6. [5 points] Let $f(x) = -4x^2 + 12kx - 17$. Use the method of completing the square to rewrite this function in vertex form and then give the coordinates of the vertex.
Show your work step-by-step. Note: Your answers may involve the constant k.

Solution:
$$\begin{aligned} f(x) &= -4x^2 + 12kx - 17 \\ &= -4(x^2 - 3kx) - 17 \\ &= -4\left[x^2 - 3kx + \left(\frac{-3k}{2}\right)^2 - \left(\frac{-3k}{2}\right)^2\right] - 17 \\ &= -4\left[\left(x - \frac{3k}{2}\right)^2 - \frac{9k^2}{4}\right] - 17 = -4\left(x - \frac{3k}{2}\right)^2 + 9k^2 - 17 \end{aligned}$$

Vertex form: $f(x) = -4\left(x - \frac{3k}{2}\right)^2 + (9k^2 - 17)$

Vertex: $(3k/2, 9k^2 - 17)$

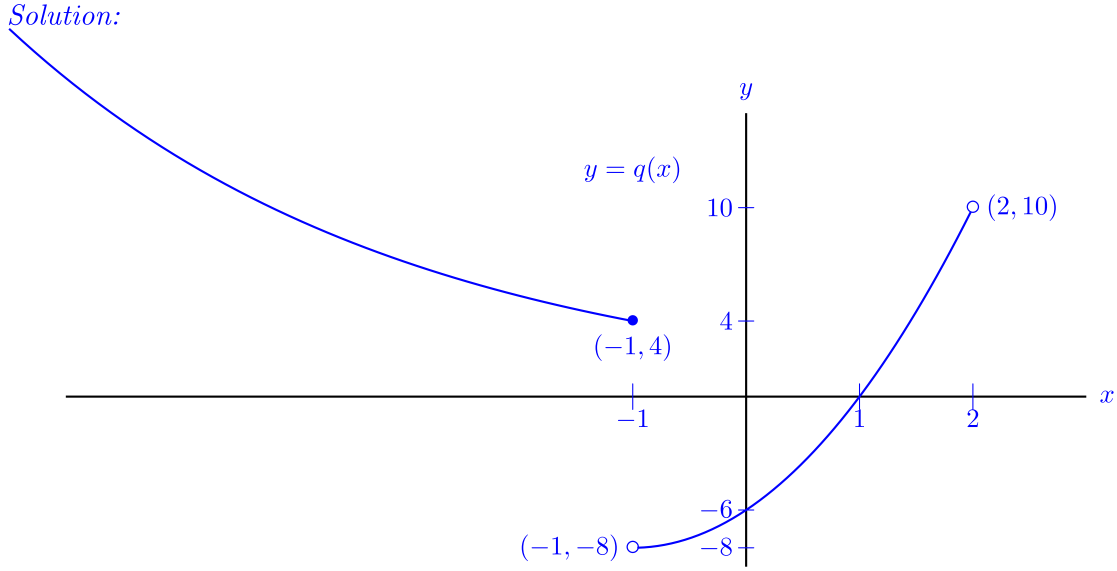
7. [10 points] Consider the function q defined by $q(x) = \begin{cases} 3(0.75)^x & \text{if } x \le -1 \\ 2(x+1)^2 - 8 & \text{if } -1 < x < 2 \end{cases}$

a. [2 points] Evaluate $q(q(0))$.

Solution: $q(q(0)) = q(2(0+1)^2 - 8) = q(2-8) = q(-6) = \boxed{3(0.75)^{-6}}$.

b. [4 points] Sketch a graph of $y = q(x)$. Carefully label your axes and important points on your graph (including intercepts).

Solution:



c. [4 points] Find the domain and range of q. (Use either interval notation or inequalities.)

Solution: Based on the given formula, we see that the domain of q is the interval $(-\infty, 2)$ and using the graph from part (b), we conclude that the range of q is the interval $(-8, \infty)$.

Domain: $(-\infty, 2)$ **Range:** $(-8, \infty)$