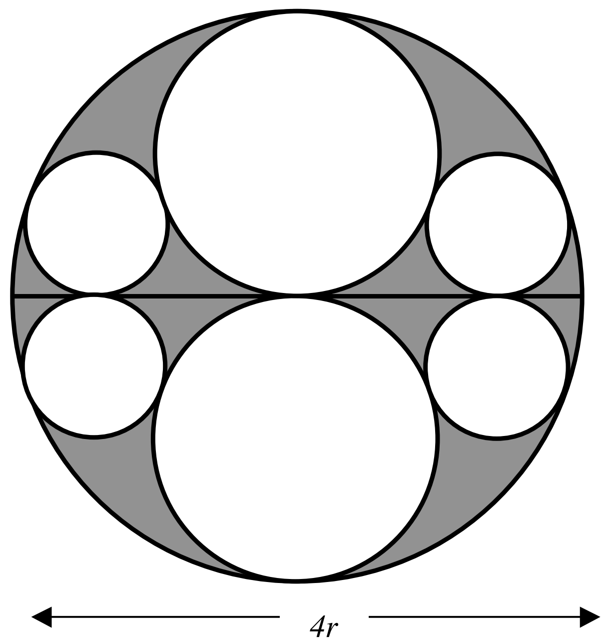
Temple Geometry

During the Edo period (1603-1867) of Japanese history, geometrical puzzles were hung in the holy temples as offerings to the gods and as challenges to worshippers.

This is one such problem.



Inside a large circle with radius 2r, two circles of radius r are drawn.

Four smaller circles, of radius p, are drawn to touch the large circle and the circles of radius r.

The following questions will help you to find the relationship between r and p

1. In the right triangle DOB,
   explain why the length of OD is 2r – p

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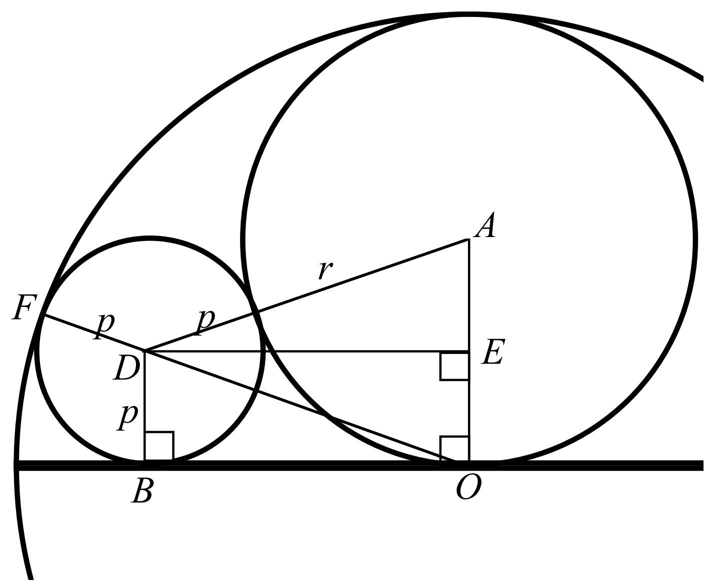

2. Use the Pythagorean theorem in triangle DOB to find an expression for OB^2.

3. In the right triangle ADE, explain why the length of AE is $r - p$.

4. Use the Pythagorean theorem in triangle ADE to find an expression for ED^2.

5. Use your results from questions 2 and 4, and the fact that OB = ED to show that $r = 2p$

6. Show that the shaded area of the diagram has area πr^2.

Temple Geometry		Rubric
	Points	Section points
1. OF = radius of large circle = 2r. FD = p, so OD is 2r - p	2	2
2. $OB^2 = DO^2 - DB^2$ $= (2r-p)^2 - p^2$ $= 4r^2 - 4pr$ *Partial credit* for some correct work	2 (1)	2
3. $AO = r$ and $EO = p$, so AE is $r - p$	1	1
4. $ED^2 = DA^2 - AE^2$ $= (r+p)^2 - (r-p)^2$ $= 4pr$ *Partial credit* for some correct work	2 (1)	2
5. Since $OB^2 = ED^2$, $4r^2 - 4pr = 4pr$ $\therefore 4r^2 = 8pr$ $\therefore r = 2p$	2	2
6. Shows that the Shaded area = $4\pi r^2 - 2\pi r^2 - 4\pi(r/2)^2 = \pi r^2$	1	1
Total Points		**10**