Advanced Tennis Corporation produces sports equipment for that sport but they are struggling to maintain market share in an increasingly competitive sector. They have decided to make their product stand out on the shelves by using unique packaging.

The marketing department wants a triangular box that can hold 4 balls, as in the illustration below. The balls fit exactly inside the box, just touching all three walls and the end caps of the container. All 3 walls of the box are the same size. Assume a tennis ball is 6 cm in diameter, and ignore the thickness of the box material.



**Task 1:** The end of the box is in the shape of a triangle. What is the type and dimensions of the triangle to 2 decimal places?

What is the diameter of the tennis ball? \_\_\_

What is the radius of the tennis ball? \_\_\_

What is the name of the point at the center of the ball’s circular image? (point Z below) \_\_\_\_\_\_\_\_



What is the measure of angle C? \_\_\_\_\_\_

What about the angle ZCD? \_\_\_\_\_ How do you know? \_\_\_\_\_\_\_\_\_\_\_\_

What is the measure of angle ZDC? \_\_\_\_\_\_

What is the measure of angle DZC?\_\_\_\_\_\_ How do you know? \_\_\_\_

Where is point D relative to BC? \_\_\_\_\_\_\_\_\_ Can you be sure without measuring?

(Note: Don’t worry, it’s not the deathly hallows.)

Examining the location of point D: It appears point D is in the middle of AB. But let’s be certain. The whole endcap of the package is an equilateral triangle. So each side is the same length. Let’s call that length **S**.

Equilateral triangle ABC. What do we know about AB and AC? \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Construct the angle bisector of Angle A, intersecting with BC at point D. What can we now say about angles BAD and CAD? \_\_\_\_\_\_ For what reason? \_\_\_\_\_\_\_\_\_\_\_\_\_

Both triangles BAD and CAD share which side? \_\_\_\_\_\_\_ So it is congruent to itself because of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ property. So triangle BAD and CAD are \_\_\_\_\_\_\_\_\_ because of \_\_\_\_\_\_ (three letters). So BD and CD are congruence because of \_\_\_\_\_\_\_ (five letters). Since BC is **S** units long, BD and CD are \_\_\_\_\_\_\_\_ units long. So D is in fact in the middle.

Now let’s examine the triangle to the left. What is s equal to in terms of x? \_\_\_\_\_

Set up the Pythagorean Theorem for this problem.

Substitute s with what you found in the previous step. Then, solve for y.

Note the locations of x and y relative to the angle measure that are across from those sides.

 Which angle measure is across from x? \_\_\_\_\_ Which angle measure is across from y? \_\_\_

Now let’s look back at Triangle ZDC from the previous page.

Which length do you think represents y? \_\_\_\_\_

Which length do you think represents x? \_\_\_\_\_

Now substitute and solve for the only remaining variable.

So how long is each side of the triangle? \_\_\_\_\_\_\_

**Task 2:** Find and calculate the surface area of the package.

**Task 3:** If the material to make the package costs $0.03/cm2, how much will the package cost to make?