1. [3] Let \( x = \frac{p}{q} \) for \( p, q \) coprime. Find \( p + q \)

2. [3] Triangle \( ABC \) has lengths \( AB = 20, AC = 14, BC = 22 \). The median from \( B \) intersects \( AC \) at \( M \) and the angle bisector from \( C \) intersects \( AB \) at \( N \) and the median from \( B \) at \( P \). Let \( \frac{p}{q} = [AMPN] : [ABC] \) for positive integers \( p, q \) coprime. Note that \([ABC]\) denotes the area of triangle \( ABC \). Find \( p + q \)

3. [4] Let \( O \) be the circumcenter of triangle \( ABC \) with circumradius 15. Let \( G \) be the centroid of \( ABC \) and let \( M \) be the midpoint of \( BC \). If \( BC = 18 \) and \( \angle MOA = 150^\circ \), find the area of \( OMG \).

4. [4] Consider the cyclic quadrilateral with sides 1, 4, 8, 7 in that order. What is its circumdiameter? Let the answer be of the form \( a\sqrt{b} + c \), for \( b \) square free. Find \( a + b + c \)

5. [5] There is a point \( D \) on side \( AC \) of acute triangle \( \triangle ABC \). Let \( AM \) be the median drawn from \( A \) (so \( M \) is on \( BC \)) and \( CH \) be the altitude drawn from \( C \) (so \( H \) is on \( AB \)). Let \( I \) be the intersection of \( AM \) and \( CH \), and let \( K \) be the intersection of \( AM \) and line segment \( BD \). We know that \( AK = 8, BK = 8, \) and \( MK = 6 \). Find the length of \( AI \).

6. [6] \( \triangle ABC \) has side lengths \( AB = 15, BC = 34, \) and \( CA = 35 \). Let the circumcenter of \( ABC \) be \( O \). Let \( D \) be the foot of perpendicular from \( C \) to \( AB \). Let \( R \) be the foot of perpendicular from \( D \) to \( AC \), and let \( W \) be the perpendicular foot from \( D \) to \( BC \). Find the area of quadrilateral \( CROW \).

7. [7] Let \( O \) be the center of a circle of radius 26, and let \( A, B \) be two distinct point on the circle, with \( M \) being the midpoint of \( AB \). Consider point \( C \) for which \( CO = 34 \) and \( \angle COM = 15^\circ \). Let \( N \) be the midpoint of \( CO \). Suppose that \( \angle ACB = 90^\circ \). Find \( MN \).

8. [8] \( ABCD \) is a cyclic quadrilateral with circumcenter \( O \) and circumradius 7. \( AB \) intersects \( CD \) at \( E \), \( DA \) intersects \( CB \) at \( F \). \( OE = 13, OF = 14 \). Let \( \cos \angle FOE = \frac{p}{q} \), with \( p, q \) coprime. Find \( p + q \).