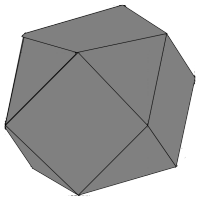
Note: Figures may not be drawn to scale.

1. Find the reflection of the point $(11, 16, 22)$ across the plane $3x + 4y + 5z = 7$.

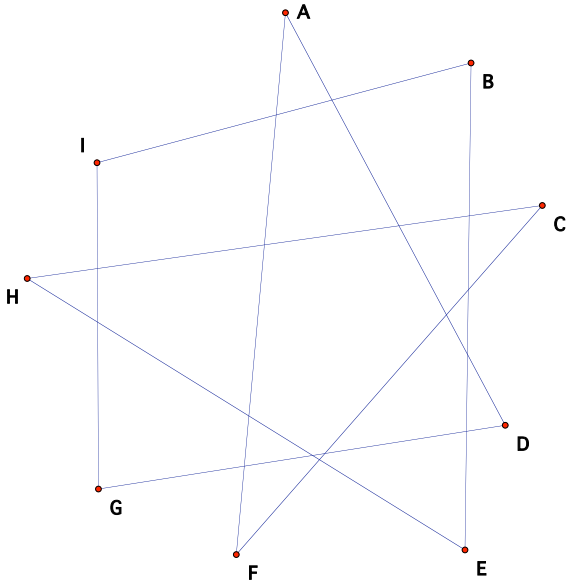
2. Find the radius of a circle inscribed in a triangle with side lengths 4, 5, and 6.

3. Find the volume of a regular cubeoctahedron of side length 1. This is a solid whose faces comprise 6 squares and 8 equilateral triangles, arranged as in the diagram below.

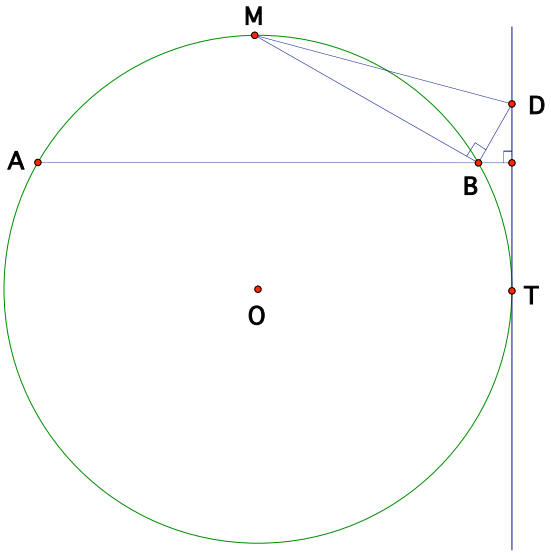


4. Given triangle ABC. D lies on $\overline{BC}$ such that $\overline{AD}$ bisects $\angle BAC$. Given $\overline{AB} = 3$, $\overline{AC} = 9$, and $\overline{BC} = 8$. Find $\overline{AD}$.

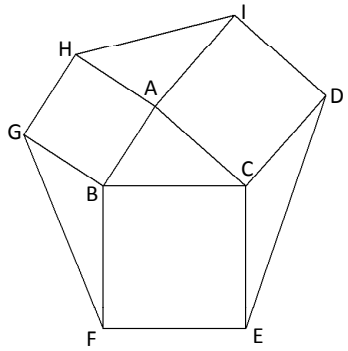
5. Find the sum of angles $A, B, C, D, E, F, G, H, I$ in the following diagram:



6. In the diagram below, let $\overline{OT} = 25$ and $\overline{AM} = \overline{MB} = 30$. Find $\overline{MD}$.



7. $\triangle ABC$ is a triangle with $AB = 5$, $BC = 6$, and $CA = 7$. Squares are drawn on each side, as in the image below. Find the area of hexagon $DEFGHI$.



8. A sphere of radius 1 is internally tangent to all four faces of a regular tetrahedron. Find the tetrahedron's volume.

9. For an acute triangle $\triangle ABC$ and a point X satisfying $\angle ABX + \angle ACX = \angle CBX + \angle BCX$, find the minimum length of AX if $AB = 13$, $BC = 14$, and $CA = 15$.

10. A, B, C, D are points along a circle, in that order. AC intersects BD at X. If $BC = 6$, $BX = 4$, $XD = 5$, and $AC = 11$, find AB.