MCS 118 Exam 1 $\,$

1. (10 pts) Determine whether the function

f(x) = x|x|

is even, odd, or neither. Make sure you justify your answer. (Hint: Since we saw in class that graphs can cheat by appearing to have symmetry they do not actually have, guessing symmetry from the graph is not really convincing justification. Use the definitions of even/odd functions for a convincing argument.)

- 2. The monthly cost of driving a car depends on the number of miles driven. Lynn (who looks a little dudish in the illustration on the left, but don't get thrown off by this detail) found that in May, it cost her \$380 to drive 480 miles and in June it cost her \$460 to drive 800 miles.
 - (a) (4 pts) Express the monthly cost C as a function of the distance driven d assuming that a linear relationship gives a suitable model.
 - (b) (3 pts) Draw the graph of the linear function.
 - (c) (3 pts) Why does a linear function give a suitable model in this situation? (Hint: a linear function has a constant slope.)
- 3. (a) (3 pts) State the definition of a function f from a set S to a set T.
 - (b) (3 pts) What does the Vertical Line Test say?
 - (c) (4 pts) Explain why a graph that fails the Vertical Line Test cannot be the graph of a function.
- 4. As a young but experienced smuggler working for Jabba the Hutt, Han Solo makes 10000 Imperial credits for successfully smuggling a load of spice (which is an illicit substance) on his Millenium Falcon. If Han smuggles more than five loads of spice in a month, Jabba pays him 15000 credits for each of the next five loads (that is for the 6th through the 10th loads). Things get really lucrative for Han if he manages to smuggle more than ten loads of spice in one month: he gets paid 20000 credits for each load beyond the first the ten.
 - (a) (4 pts) Construct a piecewise defined function p(x) for Han's smuggling income in a month, where x is the number of loads of spice he smuggled that month. Explain your work.
 - (b) (2 pts) What is the domain of p? Think carefully about this and justify your answer.
 - (c) (4 pts) Graph the function p.
- 5. (5 pts each) **Extra credit problem.** Let $f : \mathbb{R} \to \mathbb{R}$ be an even function and let g(x) = f(x) + 1.
 - (a) Does g have to be an even function? If you think it does, give a proof; if you do not think it does, find a counterexample.
 - (b) Is it possible for g to be an odd function? If you think it is, find an example; if you do not think it is, find an argument to show it is not possible.



