MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 3 - DECEMBER 2008
ROUND 7 TEAM QUESTIONS

ANSWERS

A) _____ D) _____ : _____ AM PM

B) _____ E) _____

C) (_____ , _____) F) _____

A) A triangle has sides of length $x + 1$, $x + 3$ and $11 - 2x$. Find <u>two</u> values of x so that one angle of the triangle has a measure of 120°.

B) A positive 5-digit integer N has 13 as its rightmost two digits, has a digit sum of 13 and is divisible by 13. Determine the <u>sum</u> of the smallest and largest such integers.

C) In the xy-plane, the graph of $(a + 2)x + ay + b = 0$ is 1 unit from the origin. Determine the ordered pair (a, b), if b must be the <u>minimum</u> positive value for which this is true.

D) Connie was last seen alive at 10pm last evening. According to the police report, she was found dead the next morning. It was a cool fall night and the air temperature was 65° F all night long. The CSI unit arrived on the scene and at 6:45am determined that the body temperature was 90° F and a half hour later had dropped to 89.5° F . Applying Newton's law of cooling, the time of the murder can be determined. *Help solve this crime*! Rounding to the nearest 15 minutes, at what time did the murder occur?

$$T(t) = T_a + (T_0 - T_a)e^{-kt}, \text{ where}$$

$T(t)$ denotes temperature at time t.
T_a denotes the air temperature.
T_0 denotes the initial temperature of the deceased's body.
Assume at the time of her death Connie's body temperature was 98.6° F.

Note: In the formula above, e denotes the base of natural logarithms.
On the scientific calculator, these functions are accessed using the ln and e^x keys.