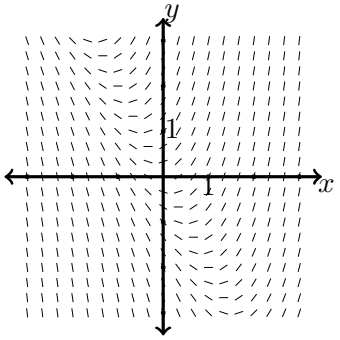
The following written homework problems are due on 9/15 (Wednesday) or 9/16 (Thursday).
Don't forget to also finish WebWork, log into Canvas, and complete the Academic Honesty form; these will be due with Homework 2.

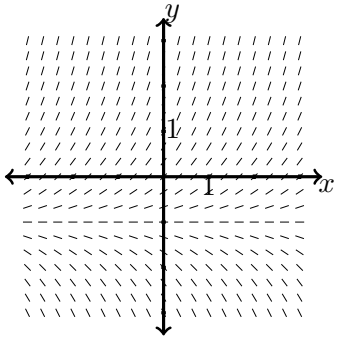
(1.1) Match each of the differential equations with its direction field below. Give a brief, unambiguous explanation for your choice. (At most one or two sentences for each part. "According to GeoGebra" doesn't count!)

(a) $y' = x^2 - y^2$

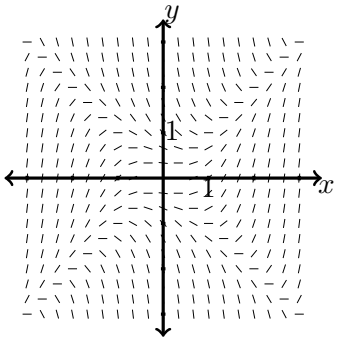


I

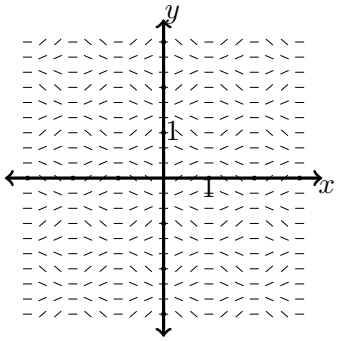
(b) $y' - y = 1$



II



III



IV

(1.2) **Newton's Law of Cooling** states that the rate of cooling of an object is proportional to the temperature difference between the objects and its surroundings, provided that this difference is not too large.

At 10:00 AM, your dad makes you a cup of chai that is $212°F$. The temperature of your house is fixed at $68°F$.

(a) Write a differential equation that expresses Newton's Law of Cooling that describes this situation. Use k as your constant of proportionality.

(b) Use Euler's method with a step size of 2 minutes to estimate the temperature of your cup of chai at 10:02 AM (your answer should be in terms of k).

(c) If your cup of chai was $190°F$ at 10:02 AM, use your answers from (a) and (b) to estimate k.

(1.3) For each of the following, be sure to briefly explain your answers (at most 1-2 sentences).

(a) Verify that all members of the family $y = \frac{1}{C-x}$ are solutions of the equation $y' = y^2$.

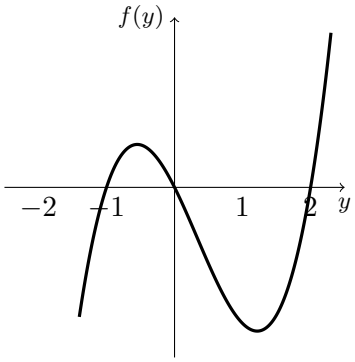
(b) Can you think of a solution of the differential equation $y' = y^2$ that is not a member of the family in part (b)?

(c) Find a solution of the initial-value problem $y' = y^2$, $y(2) = 3$.

(1.4) Professional Problem Skills Practice. Instead of a full professional problem, this week you're going to practice creating a nice graph with formatting suitable for inclusion in a professional problem. To accomplish this, **hand draw** a rough sketch of the direction field for the **autonomous** differential equation

$$y' = f(y),$$

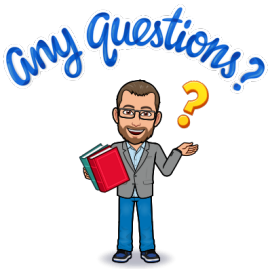
where the graph of f is shown below. Be sure to carefully label the important features of your plot and format it like a figure that would be included in a full problem, including necessary labels. Use one or two sentences after the figure to show that you know how to correctly reference your figure[1] in the body of the problem[2].



Hints: Read very carefully! In this graph, the horizontal axis is y; for a given y value, the graph shows you the value of $y' = f(y)$. In your direction field, the axes should be x and y. Recall that the lecture notes have a hint about direction fields for autonomous differential equations.

[1] You should not model your answer on the format of this question. The figure is not labeled, nor is it properly referenced.
[2] Any additional writing will not be graded and result in a point deduction for not following directions.

You should have questions! When you do, here's what to do:



1. Post your question on Canvas: http://canvas.umn.edu/
   The answers you get will help everyone in the class!
2. Email *all* of the instructors with your question.
3. Write your solution (even if you're unsure about it) and bring it to the study session. Ask an instructor *specific questions* about it.
4. Start an impromptu study session on Google Chat or similar service!

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