THE 2022 2023 KENNESAW STATE UNIVERSITY
HIGH SCHOOL MATHEMATICS COMPETITION

PART II
Calculators are NOT permitted
Time allowed: 2 hours

1. If is an even positive integer and is a perfect square, prove that is a multiple of 8.

2. Prove $2022^{2023} + 2023^{2022}$ n^2 for any integer n.

3. If – – Find the minimum value for:

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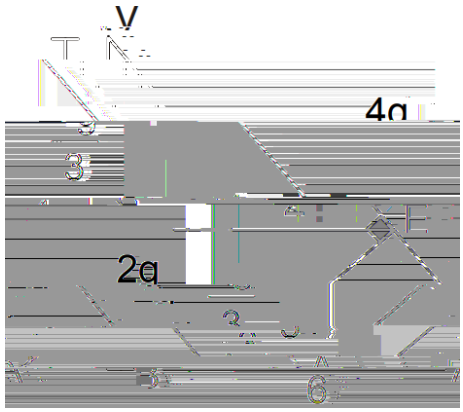
4. In the diagram, we have a right circular cylinder, where; is perpendicular to , is perpendicular to and the intersection point is E, and M is the center of the upper base.

Solutions



Notice on triangle :
triangle is similar to , then

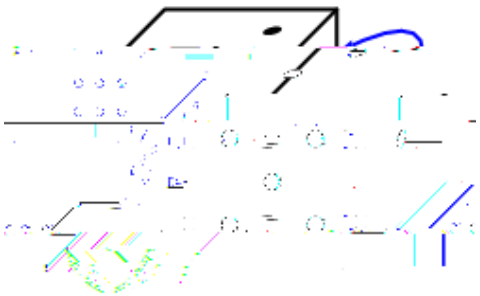
So,

5. (A, B, C, D, E, F, G, H), where G is the cube completely hidden at the bottom left back:

We can observe:

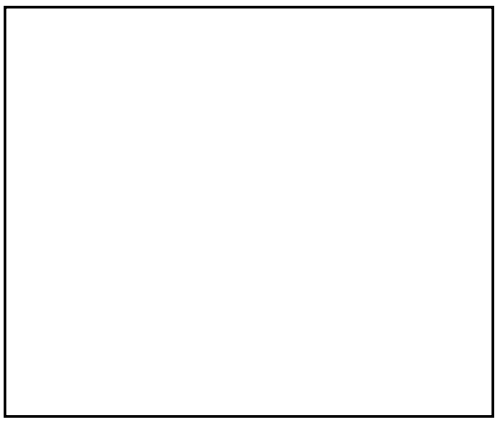
a) From cube A we can conclude that on the left face of cube B must be 7 dots.
b) Cube F has faces with 3 and 6 dots adjacent to each other, then B must have 6 dots in the faces opposite to the one with 5 dots.
c) So then (because there are 1, 3, 4, 5, 6 or 7 dots in each face) the bottom face in cube B has 4 dots.

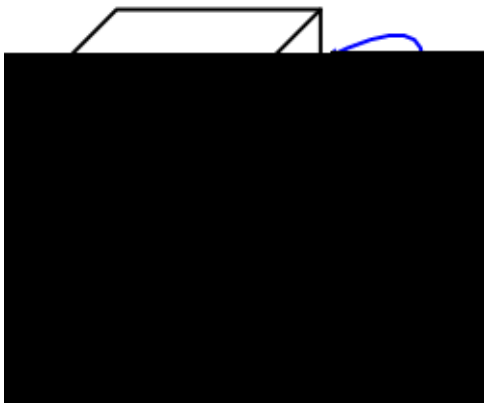
Summary for **cube B**:



Also, from previous analysis we can conclude:

a) Cube A has 6 dots on the left face.
b) Cube F has 1 dot on the bottom face.
c) Cube D has 6 dots on the hidden face.
d) **Cube H** has two possibilities:





So, the minimum number of dots on the hidden face for cube H is 4.