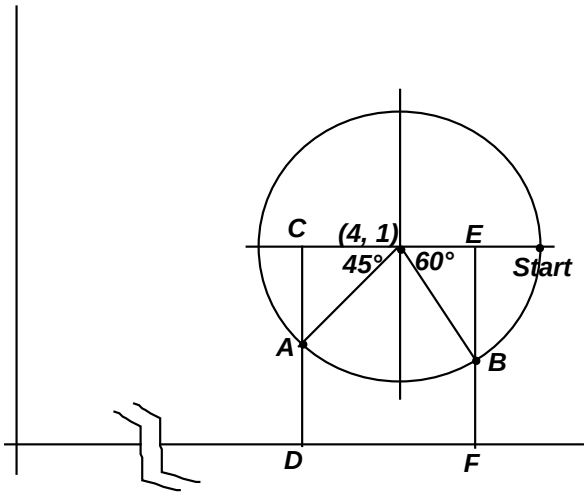
MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 6 - MARCH 2012 SOLUTION KEY

Team Round

C) $945° = 2(360°) + 225° \Rightarrow$ Q3 (45° reference angle)
$-1140° = -4(360°) + 300° \Rightarrow$ Q4 (60° reference angle)



$AD = CD - AC = 1 - \dfrac{r\sqrt{2}}{2}$

$BF = EF - EB = 1 - \dfrac{r\sqrt{3}}{2}$

$AD > BF \Rightarrow$ positive difference $= AD - BF$

$= \left(1 - \dfrac{r\sqrt{2}}{2}\right) - \left(1 - \dfrac{r\sqrt{3}}{2}\right) = \underline{\dfrac{\boldsymbol{r}}{\boldsymbol{2}}\left(\sqrt{\boldsymbol{3}} - \sqrt{\boldsymbol{2}}\right)}$

D) $\left(x^2 - 2x - 8\right)^2 = 2(x-1)^2 + 17 \Rightarrow \left(\left(x-1\right)^2 - 9\right)^2 = 2\left((x-1)^2 - 9\right) + 35$

Let $A = (x-1)^2 - 9$. Substitute, move the terms to the left side and factor.

$A^2 - 2A - 35 = (A-7)(A+5) = 0 \Rightarrow A = +7, -5$

$\Rightarrow (x-1)^2 - 9 = 7 \Rightarrow x - 1 = \pm 4 \Rightarrow x = 5, -3$ or

$\Rightarrow (x-1)^2 - 9 = -5 \Rightarrow x - 1 = \pm 2 \Rightarrow x = 3, -1$

Thus, there are 4 solutions: **<u>–3, –1, 3, 5</u>**