# Graphic Organizer #1
## Solving Systems Involving Circles

**Circle and Lines**

$(x-20)^2 + (y-20)^2 = 25$ ← Circle

$y - 20 = \dfrac{3}{4}(x-20)$ ← Line

**Step 1:** Convert the linear equation to slope – intercept form. (Be careful, this may be done for you.)

$y - 20 = \dfrac{3}{4}(x-20)$

$y - 20 = \dfrac{3}{4}x - \dfrac{60}{4}$

$y - 20 = \dfrac{3}{4}x - 15$

$\phantom{y-}\,+20 \qquad\qquad +20$

$\boxed{y = \dfrac{3}{4}x + 5}$ ← expression

**Step 2:** Substitute your equation from step 1 into the circle equation for y.   *expression*

$(x-20)^2 + (y-20)^2 = 25$

$(x-20)^2 + \left(\boxed{\tfrac{3}{4}x+5} - 20\right)^2 = 25$

$(x-20)^2 + \left(\tfrac{3}{4}x-15\right)^2 = 25$

**Step 3:** Square the binomials.   → or expand

Binomial #1:

$(x-20)^2 = (x-20)(x-20) = \boxed{x^2 - 40x + 400}$

Binomial #2:

$\left(\tfrac{3}{4}x-15\right)^2 = \left(\tfrac{3}{4}x-15\right)\left(\tfrac{3}{4}x-15\right)$

$= \dfrac{9}{16}x^2 - \dfrac{45}{4}x - \dfrac{45}{4}x + 225$

$= \boxed{\dfrac{9}{16}x^2 - \dfrac{45}{2}x + 225}$

$x^2 - 40x + 400 + \dfrac{9}{16}x^2 - \dfrac{45}{2}x + 225 = 25$

**Step 4:** Combine like terms and write the equation in standard form.

*(cloud note: multiply every term by 16 to set rid of denominator)*

$x^2 - 40x + 400 + \dfrac{9}{16}x^2 - \dfrac{45}{2}x + 225 = 25$

$x^2 - 40x + \dfrac{400}{16} + \dfrac{9}{16}x^2 - \dfrac{45x}{2} + \dfrac{200}{16} = 0$

$16x^2 - 16\cdot40x + 16\cdot\dfrac{400}{16} + 9x^2 - 360x + 16\cdot600 = 0$

$25x^2 - 1000x + 9600 = 0$

**Step 5:** Use the quadratic formula (or any method) to find the two values for x.

$25x^2 - 1000x + 9600 = 0$

$a = 25$

$b = -1000$

$c = 9600$

$x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$= \dfrac{-(-1000) \pm \sqrt{(-1000)^2 - 4(25)(9600)}}{2(25)}$

$= \dfrac{1000 \pm \sqrt{(-1000)^2 - 4(25)(9600)}}{2(25)}$    so

$\therefore \boxed{x_1 = 24}$ or $\boxed{x_2 = 16}$

**Step 6:** Substitute the values of x into the linear equations (from Step 1) to find the two values for y.

$x = 24$

$y = \tfrac{3}{4}x + 5 = \tfrac{3}{4}(24) + 5 = 23$

$x = 16$

$y = \tfrac{3}{4}x + 5 = \tfrac{3}{4}(16) + 5 = 17$

**Step 7:** Write the solution set. Write the values as ordered pairs.

$(24, 23)$

$(16, 17)$

# Graphic Organizer #2
## Solving Systems Involving Circles

Circle and Circles

$$x^2 + y^2 - 2 = 0$$
$$x^2 + y^2 + 8x - 10 = 0$$

**Step 1:** Subtract the equations to eliminate the squared terms. (Make sure the equations are written in general form.)

①  $x^2 + y^2 - 2 = 0$
②  $x^2 + y^2 + 8x - 10 = 0$

Subtract ② from ①

①  $x^2 + y^2 + 0x = 2$
②  $x^2 + y^2 + 8x = 10$

$$\boxed{-8x = -8}$$

**Step 2:** Solve the equation for x or y depending on which variable is still there.

$$\frac{-8x}{-8} = \frac{8}{-8}$$

$$\boxed{x = 1}$$

**Step 3:** Substitute the answer from step 2 into the equations and solve for the other variable.

Can substitute into ① or ②.
① is easier. So x = 1,

$$x^2 + y^2 - 2 = 0$$
$$(1)^2 + y^2 - 2 = 0$$
$$1 + y^2 - 2 = 0$$
$$y^2 - 1 = 0$$
$$y^2 = 1 \implies y = \pm 1$$

**Step 4:** Write the solutions as ordered pairs.

$$(1, 1)$$
$$(1, -1)$$