Here are three problems involving circles.
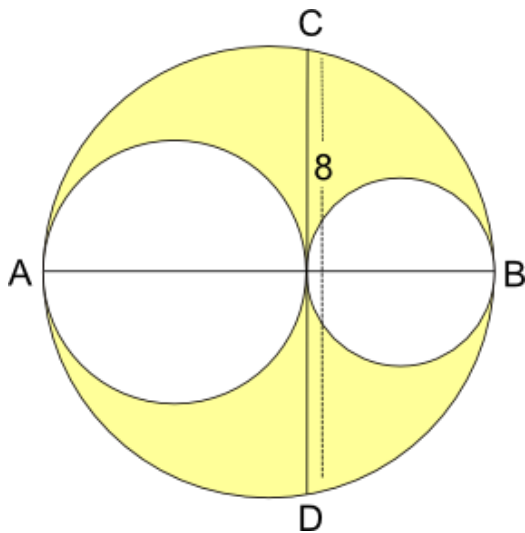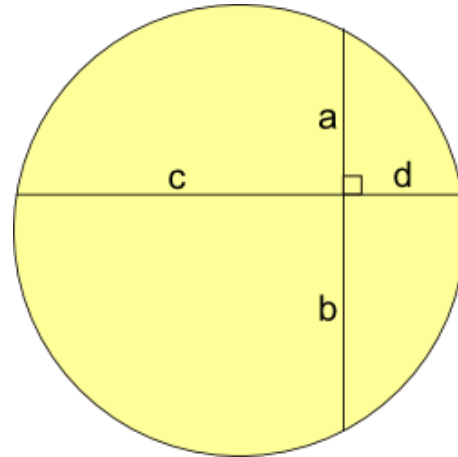
Can you solve them?
Can you find relationships between the three problems?

Firstly:

Show that ab = cd.

(where a, b, c, d are lengths)

Secondly:

These three circles are drawn so that they touch each other and their centres are all on the line AB.

If CD is 8 units in length, what is the area of the region shaded yellow?

Lastly:

If the area shaded yellow is equal to the area of the larger of the two blue circles, what is the relationship between the radii of the three circles?