MATH 111I: Exam 2
Spring — 2025
03/27/2025
75 Minutes

Name: _____

Write your name on the appropriate line on the exam cover sheet. This exam contains 12 pages (including this cover page) and 12 questions. Check that you have every page of the exam. Answer the questions in the spaces provided on the question sheets. Be sure to answer every part of each question and show all your work. If you run out of room for an answer, continue on the back of the page — being sure to indicate the problem number.

Question	Points	Score
1	8	
2	8	
3	8	
4	10	
5	8	
6	8	
7	8	
8	10	
9	8	
10	9	
11	8	
12	7	
Total:	100	

1. (8 points) Showing all your work, factor the following as must as possible:

   (a) $x^2 + 13x - 90$

   (b) $9x^2 - 16$

2. (8 points) Showing all your work, solve the following equation:

$$x(x + 4) = 45$$

3. (8 points) Showing all your work, solve the following equation:

$$x^2 - 60 = 4x$$

4. (10 points) Consider the quadratic function $f(x) = 3 - (x+8)^2$.

    (a) What is the vertex for $f(x)$?

    (b) What is the domain of $f(x)$?

    (c) Is $f(x)$ concave up or concave down? Justify your answer.

    (d) Does $f(x)$ have a maximum value or a minimum value? Explain.

    (e) Find the maximum or minimum value for $f(x)$—whichever exists.

    (f) What is the range of $f(x)$?

5. (8 points) Showing all your work, solve the following equation:

$$x = \sqrt{x} + 2$$

6. (8 points) Showing all your work, find the vertex form of $x^2 - 16x + 78$.

7. (8 points) Showing all your work, factor the following as must as possible:

(a) $3x^2 + 23x - 8$

(b) $x^3 - x^2 - 2x$

8. Consider the quadratic function $72x^2 - 121x + 45$.

   (a) (3 points) Use the discriminant of the given quadratic to explain why it factors *without* explicitly factoring it.

   (b) (4 points) Use the quadratic formula to find the x-intercepts of the given quadratic.

   (c) (3 points) Use the previous part to factor the given quadratic.

9. (8 points) For each of the given functions below, find functions $f(x)$ and $g(x)$ so that the given function can be written as $f\left(g(x)\right)$.

    (a) $(x+9)^5$

    (b) $\dfrac{1}{3x-7}$

10. (9 points) Showing any necessary work, find the domain of each of the following functions:

   (a) $x^3 + 6x - 8$

   (b) $\sqrt{x - 3}$

   (c) $\dfrac{1}{x + 7}$

11. (8 points) Three parts are given below. **Choose any <u>two</u> parts and complete these parts—showing all your work.** Cross out the part that you *do not* want graded.

   (a) Compared to the graph of $f(x)$, describe the graph of $y = -4f(x+1)$ in terms of $f(x)$.

   (b) Find the function whose graph is the graph of a function $f(x)$ reflected through the y-axis, then shifted 3 units to the left, and then finally shifted 5 units down.

   (c) The graph of $f(x)$ is shown below in black (the *very* thick function). Determine what the function plotted in red is in terms of $f(x)$.
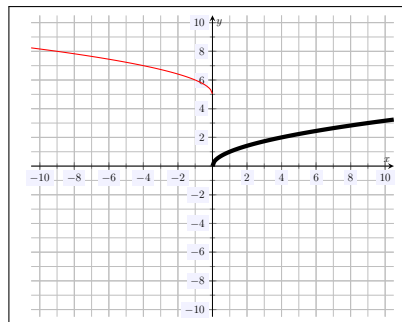
12. (7 points) Let $f(x)$ be the function $f(x) = 2x - 5$.

    (a) The graph of $f(x)$ is shown below.
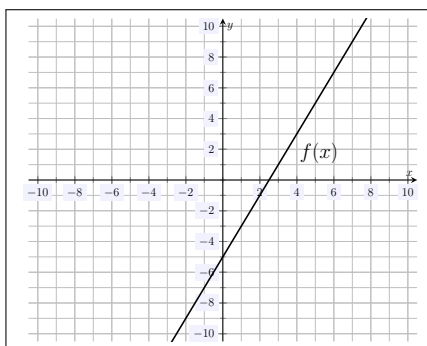
    Explain why the function $f(x)$ has an inverse, i.e. explain why $f^{-1}(x)$ exists.

    (b) Showing all your work, find $f^{-1}(x)$.