



**Intermediate Math Circles**  
**Wednesday November 12 2014**  
**Problem Set**

1. The point  $(a, 2)$  is the point of intersection of the lines with equations  $y = 2x - 4$  and  $y = x + k$ . Determine the value of  $k$ .
2. Graph the following regions.

a)  $y \leq -2$       b)  $x > 3$       c)  $y \geq 2x - 5$       d)  $2x + y < 4$

3. To find  $x$ -intercepts, set  $y = 0$  and solve for  $x$ . To find  $y$ -intercepts, set  $x = 0$  and solve for  $y$ . Graph the following regions by finding intercepts.

a)  $3x - 4y > 12$       b)  $5x + 3y \leq 5$

4. Graph the feasible region given the following inequalities in each of the following:

(a) $x + y \leq 9$ $x + 2y \leq 15$ $2x + y \leq 15$ $x \geq 0, y \geq 0$	(b) $x + 2y \geq 6$ $2x + y \geq 5$ $2x + 3y \geq 10$ $x \geq 0, y \geq 0$
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5. A formula for converting Celsius temperature  $C$  to a Fahrenheit temperature  $F$  is given by  $F = \frac{9}{5}C + 32$ .

Andrew does not like arithmetic. So he approximates the Fahrenheit temperature by doubling  $C$  and then by adding 30 to get  $f$ .

If  $f < F$ , then the error in the approximation is  $F - f$ ; otherwise, the error in the approximation is  $f - F$ . Determine the largest possible error in the approximation that Andrew would make when converting Celsius temperatures  $C$  with  $20 \leq C \leq 35$ .

6. Suppose that  $x$  and  $y$  are positive numbers with

$$xy = \frac{1}{9}$$
$$x(y + 1) = \frac{7}{9}$$
$$y(x + 1) = \frac{5}{18}$$

What is the value of  $(x + 1)(y + 1)$ ?

7. The line  $y = -\frac{3}{4}x + 9$  crosses the  $x$ -axis at  $P$  and the  $y$ -axis at  $Q$ . Point  $T(r, s)$  is on line segment  $\overline{PQ}$ . If the area of  $\triangle POQ$  is three times the area of  $\triangle TOP$ , then what is the value of  $r + s$ ?
8. A triangle has vertices  $A(0, 3)$ ,  $B(4, 0)$ ,  $C(k, 5)$ , where  $0 < k < 4$ . If the area of the triangle  $\triangle ABC$  is 8, determine the value of  $k$ .