The Equation of a Circle

$$(x-h)^2 + (y-k)^2 = r^2$$

center (h, k)

radius $= r$

1. Identify the center and radius of each circle.

a) $(x+4)^2 + (y-3)^2 = 25$

center: $(-4, 3)$
radius $= \sqrt{25} = 5$

b) $(x-1)^2 + (y-6)^2 = 1$

center: $(1, 6)$
radius $= \sqrt{1} = 1$

c) $x^2 + (y-1)^2 = \dfrac{4}{81}$

center: $(0, 1)$
radius $= \sqrt{\dfrac{4}{81}} = \dfrac{2}{9}$

d) $\left(x - \dfrac{1}{2}\right)^2 + \left(y + \dfrac{3}{2}\right)^2 = .04$

center: $\left(\dfrac{1}{2}, \dfrac{-3}{2}\right)$ OR $(.5, -1.5)$
radius $= \sqrt{.04} = 1.2$

e) $x^2 + y^2 = 2$

center: $(0, 0)$
radius $= \sqrt{2}$ OR 1.4

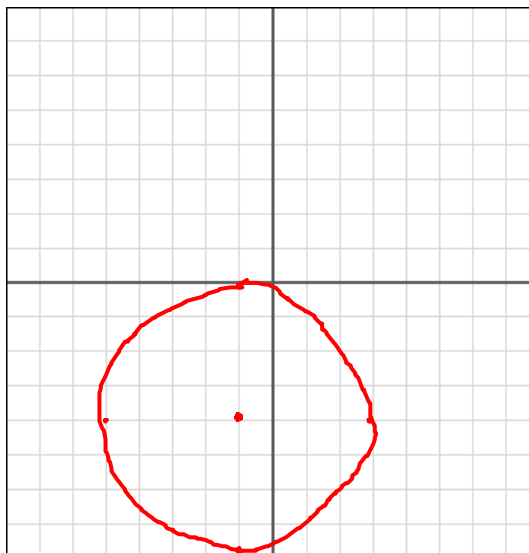2. Write the equation of each circle and sketch the graph.

a) center $(-1, -4)$
   radius $= 4$

$$(x-h)^2 + (y-K)^2 = R^2$$

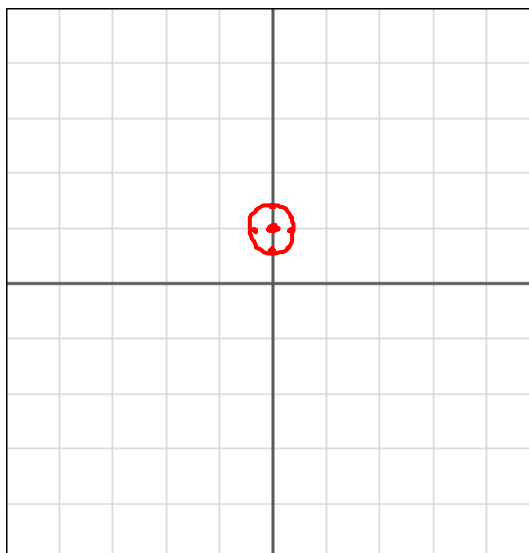$$(x+1)^2 + (y+4)^2 = (4)^2$$

$$\boxed{(x+1)^2 + (y+4)^2 = 16}$$

b) center $(0,1)$
   radius $= \dfrac{1}{3}$

$$(x-h)^2 + (y-K)^2 = R^2$$

$$(x-0)^2 + (y-1)^2 = \left(\frac{1}{3}\right)^2$$

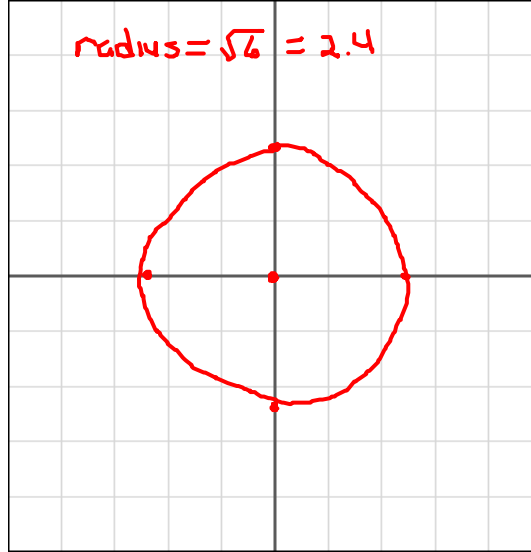$$\boxed{x^2 + (y-1)^2 = \frac{1}{9}}$$

c) center is at the origin $(0,0)$

radius $= \sqrt{6}$

$(x-h)^2 + (y-K)^2 = R^2$

$(x-0)^2 + (y-0)^2 = (\sqrt{6})^2$

$\boxed{x^2 + y^2 = 6}$

radius $= \sqrt{6} = 2.4$

d) center $\left(\dfrac{2}{3}, 0\right)$

radius $= 5\sqrt{2}$

$(x-h)^2 + (y-K)^2 = R^2$

$\left(x - \dfrac{2}{3}\right)^2 + (y-0)^2 = \left(5\sqrt{2}\right)^2$

$\boxed{\left(x - \dfrac{2}{3}\right)^2 + y^2 = 50}$

$5\sqrt{2} \times 5\sqrt{2} = 25(2) = 50$
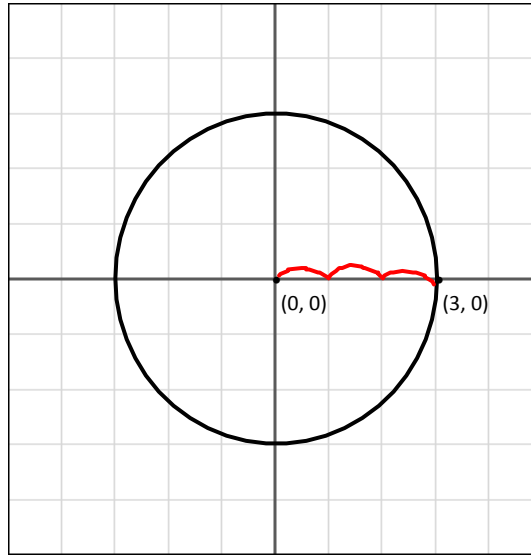
$R^2 = 50$

radius $= 5\sqrt{2} = 7.1$

3. Write the equation for each circle.

a) Center: $(0,0)$
   radius: 3

$(x-h)^2 + (y-k)^2 = R^2$

$(x-0)^2 + (y-0)^2 = (3)^2$

$$\boxed{x^2 + y^2 = 9}$$

(0, 0) (3, 0)

b) Center: $(4,-1)$

$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
   $\phantom{d = \sqrt{}}x_1\, y_1 \qquad x_2\, y_2$
   $(4,-1)\quad (7,-3)$

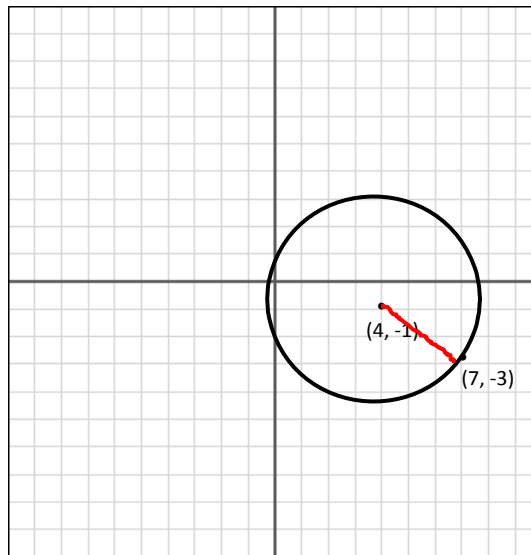$d = \sqrt{(7-4)^2 + (-3--1)^2}$

$d = \sqrt{(3)^2 + (-2)^2}$
$d = \sqrt{9+4}$
$d = \sqrt{13}$
radius $= \sqrt{13}$

$(x-h)^2 + (y-k)^2 = R^2$
$(x-4)^2 + (y+1)^2 = (\sqrt{13})^2$

$$\boxed{(x-4)^2 + (y+1)^2 = 13}$$

(4, -1) (7, -3)

4. Write the equation of the circle where the endpoints of the diameter are (-6, 2) and (1, -3).
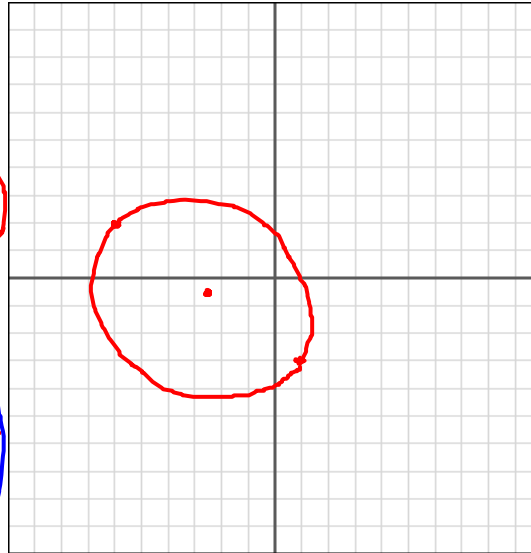
$x_1 y_1 \quad x_2 y_2$

Center:

$(x_m, y_m) = \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2} \right)$

$\left(\dfrac{-6+1}{2}, \dfrac{2+-3}{2} \right) = \left(\dfrac{-5}{2}, \dfrac{-1}{2} \right)$

$(-2.5, -.5)$

center: $(-5/2, -1/2)$

radius: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
$d = \sqrt{(1--6)^2 + (-3-2)^2}$

$d = \sqrt{(7)^2 + (-5)^2}$
$d = \sqrt{49+25}$
$d = \sqrt{74}$
diameter $= \sqrt{74}$ radius $= \dfrac{\sqrt{74}}{2}$

$(x - h)^2 + (y - k)^2 = R^2$
$\left(x + \dfrac{5}{2}\right)^2 + \left(y + \dfrac{1}{2}\right)^2 = \left(\dfrac{\sqrt{74}}{2}\right)^2$
$(x + 5/2)^2 + (y + 1/2)^2 = \dfrac{37}{2}$

$\dfrac{\sqrt{74}}{2} \cdot \dfrac{\sqrt{74}}{2} = \dfrac{74}{4}$

$\dfrac{74}{4} \div 2 = \dfrac{37}{2}$