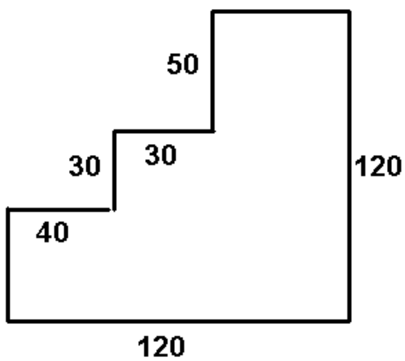
The outside surface of the NASA, IMAGE satellite is covered with solar cells (black) to collect sunlight and generate electricity for its many instruments and systems.

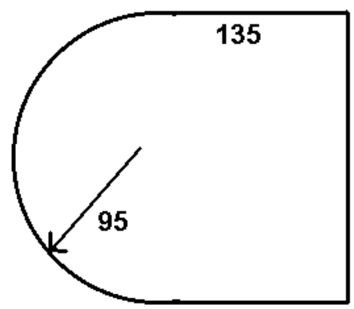
Solar Electricity.

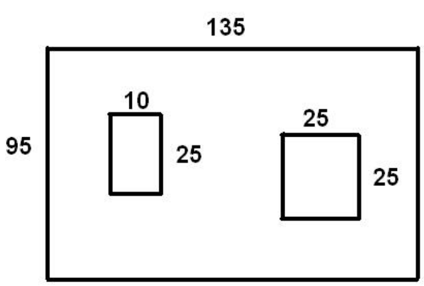
Most satellites depend on sunlight converted into electricity and stored in batteries, to run their instruments. Typical research satellites operate with only 200 to 800 watts of electricity generated by sunlight and 'solar cells'. Solar cells can be attached directly to the outer surface of a satellite, or can be found on 'solar panels' that the satellite deploys after it reaches its orbit. Engineers decide how many solar cells are needed by finding out how much power the satellite needs to operate, and then figuring out what the satellite's surface area is. If the satellite is not big enough, additional solar panels may be needed to supply the electricity. In this exercise, you will calculate the perimeter of the satellite area in centimeters, and the area, in square centimeters, of several kinds of satellite surfaces, and decide if there is enough available surface to supply the electrical needs of the satellite. All measurements in the diagrams are in centimeters. Some dimensions are missing.



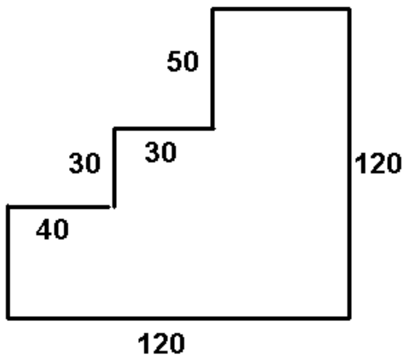
Question 1 – What is the perimeter? The area? The solar cells can provide 0.03 watts per square centimeter, and the satellite needs 257 watts. Is there enough surface area in the figure to the left to meet the electrical needs?

Question 2 - What is the perimeter? The area? The solar cells can provide 0.03 watts per square centimeter, and the satellite needs 957 watts. Is there enough surface area in the figure to the right to meet the electrical needs?





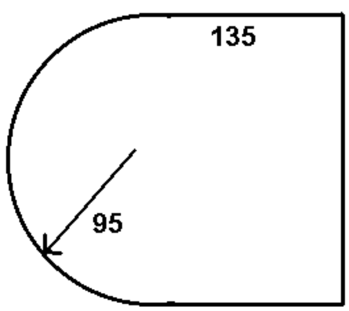
Question 3 - What is the outside perimeter? The area with the two holes removed? The solar cells can provide 0.03 watts per square centimeter, and the satellite needs 759 watts. Is there enough surface area in the figure to the left to meet the electrical needs?



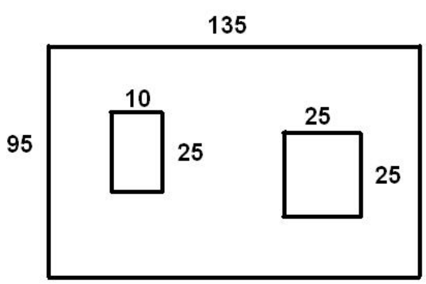
Answer 1 a) The missing side can be reconstructed from the other measurements. The perimeter is P = (120+ 120+ 50 + 50 + 30 + 30 + 40 + 40) =
Perimeter = 480 centimeters.

B) The area can be found from breaking the figure into rectangular sections from right to left:
Area = (120 x 50) + (30 x 70) + (40 x 40) =
6000 + 2100 + 1600 = **9,700 square cm**.

C) The solar cells produce 0.03 watts per square cm, so the power available is 9,700 x 0.03 = **291 watts**. This is greater than the minimum satellite requirement of 257 watts.



Answer 2 a) From the radius of the half-circle, the rectangle has a length of 2 x 95 = 190 cm, so the sum of the three sides is 460 cm. The circumference of the semi-circle is (3.14) x 95 = 298.3 cm. **Perimeter = 758.3 centimeters.**
B) The area can be found from breaking the figure into a rectangle and a semi-circle.
Area = (135 x 190) + ½ (3.14) $(95)^2$ =
25,650 + 14,169 = **39,819 square cm**.
C) The solar cells produce 0.03 watts per square cm, so the power available is 39819 x 0.03 = **1194 watts**. This more than the minimum satellite requirement of 957 watts.



Answer 3 – a) The perimeter is P = (135 + 135 + 95 + 95) **= 460 centimeters.**

B) Calculate the area of the large rectangle and subtract the two interior holes: 135x95 - 10x25 - 25x25
12825 - 250 - 625 = **11,950 square cm**.

C) The solar cells produce 0.03 watts per square cm, so the power available is 11950 x 0.03 = **358 watts**. This less than the minimum satellite requirement of 759 watts.