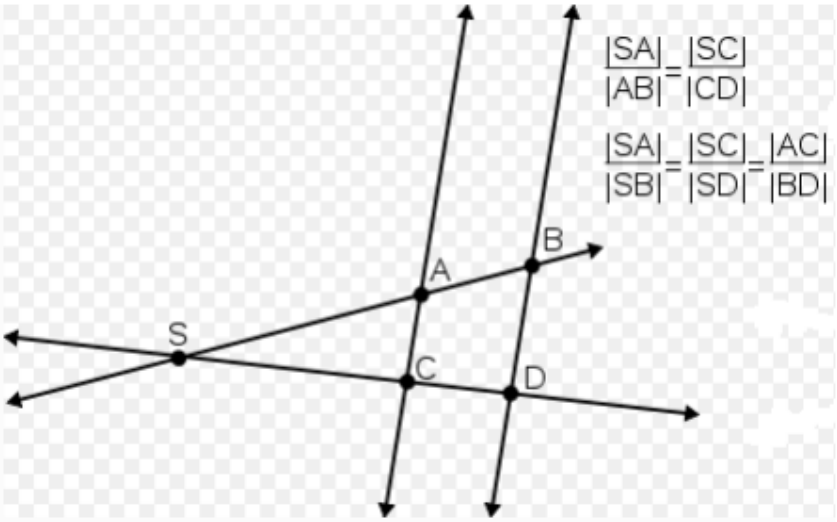
Intercept theorem (Thales´ theorem)

The **intercept theorem** is an important theorem in elementary geometry about the ratios of various line segments, that are created if 2 intersecting lines are intercepted by a pair of parallels. It is equivalent to the theorem about ratios in similar triangles. Traditionally it is attributed to Greek mathematician Thales, which is the reason why it is named **theorem of Thales** in some languages.



Related concepts:

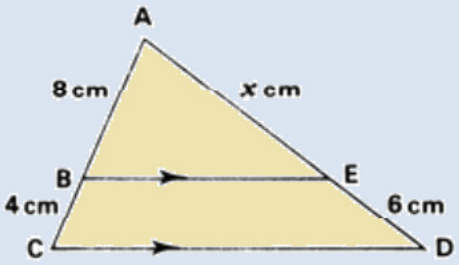
Similarity and similar triangles

Arranging 2 similar triangles, so that the intercept theorem can be applied

The intercept theorem is closely related to similarity. In fact it is equivalent to the concept of similar triangles,i.e. it can be used to prove the properties of similar triangles and similar triangles can be used to prove the intercept theorem. By matching identical angles you can always place 2 similar triangles in one another, so that you get the configuration in which the intercepts applies and vice versa the intercept theorem configuration contains always 2 similar triangles.

EXAMPLE 1

In the diagram given, find x:



Using Thales´theorem (Intercept theorem):

AC and AD are two intersecting lines. BE and CD are two parallel lines that intercept AC and AD, and so

$$\frac{|AB|}{|BC|} = \frac{|AE|}{|ED|}$$

$$\frac{8}{4} = \frac{x}{6}$$

$$x = \frac{6 \cdot 8}{4} = 12\ cm$$

Using similarity:

Δs ACD and ABE are similar, and so

$$\frac{|AC|}{|AB|} = \frac{|AD|}{|AE|}$$

$$\frac{8+4}{8} = \frac{x+6}{x}$$

$$x(8+4) = 8(x+6)$$

$$8x + 4x = 8x + 48$$

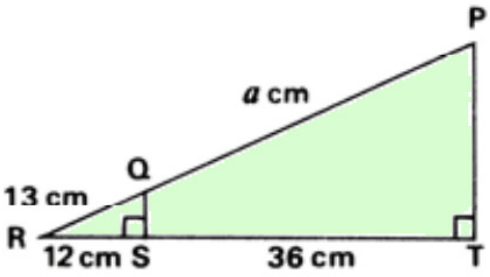
$$4x = 48$$

$$x = 12\ cm$$

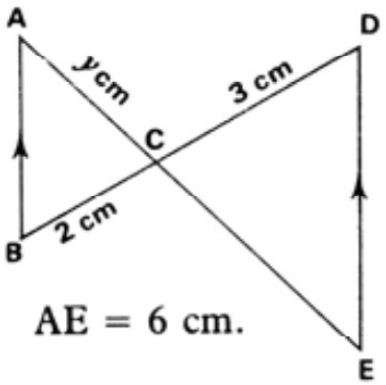
EXERCISES

1. In the following, find the values of the unknows.

a)

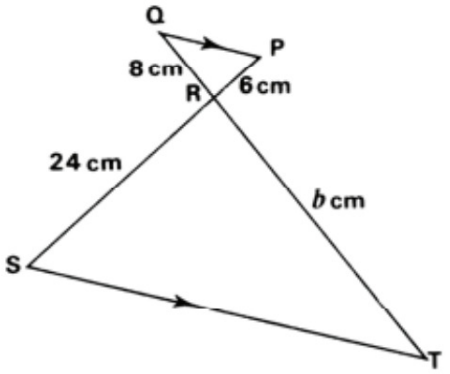


b)

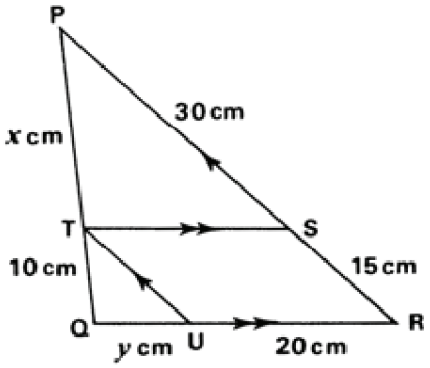


AE = 6 cm.

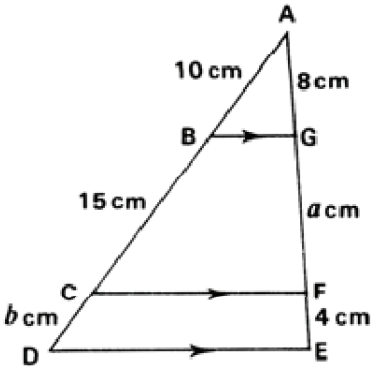
c)



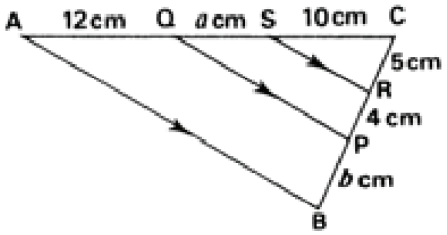
d)



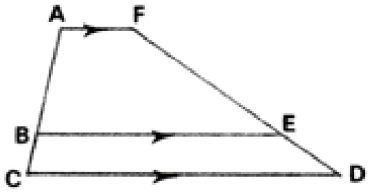
e)



f)



2. In the figure, AF//BE//CD. If AB=15 cm, BC=5cm and FD=40 cm, find the length of FE.



3. Find the length of AC.