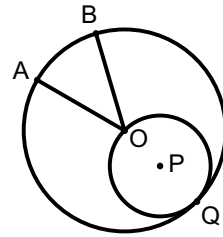


FRESHMAN-SOPHOMORE RELAY COMPETITION
ICTM 2011 DIVISION AA STATE FINALS

ROUND 1

- Find the value of x that makes the following proportion true: $\frac{3}{2x-10} = \frac{12}{x+16}$.
- Mario's car gets 34 miles per gallon when driven on the highway but *ANS* fewer miles per gallon when driven in the city. If Mario drove 414 miles on 13 gallons of gas, how many highway miles did Mario drive?

- In $\odot O$, $\odot P$ is internally tangent at point Q and contains point O . The radius of $\odot P$ is 5 and major arc \widehat{AQB} has measure of $(ANS)^\circ$. The area of the portion of $\odot O$ that lies in the exterior of **both** $\odot P$ and sector OAB is $k\pi$. Find the value of k . Answer as an improper fraction reduced to lowest terms.

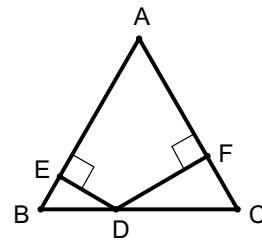


- ANS* should be an improper fraction of the form $\frac{k}{w}$. The altitude to the hypotenuse of a right triangle divides the hypotenuse into two segments of length k and w . Find the exact length of the shorter leg of the right triangle.

ANSWERS

- 8
- 323 (Miles optional.)
- $\frac{1165}{18}$ (Must be this reduced improper fraction.)
- $39\sqrt{14}$ (Must be this exact answer, units optional.)

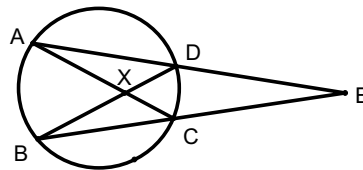
1. Brian runs a 60 meter course at an average rate of 7 meters per second. Katie runs the same course at an average rate of 6 meters per second. How many more seconds did it take Katie to finish the course? Write your answer as a reduced improper fraction.
2. The coordinates of a y-intercept of a figure are $(0, b)$ while the y-intercept itself is just the value b . Find the y-intercept of the line with slope ANS passing through the point $(14, 32)$.
3. Rectangle $MATH$ has perimeter ANS and the ratio of width to length of $1:3$. \overline{MT} divides the rectangle into two congruent right triangles. Let k° be the measure of the smallest angle in one of these triangles and $w = MT$. Find the numeric sum $(k + w)$. Write your answer as a decimal rounded to the nearest tenth.
4. $\triangle ABC$ is equilateral. Point D is chosen at random on base \overline{BC} and \overline{DE} and \overline{DF} are drawn perpendicular to respective sides \overline{AB} and \overline{AC} . If $ANS = DE + DF$, find the perimeter of $\triangle ABC$. Write your answer as a decimal rounded to the nearest tenth.



ANSWERS

1. $\frac{10}{7}$ (Must be this reduced, improper fraction, seconds optional.)
2. 12 (Must be this value only, not an ordered pair.)
3. 23.2 (Must be this decimal.)
4. 80.4 (Must be this decimal, units optional.)

- $-1 < -2x + 7 < 9$ has solution set $\{x : k < x < w\}$. Find the value of $(k + w)$.
- $4|5x - (ANS)| + 6 = 30$. Find the sum of the two solutions for x . Write your answer as an exact decimal.
- A regular cuboctahedron (made by slicing corners off a cube) is a polyhedron with 6 square faces and 8 equilateral triangle faces, with each common edge having length ANS . Find the total surface area of this regular cuboctahedron. Write your answer as a decimal rounded to the nearest hundredth of a unit.
- Let $ANS^\circ = m\angle E$ in the circle shown.
 $m\angle AXD = 110^\circ$ and $m\widehat{CD} = k^\circ$. Find the value of k . Write your answer as a decimal rounded to the nearest hundredth of a degree.



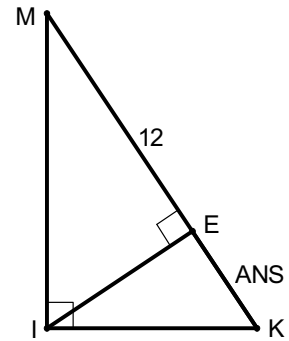
ANSWERS

- 3
- 1.2 (Must be this exact decimal.)
- 13.63 (Must be this decimal, units optional.)
- 56.37 (Must be this decimal, degrees optional.)

1. Let x be a member of $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. For how many distinct values of x will the expression $\left[x \left(1 + \frac{1}{2} \right) + 0.5 \right]$ be a whole number?

2. Let $k = 2(ANS)$. Solve for x when $\frac{2x}{x-1} + \frac{2}{3} = \frac{k}{x-1}$.

3. $\triangle MIK$ is a right triangle with $\overline{MI} \perp \overline{IK}$. $\overline{IE} \perp \overline{MK}$ at point E . $ME = 12$ and $KE = ANS$. Find the exact area of $\triangle MIK$.



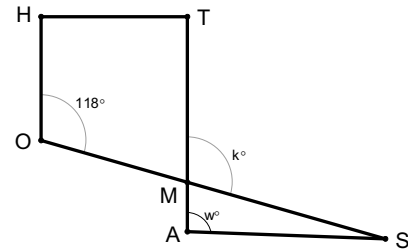
4. Let ANS represent the numerical area of Rhombus $RHOM$. One Angle of $RHOM$ measures 45° . Find the numerical length of the shorter diagonal of $RHOM$. Write your answer as a decimal rounded to the nearest tenth of a unit.

ANSWERS

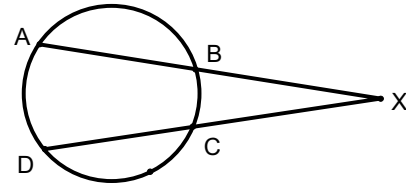
1. 5
2. 4
3. $32\sqrt{3}$ (Must be this exact answer.)
4. 6.8 (Must be this decimal, units optional.)

- Find the sum of the solutions for the equation $x^2 - 26 = 11x$.
- Set $A = \{ANS, 9, 10, 11, 12, 15, 16\}$. Let $C = \{2, 9, 7\}$. The arithmetic mean of C is 6 since the average of 2, 9, and 7 is 6. The median of C is 7 because 7 is the middle data point if the data are arranged in order. Set A has median k and arithmetic mean w . Find the sum $(k + w)$.

- In the diagram, $\overline{HO} \parallel \overline{TA}$. $m\angle HOM = 118^\circ$, $m\angle TMS = k^\circ$, $m\angle MAS = w^\circ$, and $m\angle MSA = (ANS)^\circ$. Find the sum $(k + w)$.



- Given the circle with two secant segments meeting at point X , $\overline{AB} \cong \overline{CD}$ and $m\widehat{ADC} = (ANS)^\circ$. Find the degree measure of $\angle AXD$.



ANSWERS

- 11
- 23
- 213 (Degrees optional.)
- 33 (Degrees optional.)