**MASSACHUSETTS MATHEMATICS LEAGUE**
**CONTEST 3 - DECEMBER 2012**
**ROUND 3 COORDINATE GEOMETRY OF LINES AND CIRCLES**

**ANSWERS**

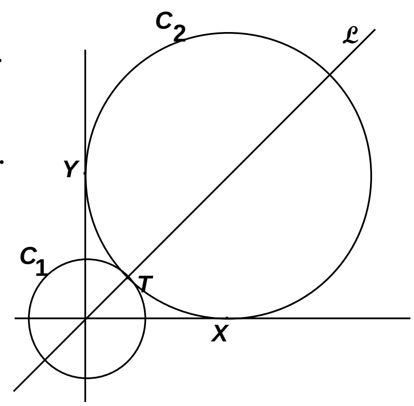
A) $k =$ ______________________

B) $a =$ ______________________

C) ( ________ , ________ , ________ )

A) The lines $y = mx + 1$ and $y = \dfrac{2x}{5} - m$ intersect at the point $(6, k)$. Determine the value of $k$.

B) Let circle $C_1 = \{(x, y) \mid x^2 + y^2 = 36\}$ and line $\mathscr{L} = \{(x, y) \mid y = x\}$. Circle $C_2$ has its center on $\mathscr{L}$ outside of $C_1$ and is tangent to the $x$-axis at $X(a, 0)$, the $y$-axis at $Y(0, b)$ and circle $C_1$ at point $T$. Compute the value of $a$.




C) When removed, the label on a cylindrical can is a rectangle. Suppose the height ($H$) of the can is 4 times the radius ($r$) of the base. The label is placed in quadrant 1 of the $xy$-plane as shown in the diagram at the right. The distance from point $O$ to point $P$ can be expressed in terms of $H$ and $r$ in simplest form as $\dfrac{\sqrt{A\pi^2 + B}}{C}\dfrac{H^2}{r}$, where $A$, $B$ and $C$ are positive integers. Compute the ordered triple $(A, B, C)$.