MASSACHUSETTS MATHEMATICS LEAGUE
DECEMBER 2003
ROUND 6: POLYGONS

ANSWERS

A) 21

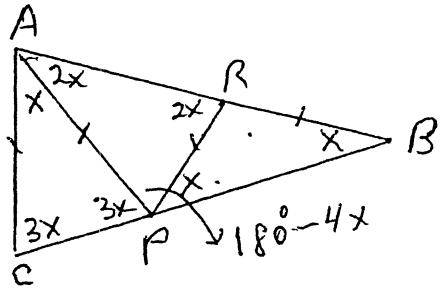
B) 180/7°

C) $24\sqrt{5}$

A) Calculate the number of diagonals that can be drawn from a single vertex in a regular polygon whose interior angles each measure 165 degrees.

$n = \frac{360}{180-165} = \frac{360}{15} = 24$. The number of diagonals from a single vertex is $n-3 = 21$.

B) A pennant is designed in the shape of an isosceles triangle, triangle ABC with vertex angle B. Points P and R are located on segments CB and AB respectively so that AC = AP = PR = RB. ~~To the nearest tenth,~~ Calculate the measure of angle B.

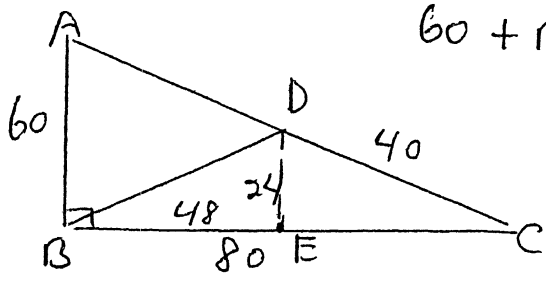


$3x + 3x + x = 180^\circ$

$7x = 180^\circ$

$x = \frac{180^\circ}{7} = 25.7^\circ$

C) A yard in the shape of a right triangle has sides that measure 60, 80, and 100 feet. A fence runs from the right angle to the hypotenuse separating the yard into two regions of equal perimeter. In simple radical form, calculate the length of the fence.



$60 + BD + (100 - CD) = 80 + CD + BD$

$160 - CD = 80 + CD$

$80 = 2CD$, $CD = 40$

$\triangle CDE \sim \triangle CAB$ so $EC = 32$

and $DE = 24$, so $BE = 80 - 32 = 48$

$BD = 24\sqrt{5}$