Sheet #733: Calculations for Semi-circular Roman Arches Name: _____

Question A . Your group is planning to draw a semi-circular arch composed of isosceles trapezoids.

(a) What central angle is needed to draw an arch with this number of blocks? The central angle is the angle subtended by the face of the block relative to the center of the baseline of the structure.

(i) 9 blocks $180^\circ/9 = 20^\circ$

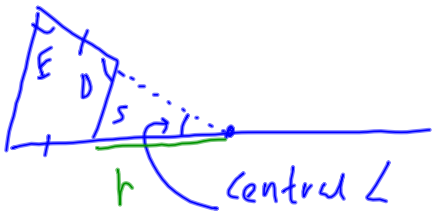
(ii) 25 blocks $180^\circ/25 = 7.2^\circ$

(b) Find the measures of the four internal angles of each trapezoid for the cases (i) and (ii).

(i) 9 blocks $100^\circ, 100^\circ, 80^\circ, 80^\circ$

(ii) 25 blocks

$93.6^\circ, 93.6^\circ, 86.4^\circ, 86.4^\circ$



EXTERNAL ANGLE = CENTRAL ANGLE.

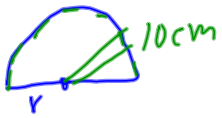
Question B. Your group has been given an isosceles trapezoidal prism (a block) to construct a semi-circular arch. The measurements of the prisms are below.

Internal angle 1: 92 degrees. Internal angle 2: 88 degrees. Length of front face: 10 centimeters.

(a) Find the total number of blocks needed. Comment on any fractional blocks and/or even/odd situations.

$92, 88.$ central $\angle = 4^\circ$. $N = 45$

(b) Approximate the inner "radius" of the arch. This is the horizontal distance from the center to the lowest inner corner of the arch.



CIRCLE : $2\pi r =$ Circumf.

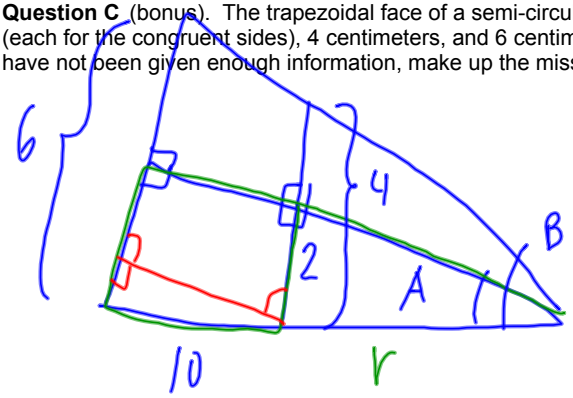
$\frac{1}{2}\odot$: $\pi r = 45 \cdot 10\text{cm}$.

(c) If the "depth" of the block is 30 centimeter, find the horizontal extent of the arch (the outer "diameter"). Here the "depth" means the length of one of the sides of the block.

$2r + 2 \cdot \text{depth} = 2 \cdot 143.2 + 2 \cdot 30 = 346.5\text{cm}$,

$r = 450\text{cm}/\pi \approx 143.2\text{cm}$.

Question C (bonus). The trapezoidal face of a semi-circular arch has these side lengths: 10 centimeters (each for the congruent sides), 4 centimeters, and 6 centimeters. Calculate the inner "radius" exactly. If you have not been given enough information, make up the missing info.



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