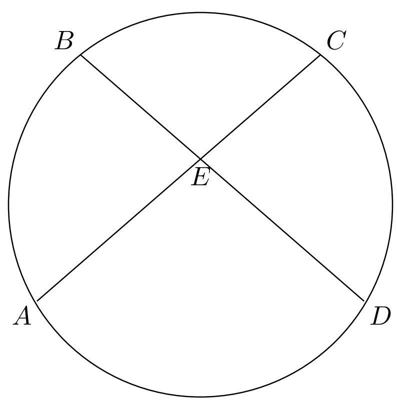
EXERCISE 12. Let C be a circle centered at a point O with radius r. If P is any point other than O, the inverse of P with respect to C is the point P' on the ray $\overrightarrow{OP}$ such that the product of the distances of P and P' from O is equal to r^2.



Suppose that P is interior to C and construct the perpendicular to $\overrightarrow{OP}$ at P meeting the circle at T. The tangent to C at T then meets $\overrightarrow{OP}$ at the inverse point P'. That is, prove that

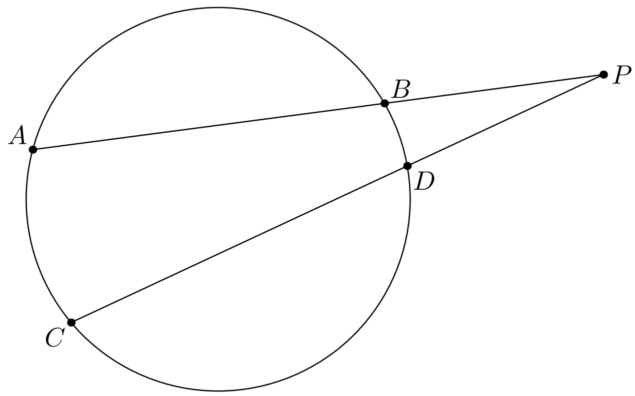
$$\overline{OP} \cdot \overline{OP'} = \overline{OT}^2 = r^2.$$

EXERCISE 13.



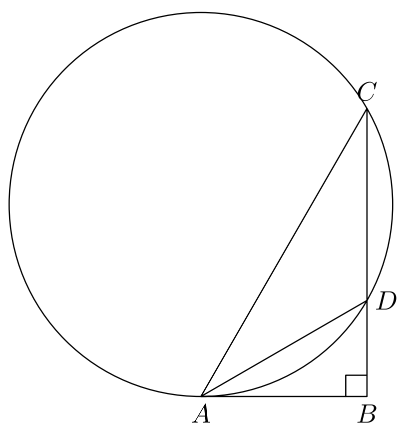
Prove: $BE \cdot ED = AE \cdot EC$.
Hint: Draw some auxiliary lines and find similar triangles.

Exercise 14.



Prove: $PA \cdot PB = PC \cdot PD$.
Hint: Draw some auxiliary lines and find similar triangles.

Exercise 15.



Given: AB tangent to the circle at A,
Prove: $(AB)^2 = (BC)(BD)$