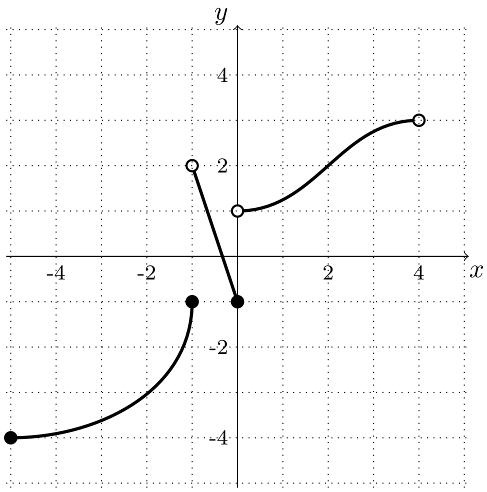
1. [13 points] Let $j(x)$ be a function with domain $[-10, 13]$; some values of $j(x)$ are given in the table below.

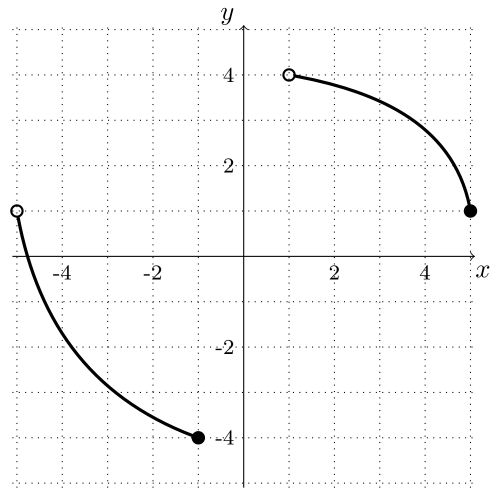
x	-10	-4	0	1	7	13
$j(x)$	-4	-2	1	1.5	1.8	1.9

The graphs of $y = k(x)$ and $y = \ell(x)$ are given below. Note that $\ell(x)$ is an invertible function.

GRAPH OF $y = k(x)$



GRAPH OF $y = \ell(x)$



a. [4 points] Based on the information above, which of the following statements *could* be true about the function $j(x)$ on $[-10, 13]$? **Circle all that apply**. You may use the space below for scratch work, but **you do not need to show any work for this part**.

$j(x)$ is concave up.

$j(x)$ is an increasing function.

$j(x)$ is a linear function.

$j(x)$ is concave down.

$j(x)$ is a decreasing function.

$j(x)$ is a vertical shift of k.

$j(x)$ is neither concave up nor concave down.

$j(x)$ is a quadratic function with vertex $(0, 1)$.

$j(x) = ab^x$ for some constants $a, b > 0$.

b. [2 points] What is the range of the function $\ell(x)$? **You do not need to show any work for this part**, but write your answer *in the space provided, using inequalities or interval notation.*

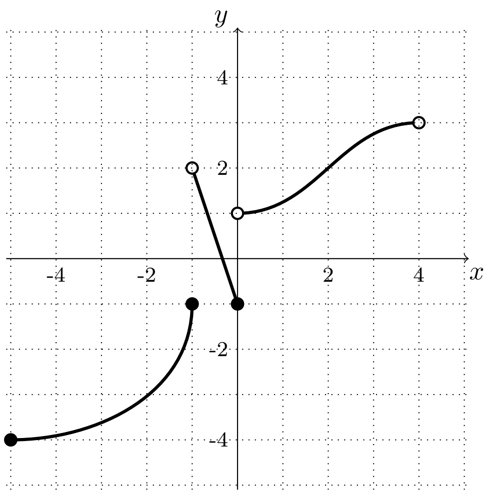
The range of $\ell(x)$ is $[-4, 4)$

THIS PROBLEM CONTINUES ON THE NEXT PAGE

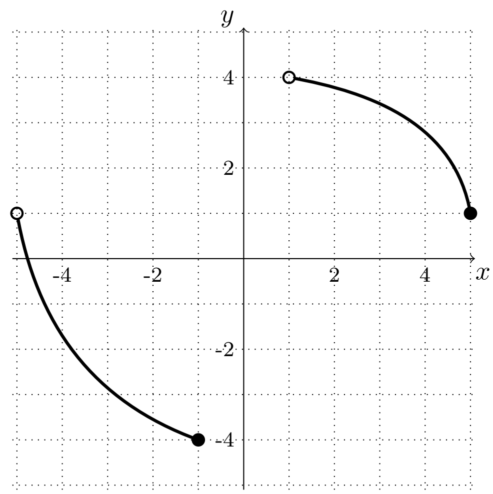
The table for $j(x)$, as well as the graphs of $y = k(x)$ and $y = \ell(x)$, have been reproduced below for your convenience.

x	-10	-4	0	1	7	13
$j(x)$	-4	-2	1	1.5	1.8	1.9

GRAPH OF $y = k(x)$



GRAPH OF $y = \ell(x)$



c. [4 points] Evaluate the following expressions, writing your answers in the space provided. If the expression cannot be evaluated based on the information given, write UNDEFINED. You may use the space below for scratch work, but **you do not need to show any work for this part**.

$\ell^{-1}(5)$ UNDEFINED

$\ell^{-1}(1)$ 5

$j(-4)^{-1}$ $-\frac{1}{2}$

$j(k(-5))$ -2

d. [3 points] Find all values of x for which $\ell(k(x)) = -4$. **Show your work** and write your answer in the space provided. Write NONE if there are no such values of x.

Solution: From the graph of $y = \ell(x)$, we see that $\ell(k(x)) = -4$ when $k(x) = -1$. This happens when $x = -1$ or when $x = 0$.

$\ell(k(x))$ is -4 for $x = 0, -1$