

*University of North Georgia*  
*Sophomore Level Mathematics Tournament*  
*April 11, 2015*

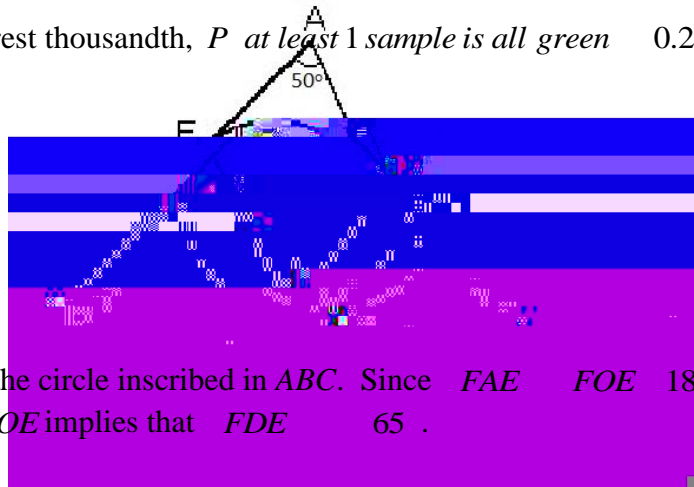
**Solutions for the Afternoon Team Competition**

Round 1

If you give 1 cookie to the first friend, 2 cookies to the second friend, etc., after 19 friends you have 190 cookies.

So, rounded to the nearest thousandth,  $P$  at least 1 sample is all green = 0.200.

Round 4



Let  $O$  be the center of the circle inscribed in  $ABC$ . Since  $\angle FAE = \angle FOE = 180^\circ$ , then  $\angle FOE = 130^\circ$ . Also,  $2 \angle FDE = \angle FOE$  implies that  $\angle FDE = 65^\circ$ .

Round 5

For the first line:  $y - 3x = 0$ , so  $y = 3x$  and  $m_1 = 3$ .

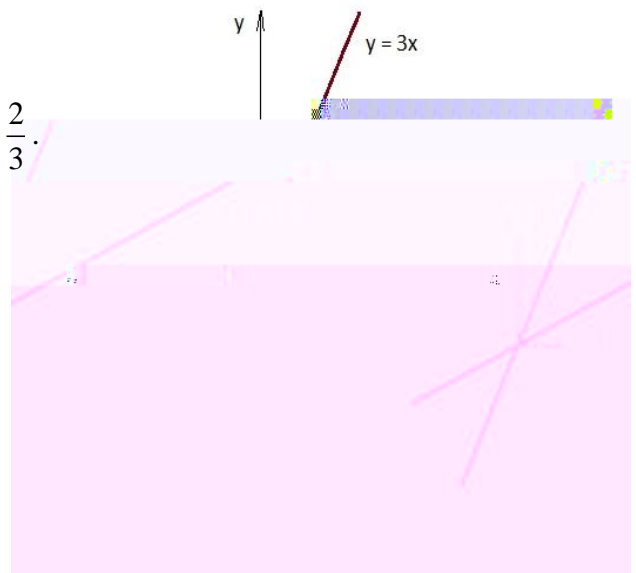
For the second line:  $2x - 3y = 1$ , so  $y = \frac{2}{3}x - \frac{1}{3}$  and  $m_2 = \frac{2}{3}$ .

Using the difference formula for tangent, we have

$$\tan \left| \frac{m_1 - m_2}{1 + m_1 m_2} \right| = \left| \frac{\frac{2}{3} - 3}{1 + 3 \cdot \frac{2}{3}} \right| = \left| \frac{\frac{7}{3}}{3} \right|.$$

So  $\tan \theta = \frac{7}{9}$ , then  $\theta = \tan^{-1} \frac{7}{9} = 37.87^\circ$ .

Rounded to the nearest whole degree = 38



Round 6

The equation of the line through  $(a, 0)$  and  $(0, b)$  is  $\frac{x}{a} + \frac{y}{b} = 1$ . Since  $(4, 3)$  is on the line, we have

$\frac{4}{a} + \frac{3}{b} = 1$ . From this equation we get  $\frac{4}{a} = 1 - \frac{3}{b}$  and  $4b = 3a - ab$  then  $ab = 4b - 3a = 0$ .

Multiplying  $a = 4 - \frac{3}{b}$  gives  $ab = 4b - 3a = 12$ . Since  $ab = 4b - 3a = 0$ , we have  $a = 4 - \frac{3}{b} = 12$ .

Round 7

Find the roots of the quadratic using the quadratic formula.

Adding the roots gives:  $\tan \frac{P}{2} + \tan \frac{Q}{2} = \frac{b}{a}$

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Hence  $A = \frac{1}{100}$ .

Round 10

Since  $ABCDE = 25000$  either  $A = 1$  or  $A = 2$  and  $B = 1, 2, \text{ or } 4$ .

Since  $EDCBA$  is also even