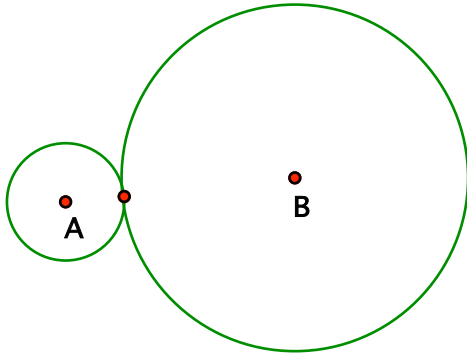


Student Worksheet

The curvature of a circle is the reciprocal of its radius.

Use **Figure 1** to answer question 1 and 2.

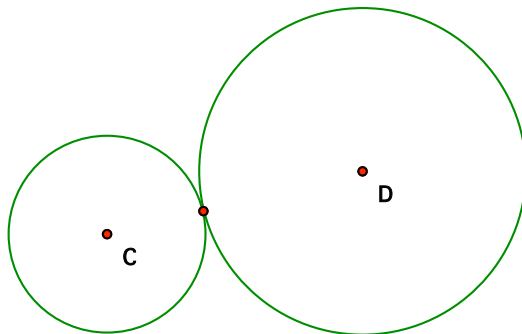
Figure 1



1. If the radius of circle *A* is $1/6$, then its curvature is _____.
2. If the radius of circle *B* is $1/2$, then its curvature is _____.

Use **Figure 2** to answer questions 3-5.

Figure 2

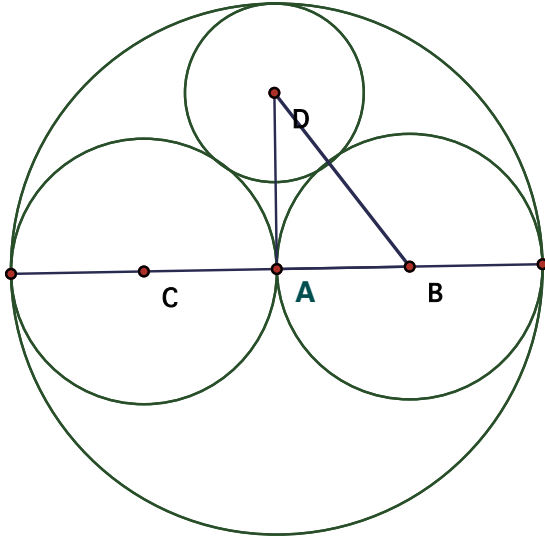


3. If the radius of circle *C* is $1/5$, then its curvature is _____.
4. If the radius of circle *D* is $1/3$, then its curvature is _____.
5. If you have a small circle and a large circle, which one will have the larger curvature?

Use **Figure 3** to answer questions 6-9.

The circles in Figure 3 are all tangent to each other. The radius of circle *A* is 1.

Figure 3



6. The curvature of circle A is _____.
7. The radius of circle C is _____ and the curvature of circle C is _____.
8. The radius of circle B is _____ and the curvature of circle B is _____.
9. The radius of circle D is _____ and the curvature of circle D is _____.

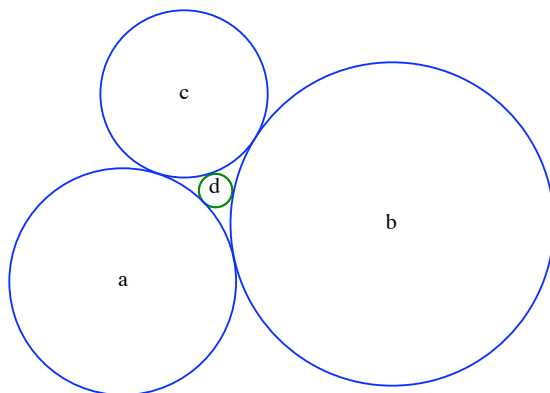
In 1643, French mathematician Rene Descartes developed a formula relating the curvatures of four circles that all touch, or are tangent, to each other.

Descartes' Circle Equation Theorem:

Given four mutually tangent circles as in Figure 4 with curvatures a , b , c , and d , then

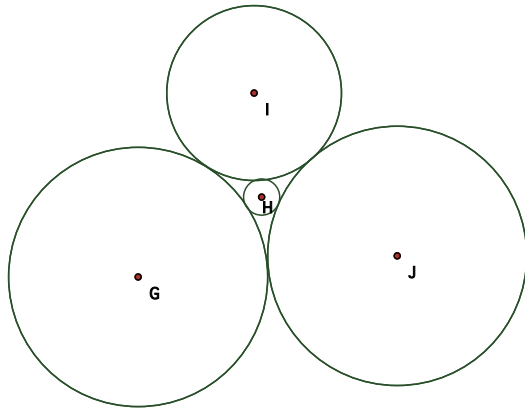
$$(a^2 + b^2 + c^2 + d^2) = (1/2) (a + b + c + d)^2 .$$

Figure 4



Use Figure 5 to answer questions 10-13.

Figure 5

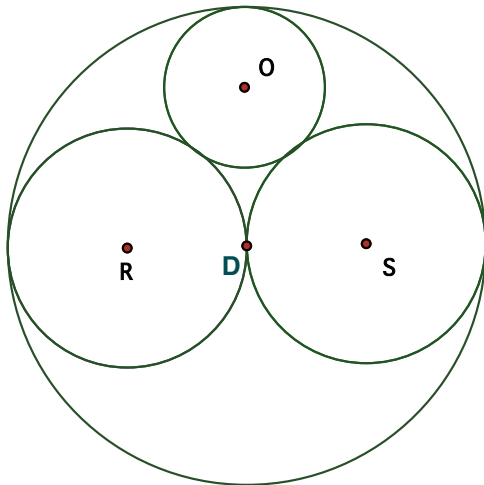


10. If the radius of circle G is $1/2$, then its curvature is _____.
11. If the radius of circle J is $1/2$, then its curvature is _____.
12. If the radius of circle H is $1/15$, then its curvature is _____.
13. Using Descartes' formula, the curvature of circle I is _____, and the radius of circle I is _____.

Use Figure 6 to answer questions 14-18.

A radius of circle C and circle B is $1/2$ and the radius of circle D is $1/3$.

Figure 6



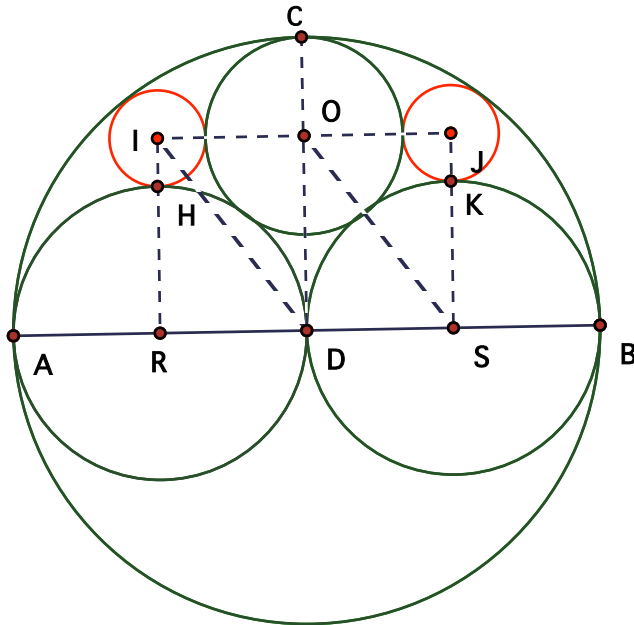
14. The curvature of circle R is _____.
15. The curvature of circle S is _____.
16. The curvature of circle O is _____.
17. The radius of circle D is _____, and its curvature is _____.

Note that since circle D contains the others, its curvature will be negative. If all of the points of tangency are external, the curvatures are considered positive, but if one circle encompasses the others, that circle has negative curvature.

Use Figure 7 for questions 19-25.

Circles are tangent to each other as shown in Figure 7. The radius of circle D is 1. [Hint: you have seen parts of this figure before.]

Figure 7



Find each of the following.

19. The radius of circle I .
20. The curvature of circle I .
21. The radius of circle J .
22. The curvature of circle J .
23. What is the best name for figure $DSJO$? _____
24. What is the best name for segment DO in relation to segment AB ? _____
25. Given a segment AB as in Figure 8, construct Figure 7.

Figure 8



Use Figure 9 for question 26.

Figure 9.

