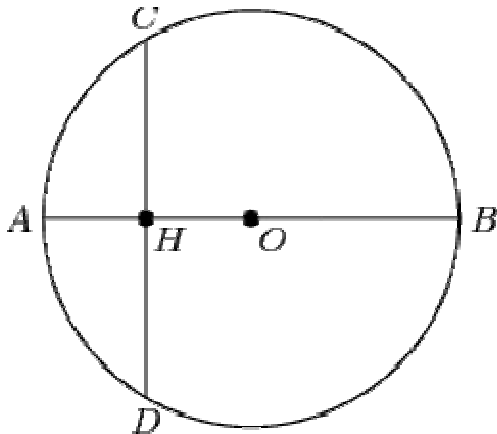
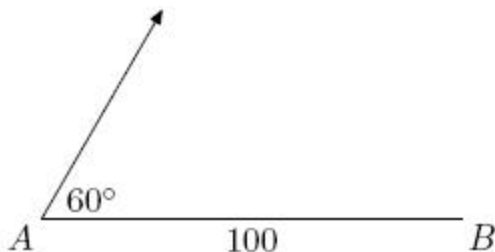


- Twenty five of King Arthur's knights are seated at their customary round table. Three of them are chosen - all choices being equally likely - and are sent of to slay a troublesome dragon. Find the probability that at least two of the three had been sitting next to each other.
- The length of diameter AB is a two digit integer. Reversing the digits gives the length of a perpendicular chord CD . The distance from their intersection point H to the center O is a positive rational number. Determine the length of AB .



- The increasing sequence 1, 3, 4, 9, 10, 12, 13, ... consists of all those positive integers which are powers of 3 or sums of distinct powers of 3. Find the 100th term of this sequence.
- Two skaters, Allie and Billie, are at points A and B , respectively, on a flat, frozen lake. The distance between A and B is 100 meters. Allie leaves A and skates at a speed of 8 meters per second on a straight line that makes a 60° angle with AB . At the same time Allie leaves A , Billie leaves B at a speed of 7 meters per second and follows the straight path that produces the earliest possible meeting of the two skaters, given their speeds. How many meters does Allie skate before meeting Billie?



- Find the sum of all positive rational numbers that are less than 10 and that have denominator 30 when written in lowest terms.
- Circles of radius 3 and 6 are externally tangent to each other and are internally tangent to a circle of radius 9. The circle of radius 9 has a chord

that is a common external tangent of the other two circles. Find the square of the length of this chord.

7. Find $x^2 + y^2$ if x and y are positive integers such that

$$\begin{aligned}xy + x + y &= 71 \\x^2y + xy^2 &= 880\end{aligned}$$

8. Every card in a deck has a picture of one shape - circle, square, or triangle, which is painted in one of the three colors - red, blue, or green. Furthermore, each color is applied in one of three shades - light, medium, or dark. The deck has 27 cards, with every shape-color-shade combination represented. A set of three cards from the deck is called complementary if all of the following statements are true:
- Either each of the three cards has a different shape or all three of the cards have the same shape.
 - Either each of the three cards has a different color or all three of the cards have the same color.
 - Either each of the three cards has a different shade or all three of the cards have the same shade.

How many different complementary three-card sets are there?