

In order to receive full credit, you must **show all your work** and simplify your answers.

1. (2 points) Identify the vertex of the graph $y = (x - 2)^2 - 3$:

Solution: Since the graph is obtained from $y = x^2$ with a horizontal shift right 2 units and a vertical shift down 3 units, the vertex is $(2, -3)$.

2. (2 points) Find the y -intercept of the graph:

Solution: To find the y -intercept, plug in $x = 0$, in which case $y = (0 - 2)^2 - 3 = 4 - 3 = 1$. So the y -intercept is at $(0, 1)$.

3. (3 points) Note that $(x - 2)^2 - 3 = x^2 - 4x + 1$.

- a. Use the quadratic formula to find the solutions of $x^2 - 4x + 1 = 0$:

Solution:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(1)}}{2(1)} = \frac{4 \pm \sqrt{16 - 4}}{2} = \frac{4 \pm \sqrt{12}}{2} = \frac{4 \pm 2\sqrt{3}}{2} = 2 \pm \sqrt{3}$$

These solutions represent the x -intercepts of the graph (since they are the x -values for which $y = x^2 - 4x + 1 = 0$!)

- b. What do the solution in part (a) represent on the graph?

Solution: These solutions represent the x -intercepts of the graph (since they are the x -values for which $y = x^2 - 4x + 1 = 0$!)

4. (3 points) Use the information above to sketch the graph. Label each piece of information on the graph. (You can use the approximation $\sqrt{3} \approx 1.7$)

Solution:

The x -intercepts are at $x = 2 + \sqrt{3} \approx 2 + 1.7 = 3.7$ and $x = 2 - \sqrt{3} \approx 2 - 1.7 = 0.3$:

