MCS 118 EXAM 1 Oct 12, 2018

All of your answers must be carefully justified. Neat work, clear and to-the-point explanations will receive more credit than messy, chaotic answers. You may refer to any result proved in class unless otherwise specified. You may use results you proved on your homework, except for ones the problem specifically asks you to prove.

You are not allowed to use your textbook or your class notes, but you may use a simple calculator.

- 1. (5 pts each) Let $f : \mathbb{R} \to \mathbb{R}$ and $g : \mathbb{R} \to \mathbb{R}$ be functions.
 - (a) If f and g are both even functions, is the product fg even?
 - (b) Is fg odd if f is even and g is odd?



- 2. (5 pts each) An airplane takes off from an airport and lands an hour later at another airport,
 400 miles away. If t represents the time in minutes since the plane has left the terminal, let y(t) be the altitude of the plane at time t.
 - (a) Sketch a possible graph of y(t). Remember to label your axes with a proper scale and units. Justify your answer by explaining the shape of your graph.
 - (b) Sketch a possible graph of the vertical velocity as a function of t. Remember to label your axes with a proper scale and units. Justify your answer by explaining the shape of your graph.



- (5 pts each) You rent a unicycle from Krusty the Clown's Unicycle Rental. The rental costs \$25 for the day and includes the first 500 yards of riding. There is a charge for every additional yard beyond that. Yes, Krusty's unicycles have odometers. You know from Sideshow Bob that when he rented a unicycle from Krusty and rode it 900 yards, he paid \$37.
 - (a) Write down an expression for the rental charge C as a function of the distance d that the unicycle is ridden.
 - (b) Graph C(d). Remember to label your axes.
- 4. (5 pts each)
 - (a) The domain of the function $f(x) = \sqrt{c x^2}$ is (-5, 5). What does this tell you about the value of c?
 - (b) Give an example of a rational function whose domain is $(-\infty, -3) \cup (-3, 2) \cup (2, \infty)$.
- 5. (5 pts each) **Extra credit problem.** Let $f : \mathbb{R} \to \mathbb{R}$ and $g : \mathbb{R} \to \mathbb{R}$ be functions. (a) If f and g are both increasing functions, is the product fg increasing?
 - (b) Can f be both increasing and an even function?