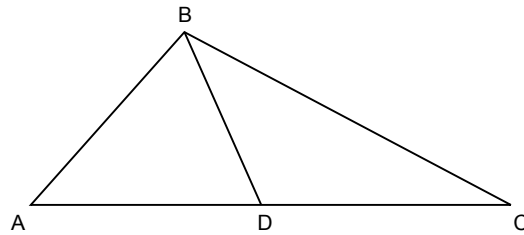

Problem of the Week

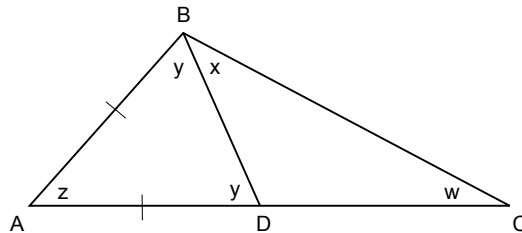
Solution Six

In the diagram below, we are given that $\overline{AB} = \overline{AD}$. We are also given that $\angle ABC - \angle ACB = 30$. Find $\angle CBD$.



SOLUTION: We find that $\angle CBD = 15$.

Let us label the angles in the diagram as follows:



Note that the given information implies that triangle ABD is isosceles, and that is why we assigned the same letter to its base angles. Our goal is to find x .

We can now start writing down equations involving the angles. We are given that

$$w = (x + y) + 30.$$

Since the sum of the angles of a triangle add up to 180, we can use the angles of triangle ABC to write:

$$z = 180 - (x + y) - w.$$

Substituting the first equation into the second leads to

$$z = 180 - (x + y) - (x + y + 30) = 210 - 2x - 2y.$$

Now we can use the angles of triangle ABD to write

$$z = 180 - 2y.$$

These two equations imply that

$$z = 180 - 2y = 210 - 2x - 2y.$$

The terms involving y now cancel, leaving us with a simple equation in x alone:

$$180 = 210 - 2x.$$

This equation is easily solved to show that $x = 15$.