APPM 1350 **Midterm 1** **Spring 2013**

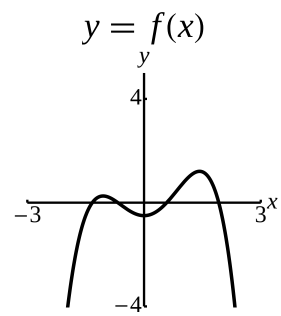
On the front of your bluebook, please write: a grading key, your name, and instructor's name (Chang or Rubio). This exam is worth 100 points and has 7 questions. **Show all work! Simplify all answers.** Answers with no justification will receive no points. Please begin each problem on a new page. No notes, calculators, or electronic devices are permitted.

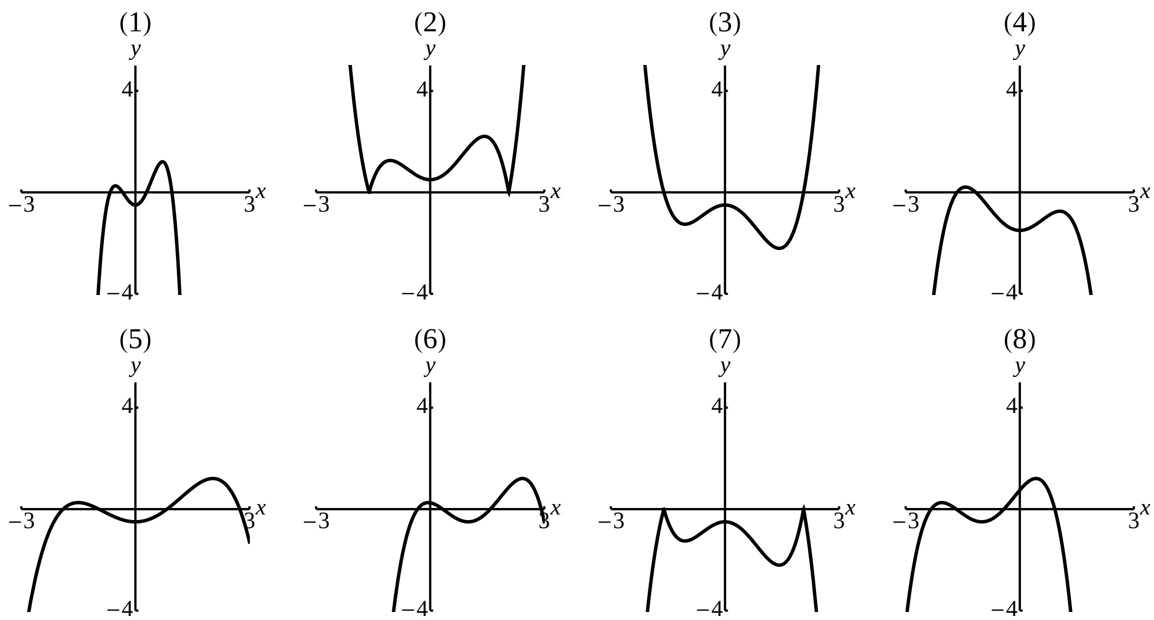
---

1. (12 points) Consider the function $y = f(x)$ shown at right. Use transformations to match the following functions to the graphs shown below. No explanation is necessary.

   (a) $y = f(x+1)$ (c) $y = f(-x) - 1$

   (b) $y = f(2x)$ (d) $y = |-f(x) - 1|$





2. (10 points) Let $f(x) = \sin x$ and $g(x) = \dfrac{x}{x^2+2}$.

   (a) Find $(g \circ f)(x)$.

   (b) What is the domain of $g \circ f$?

   (c) Is $g \circ f$ even, odd, or neither? Justify your answer.

3. (14 points) Let $f(x) = \sqrt{5 - 4x}$.

   (a) Use the definition of the derivative to find $f'(x)$.

   (b) Find an equation of the normal line to the curve $y = f(x)$ at $x = -1$.

4. (32 points) Evaluate the following limits. (Note that you may <u>not</u> use l'Hospital's Rule.)

   (a) $\displaystyle\lim_{x \to 3^-} \frac{x^2 + x - 12}{9 - x^2}$ (b) $\displaystyle\lim_{x \to 0^-} \sqrt[3]{\frac{5x^3 - 3|x|}{x}}$ (c) $\displaystyle\lim_{x \to 0+} \sqrt{x} \cos\frac{\pi}{x}$

   (d) $\displaystyle\lim_{x \to -\infty} \frac{7x - \sqrt{49x^2 - 8x}}{7x + \sqrt{x^2 - 6x}}$

5. (10 points) Show that the equation $\sqrt{x} = \sin x + \frac{1}{2}$ has at least one real root.

6. (12 points) Use the definition of continuity to determine whether the following function g is continuous at $x = 0$.

$$g(x) = \begin{cases} 6\tan(2x)\csc(3x), & x < 0 \\ \sec^4(x + \frac{\pi}{4}), & x \geq 0 \end{cases}$$

7. (10 points) Find a parabola with equation $y = ax^2 + bx + c$ that has slope 1 at $x = 6$, slope -3 at $x = -2$, and passes through the point $(0, 5)$.