

1. With your three points chosen for your circle, you have three ways of substituting for x and y, leaving h, k, and r as unknown. Call these equations 1, 2, and 3. For a circle passing through points (2, -1), (4, 3) and (-5, -3) they might look something like this:

$$(2 - h)^2 + (-1 - k)^2 = r^2$$

$$(4 - h)^2 + (3 - k)^2 = r^2$$

$$(-5 - h)^2 + (-3 - k)^2 = r^2$$

- a. Note: do not use any of these equations in your assignment. These are just offered as an example.
2. The equations are all equal to  $r^2$ , so you can make any two of them equal to each other, such as:

$$(2 - h)^2 + (-1 - k)^2 = (4 - h)^2 + (3 - k)^2.$$

3. Reduce this to one variable. That is, solve for h in terms of k. The squared terms should subtract out. For the above working, I obtained  $h = 5 - 2k$ .
4. Make the last two equations equal. Re-express completely in terms of k and expand.

Example of a substitution for  $h = 5 - 2k$ :

$$(4 - h)^2 + (3 - k)^2 = (-5 - h)^2 + (-3 - k)^2$$

$$(4 - 5 + 2k)^2 + (3 - 2k)^2 = (-5 - 5 + 2k)^2 + (-3 - 2k)^2$$

Expand and gather terms. You eventually end up with a value for k (in my case  $k = \frac{99}{24} = 4.125$ ).

5. Use your new k value to solve for h (in my case  $h = 5 - 2k = 5 - 8.25 = -3.25$ ).
6. Using any of the three equations you created, find the radius r. Example:

$$(-5 - h)^2 + (-3 - k)^2 = r^2$$

$$r = \sqrt{(-5 + 3.25)^2 + (-3 - 4.125)^2} \approx \sqrt{53.828} \approx 7.34$$

7. State the equation for the circle using h, k and r. Example:

$$(x + 3.25)^2 + (y - 4.125)^2 = 53.828$$