Math 120 Section **Midterm II, February 23rd** **Winter 2023**

HONOR STATEMENT
I affirm that my work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam.

Name

Signature

Student ID #

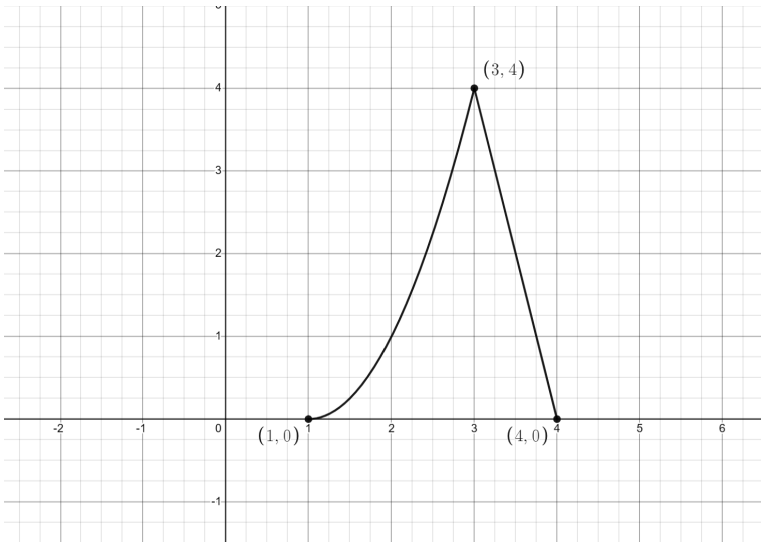
1.	2.	3.	$\sum$
10	10	10	30

- You have 50 minutes for 3 problems. Check your copy of the exam for completeness.
- You are allowed to use a hand written sheet of paper (8x11 in), back and front.
- Calculator : TI 30 X.
- Justify all your answers and show your work for credit.
- All answers must be exact, no rounding.

Do not open the test until everyone has a copy and the start of the test is announced.

GOOD LUCK!

Problem 1. Consider the function $f(x)$ whose graph is given.



(a) Graph of f

(a) What is $f(f(2))$?

(b) Is $f(x)$ one-to-one? Explain your answer.

(c) If $g(x) = \frac{1}{4}f\left(-\frac{1}{2}x + 1\right)$, which four transformations has f undergone and in which order? Add the relevant number of units for shifts/dilation factor/reflection axis when applicable.

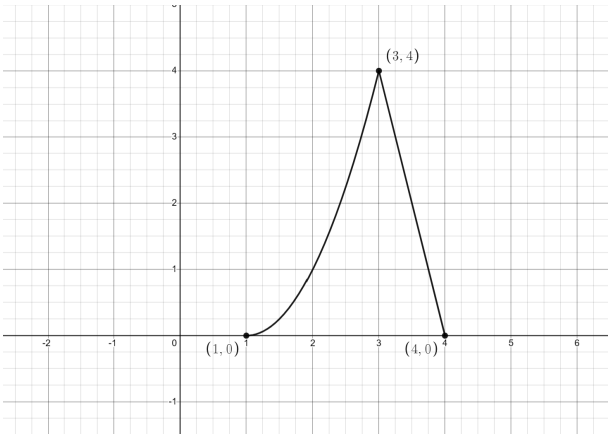
I:

II:

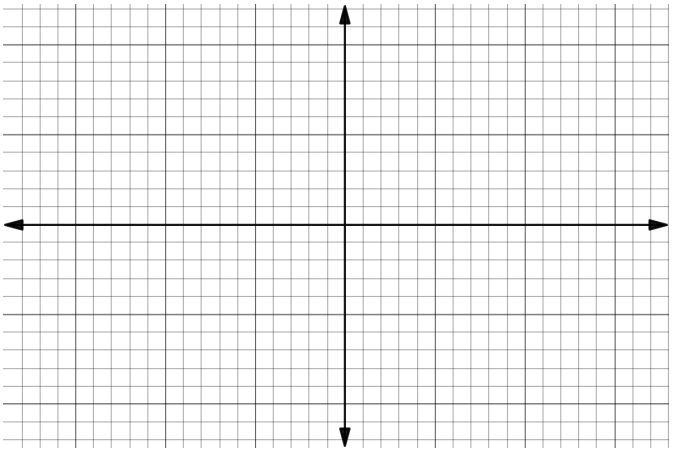
III:

IV:

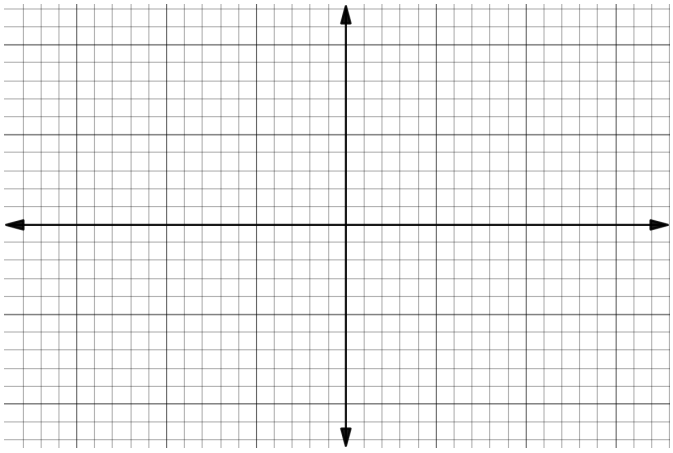
(d) In the coordinate systems in (b)-(e) on the next page, sketch the graph of the transformed f after each step you indicated in (c). The final graph (e) should be that of $g(x)$. You must **label all axes, mark units and you must make sure that the three given points** $(1, 0), (3, 4), (4, 0)$ appear in their exact coordinates after the respective (sequence of) transformations.



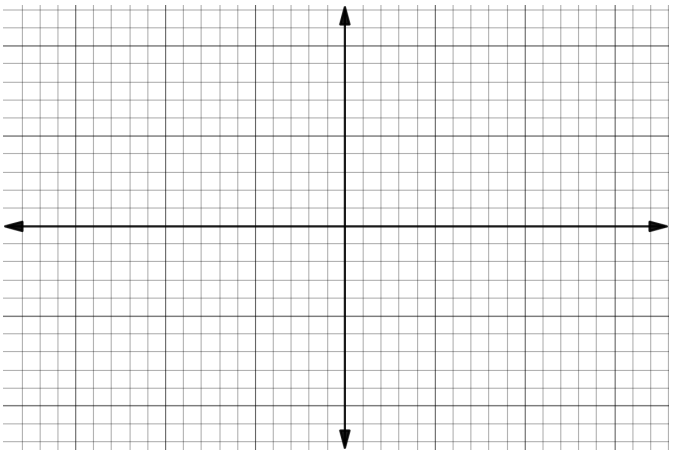
(a) Graph of f - below find $\frac{1}{4}f\left(-\frac{1}{2}x+1\right)$



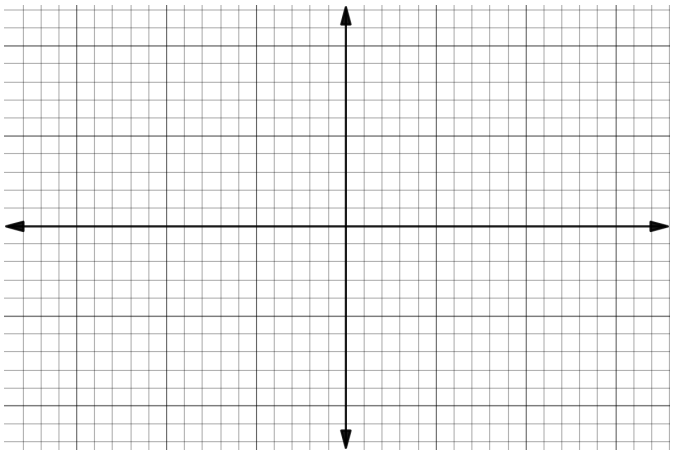
(b) Graph after first transformation



(c) Graph after second transformation



(d) Graph after third transformation



(e) Graph after final transformation

Problem 2. Town A has $70,000$ inhabitants at the beginning of 2020 and it is expected to grow by 4% every three years. Town B has $60,000$ inhabitants at the beginning of 2020 and grows exponentially so that there are $66,000$ inhabitants 3 years later. In which year will both towns have the same number of inhabitants? (For computations keep 6 decimal places, but indicate the full year when the numbers will be equal).

Problem 3. (a) Given the function $f(x) = \frac{1}{1+(x-1)^2}$ on the domain $x \leq 1$. Find the rule of the inverse function of $f(x)$.

(b) In the following coordinate system you find the graph of a function $g(x)$ (solid line) as well as the line $y = x$ (dashed line). Sketch the inverse function of $g(x)$ in the same coordinate system. At least two points on the inverse function should be exact.