1. (20 points) Find the center and radius of a circle with the following equation. Show all work.

$$x^2 + y^2 - 10x - 4y + 24 = 0$$

You have to complete the square in both x and y.

$$\begin{aligned} x^2 + y^2 - 10x - 4y + 24 &= 0 \\ x^2 - 10x + y^2 - 4y &= -24 \\ x^2 - 10x + 25 + y^2 - 4y + 4 &= -24 + 25 + 4 \\ (x-5)^2 + (y-2)^2 &= 5 \end{aligned}$$

Now we have the general form of an equation of the circle. From this we can tell that the center is at $(5, 2)$ and the radius is $\sqrt{5}$.

2. Let $A(1, -3)$ and $B(-9, -6)$ be the endpoints of the diameter of a circle. Show all work for each of the following.

(a) (3 points) Find the **center** of the circle.

The center of the circle is at the midpoint of the diameter.

$$\begin{aligned} \text{center} &= \Big(\frac{1 + (-9)}{2}, \frac{-3 + (-6)}{2}\Big) \\ &= \Big(\frac{-8}{2}, \frac{-9}{2}\Big) \\ &= \Big(-4, \frac{-9}{2}\Big) \end{aligned}$$

(b) (3 points) Find the **radius** of the circle.

The radius of the circle is half of the diameter. To find the diameter we use the distance formula for the two points given to be the endpoints of the diameter.

$$\begin{aligned} \text{diamter} &= \sqrt{(1 - (-9))^2 + (-3 - (-6))^2} \\ &= \sqrt{(1+9)^2 + (-3+6)^2} \\ &= \sqrt{10^2 + 3^2} \\ &= \sqrt{109} \\ \text{radius} &= \frac{\text{diameter}}{2} \\ &= \frac{\sqrt{109}}{2} \end{aligned}$$

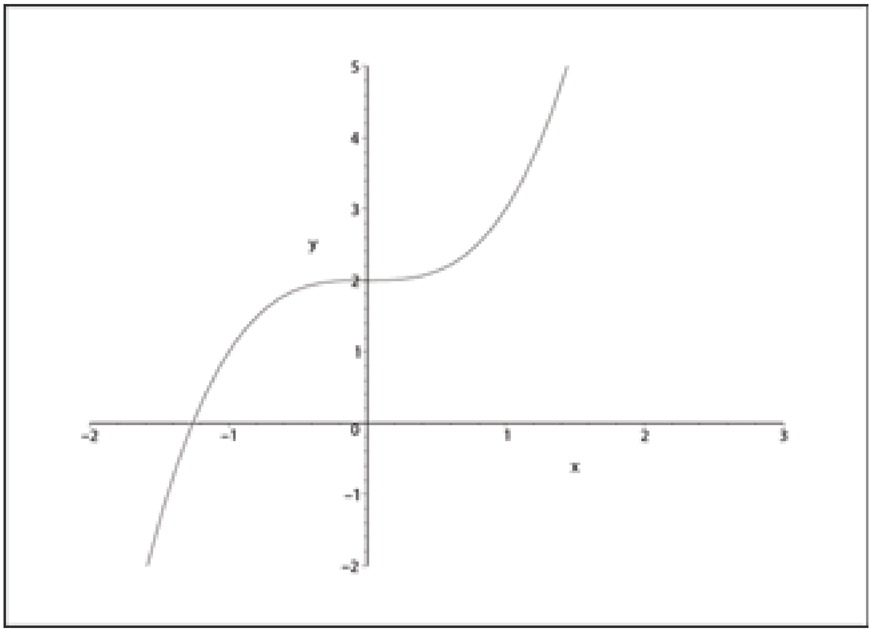
(c) (3 points) Find the **equation** of the circle.

From parts (a) and (b) we know the center and radius of the circle. So we can use the general form of the equation of a circle to get

$$\begin{aligned} (x - (-4))^2 + \Big(y - \frac{-9}{2}\Big)^2 &= \Big(\frac{\sqrt{109}}{2}\Big)^2 \\ (x+4)^2 + \Big(y + \frac{9}{2}\Big)^2 &= \frac{109}{4} \end{aligned}$$

3. Graph the equation $y = x^3 + 2$ on the viewing rectangle $[-2, 3]$ by $[-2, 5]$.

   (a) (3 points) Sketch the graph as you see it on the calculator.
   This graphic is not from your calculator, but it should look the same anyways.



   (b) (2 points) Using your calculator, approximate the x-intercept to two decimal places.
   x-intercept is $x = -1.26$