

Homework 1: Mathematical Foundations

Math 124, Fall 2026 at the University of Michigan

due Tuesday, September 8th at 11:59PM

Write your solutions to the following problems either by writing them on a piece of paper or on a tablet and scanning your answers as a PDF. Note that you are not allowed to use LaTeX, Google Docs, or any other digital document creation software to type your answers. Homeworks are due to Pensive by 11:59PM on the due date. See the [syllabus](#) for details on the slip day policy.

Homework will be evaluated not only on the correctness of your answers, but on your ability to present your ideas clearly and logically. You should always explain and justify your conclusions, using sound reasoning. Your goal should be to convince the reader of your assertions. If a question does not require explanation, it will be explicitly stated.

Before proceeding, make sure you're familiar with the [collaboration policy](#).

Total Points: $24 + 14 + 16 + 16 + 16 + 14 = 100$

Problem 1: Triangle Time (24 pts)

Solve each part using any method you'd like. But, as with all homework problems, explain your solutions clearly. For expressions involving square roots or inverse trigonometric functions, make sure to provide both the unsimplified expression (e.g. $2 \cos^{-1}(\frac{1}{3})$ or $\sqrt{15}$) **and** a rounded estimate to two decimal places (e.g. 141.06° or 3.87).

- a) (8 pts) Let $A = (1, 2)$, $B = (8, 1)$, and $C = (6, 8)$. Compute the area of the triangle ABC. See [here](#) on Ed for a hint.
- b) (8 pts) A right triangle has side lengths 9 cm, 18 cm, and x cm. Compute **all possible** values of x , and find all three angles of the triangle in each case.
- c) (8 pts) In a triangle ABC , let side $a = 9$ cm, side $b = 17$ cm, and angle $C = 13^\circ$. Compute the length of side c , and the angles A and B in degrees. *Hint: use the law of cosines and law of sines.*

Problem 2: Paralleling the Lab Activity (14 pts)

Consider the line

$$2x - 3y = 6.$$

- a) (4 pts) Plot the line by hand. Make sure to label your axes and label at least two points on the line.
- b) (5 pts) Find an equation for a line that is parallel to this line and passes through the point $(5, 3)$.
- c) (5 pts) Find an equation for a line that is perpendicular to this line and passes through the point $(1, 2)$.

Problem 3: Bob the Builder (16 pts)

Write each of the following sets in set-builder notation. Refer to [Chapter 1.2](#) of the course notes and Lab 1 for examples.

- a) (4 pts) All even integers.
- b) (6 pts) All y -values of points on the parabola $y = x^2 + 3$.
- c) (6 pts) The unit circle in $\mathbb{R}^2$ (two-dimensional space), i.e., the circle with center $(0, 0)$ and radius 1.

Problem 4: Mathematical Feng Shui (16 pts)

In each of the following subparts, you are given a problem along with a potential solution. Identify the mistakes in each solution, and rewrite the solution so that it is mathematically valid. *Note that a solution may yield the right answer, but may make grammatical mistakes along the way.*

- a) (7 pts) Problem: Solve for x in the equation

$$3(x - 2) + 4 = 2x + 7.$$

Solution:

1		$3(x - 2) + 4 = 3x - 2 = 2x + 7 = x = 9.$
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- b) (9 pts) Problem: Solve the inequality

$$\frac{1}{x} > 2.$$

Solution:

1		$\frac{1}{x} > 2$
2		$1 > 2x$
3		$x < \frac{1}{2}$
4		So, the solution set is $\{x \in \mathbb{R} : x < \frac{1}{2}\}.$

Problem 5: A Systematic Start (16 pts)

A big focus of this class is learning how to solve systems of equations at scale. For now, let's review your prior knowledge of solving systems. Each part of this problem defines a system of equations — your job is to state it and solve it without any calculator or software assistance.

- a) (7 pts) The University of Michigan has been hacked by conniving tricksters, and now their football ticket prices are all wrong! One boothsperson reported that they sold 3 student tickets and 5 adult tickets for \$87.50. Another boothsperson reported that they sold 41 student tickets and 6 adult tickets for \$217.20. What are the current costs of 1 student ticket and 1 adult ticket?
- b) (9 pts) You, Sarah, and Stephen each have a pet bug. Each bug begins at position 0 on the number line. A positive position means that the bug moved to the right of its starting point, while a negative position means that it moved to the left.

At the end of the experiment, the following statements are true:

- The sum of the three bugs' final positions is 35 centimeters.
- Five times your bug's position, plus four times Sarah's bug's position, plus Stephen's bug's position is 7 centimeters.
- Stephen's bug is 7 centimeters to the right of Sarah's bug.

Find the final position of each bug. If the winner is the bug whose final position has the greatest absolute value, which bug wins?

Problem 6: Programming Activity (14 pts)

Most homeworks and some labs will have a Jupyter Notebook, containing Python code that supplements our understanding of the relevant mathematical ideas of the week.

To open the notebook for Homework 1, click [this link](#). Instructions on how to use Google Colab are at math124.org/running-code.

You do not need to submit the notebook anywhere. To get credit for the work you did in this notebook, include screenshots of the following parts of your notebook as part of your PDF submission to Homework 1 on Pensive, specifically under Problem 6:

- A screenshot of the **code** you wrote in Task 2, to implement the sepia filter.
- A screenshot of the grayscale and sepia versions of the image you uploaded.