APPM 1350
Exam 1
Fall 2022

Name	
Student ID	
Instructor	**Section**

This exam is worth 100 points and has **4 problems**.

Make sure all of your work is written in the blank spaces provided. If your solutions do not fit, there is additional space at the end of the test. Be sure to **make a note** indicating the page number where the work is continued or it will **not** be graded.

Show all work and *simplify* your answers. Name any theorem that you use. Answers with no justification will receive no points unless the problem explicitly states otherwise.

Notes, papers, calculators, cell phones, and other electronic devices are not permitted.

End of Exam Check List

1. If you finish the exam before 7:45 PM:
   - Go to the designated area to scan and upload your exam to Gradescope.
   - Verify that your exam has been correctly uploaded and all problems have been labeled.
   - Leave the physical copy of the exam with your proctors.
2. If you finish the exam after 7:45 PM:
   - Please wait in your seat until 8:00 PM.
   - When instructed to do so, scan and upload your exam to Gradescope at your seat.
   - Verify that your exam has been correctly uploaded and all problems have been labeled.
   - Leave the physical copy of the exam with your proctors.

Formulas

$$\sin(2\theta) = 2\sin\theta\cos\theta \qquad \cos(2\theta) = 2\cos^2\theta - 1 = 1 - 2\sin^2\theta$$

1. (30 pts)

Evaluate the following limits and simplify your answers. If a limit does not exist, clearly state this.
(Reminder: You may not use L'Hopital's Rule or Dominance of Powers in any solutions on this exam.)

(a) $\lim_{x \to -5} \dfrac{|x^2 - 25|}{2x + 10}$

(b) $\lim_{x \to 0} \dfrac{5x - \tan(x)}{x}$

(c) $\lim_{x \to 0} \left(x^6 \sin\left(\dfrac{\pi}{x}\right) - 3 \right)$

2. (20 pts) Problems (a) and (b) are not related.

   (a) Suppose $\csc(\theta) = 5$ and $\cos(\theta) < 0$. Determine $\tan(2\theta)$.

   (b) Consider $f(x) = \cos(2x)$ and $g(x) = 3\cos(x) - 2$. Find all values of x on the interval $[0, 2\pi]$ that satisfy $f(x) = g(x)$.

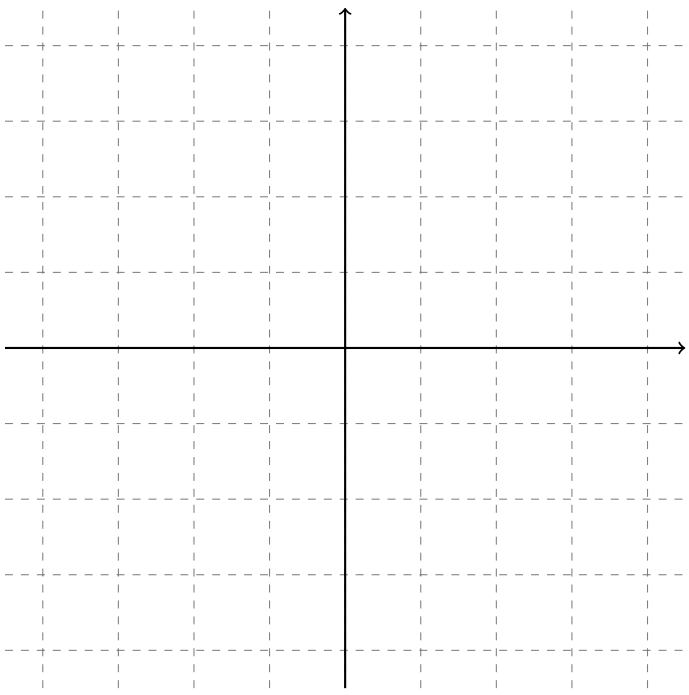
3. (20 pts)

Consider

$$f(x) = \begin{cases} \frac{2}{x}, & x < a \\ 2x + 3, & x \geq a \end{cases}$$

(a) Determine all values for a such that $f(x)$ will be continuous for all x. (Be sure to justify your answer with the definition of continuity.)

(b) Use the grid provided on the next page to sketch a graph for $y = f(x)$ using one of the values of a you found in (a). (Clearly state the value of a being used. Be sure your axes and any intercepts are clearly labeled.)



4. (30 pts) The following problems are not related.

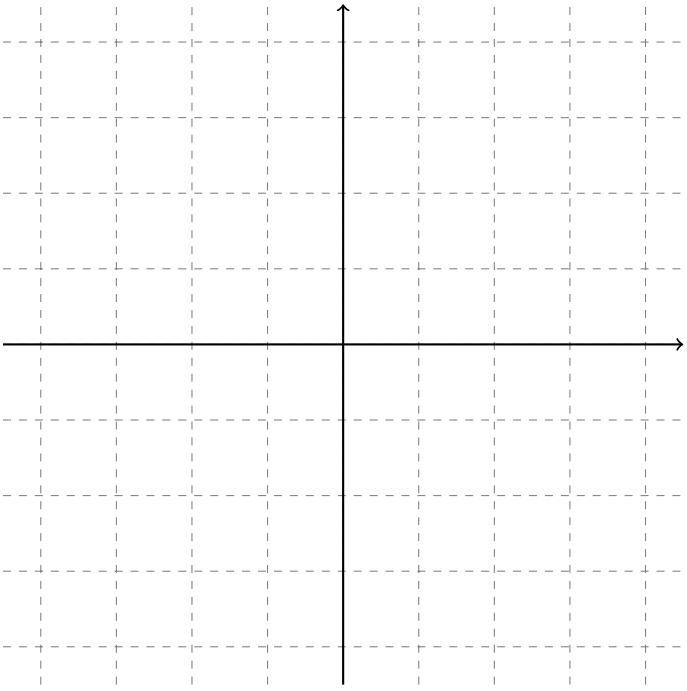
   (a) Consider $s(x) = 3x^3 - 2x^2$ and $r(x) = 2x + 5$. Use a theorem to determine an interval where $s(x) = r(x)$ for some x on that interval. (Clearly state the name of the theorem used and be sure to justify its use.)

   (b) Consider $h(x) = \dfrac{4 + \sin(x)}{7 - 3x}$. Determine all vertical asymptotes of $y = h(x)$. Justify each with the definition of vertical asymptotes.

   (c) Use the grid provided on the next page to sketch the graph of a single function $y = f(x)$ that satisfies each of the following conditions. (Be sure that your axes and all relevant points are clearly labeled.)

$$\lim_{x \to -\infty} f(x) = -3 \qquad \lim_{x \to 2^+} f(x) = 2 \qquad \lim_{x \to 2^-} f(x) = \infty$$

$$f(2) = -1 \qquad f(-1) = 0 \qquad f \text{ is an odd function.}$$



END OF TEST

ADDITIONAL BLANK SPACE

If you write a solution here, please clearly indicate the problem number.