**CHES Math Club – 4th grade**
**Solutions for 5 March 2020**

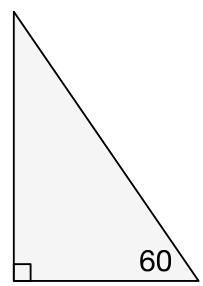
## Angles and Clocks

Remember that the angles in a triangle always add up to 180 degrees, and supplementary angles (which add up to a straight angle) also add to 180 degrees

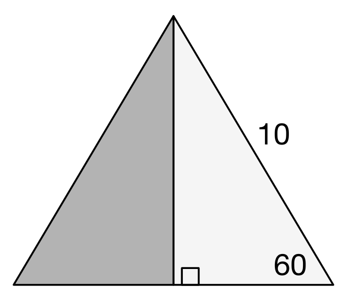
1. Suppose we have the following right triangle, in which one angle is 60 degrees. What is the size of the unlabeled angle?

   **Answer:**

   *30 degrees*



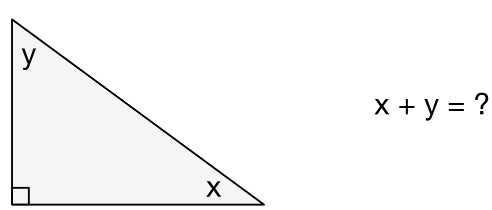

2. Let's suppose the right triangle in the previous question has a long side (*hypoteneuse*) of length 10, and we glue it to a mirror-image triangle to form a bigger triangle. What is the size of the angle on the top? What is the length of the bottom edge of the big triangle? What is the length of the short side of the original triangle?




   **Answer:**

   *60 degrees; 10; 5*

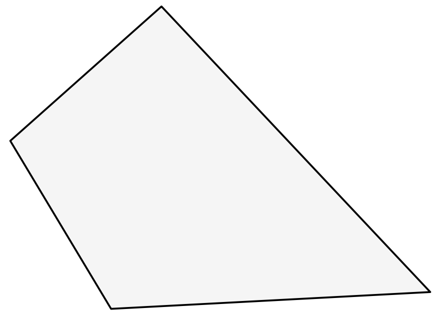
3. In an arbitrary right triangle, what do the two angles that are *not* right angles add up to? (Such angles are called *complementary angles*.)



**Answer:**

*90 degrees*

4. A *quadilateral* is a polygon with four sides. What do the four angles of a quadrilateral add up to? (Hint: draw a line that cuts the quadrilateral into two triangles.)



**Answer:**

*360 degrees*

5. A traditional clock has an hour hand that takes 12 hours to go around a full circle and a minute hand that takes 1 hours to go around the circle. What is the angle between the hands at:

   3:00? 90

   6:00? 180

   2:00? 60

6. How many degrees does the minute hand move in a minute?

   **Answer:**

   6

7. How many degrees does the hour hand move in an hour?
   In 2 minutes?
   In 1 minute?
   **Answer:**
   $360/12 = 30$
   $30/30 = 1$
   $30/60 = 1/2$

8. What is the angle between the two hands at:

   12:02? $12 - 1 = \boxed{11}$

   1:30? $180 - 45 = \boxed{135}$

   4:10? $120 + 5 - 60 = \boxed{65}$

9. Math Club is between 2 and 3pm. Partway through, Lionel notices that the hands on the clock are within one degree of each other. What time is it to the nearest minute?

   **Answer:**
   *At 2:00 they are 60 degrees apart. Every two minutes, the hour hand moves 1 degree and the minute hand moves 12 degrees. So after 11 minutes, the angle between the hands is reduced by* $11 \times 11/2$ *= 12.1 degrees.*
   $\boxed{\textit{2:11}}$

10. Later on, Zach notices that the hands are pointing in nearly opposite directions. What time is it?

**Answer:**

*Now we need the minute hand to move 60+180 = 240 degrees farther than the hour hand. The minute hand advances 11 degrees every two minutes, so it takes (240/11)×2 minutes, or approximately 44 minutes.* $\boxed{2:44}$