College of the Holy Cross, Fall Semester, 2015
MATH 133, section 1, Midterm 1
Thursday, September 24

Your Name: ______________________________

Instructions Please write your answers in the spaces provided, and show work on the test itself. Use the back of the preceding page if you need more space for scratch work. There are 100 possible points distributed as below.

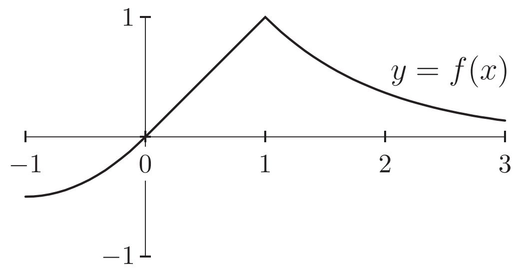
Please do not write in the space below

Problem	Points/Poss
1	/ 15
2	/ 15
3	/ 20
4	/ 20
5	/ 15
6	/ 15
Total	/100

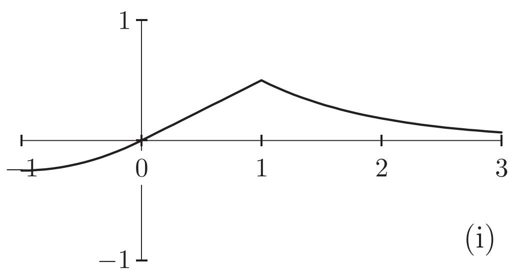
1. (a) (7.5) Express the set of all x satisfying $|4x - 12| \leq 8$ as an interval or union of intervals.

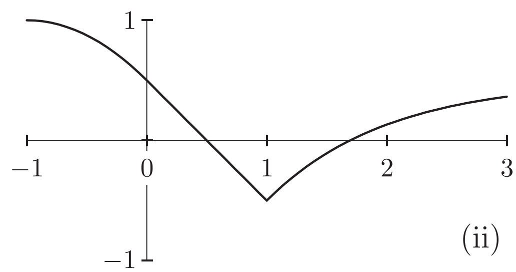
   (b) (7.5) What is the domain of the function $f(x) = \frac{1}{x\sqrt{4-x}}$? Any correct form is OK.

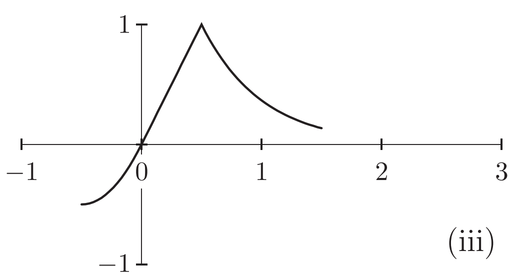
2. (15) The graph $y = f(x)$ and four graphs obtained by transforming it are shown. Match the given formulas with the corresponding graph. Note that there is an extra graph that does not match any of the formulas.

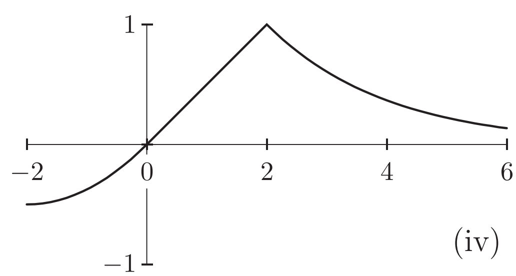


(a) $y = f(\frac{1}{2}x)$:__________ (b) $y = \frac{1}{2}f(x)$:__________ (c) $y = f(2x)$:__________







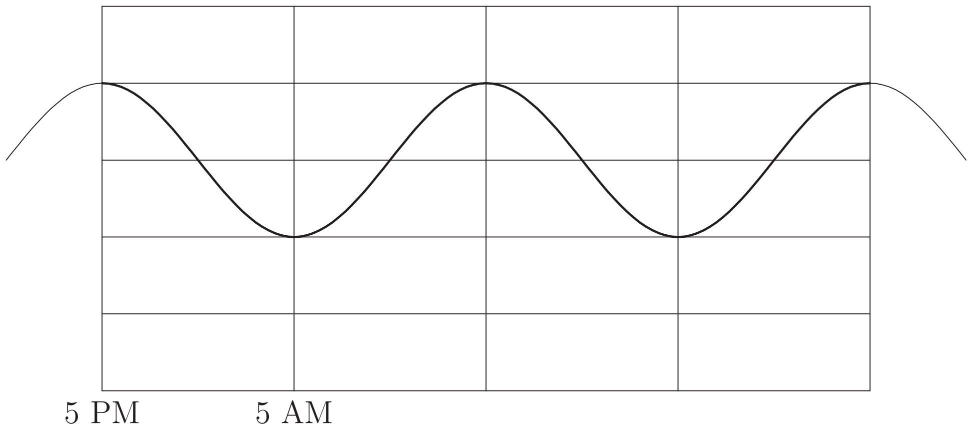


3. (a) (10) Complete the square: $q(x) = 3x^2 + 18x + 36$.

(b) (5) What is the minimum value of $q(x)$?

(c) (5) Using your answers from parts (a) and (b), determine the *range* of the function $r(x) = \sqrt{q(x)} = \sqrt{3x^2 + 18x + 36}$.

4. The temperature H in a desert varies sinusoidally from a high of 80°F at 5 PM to a low of 40°F at 5 AM. (See graph below)



(a) (5) What is the period of this sinusoidal oscillation? ________

(b) (5) What is the amplitude? ________

(c) (10) If $t = 0$ is the first 5PM time shown, give a possible formula for H as a function of t.

5. (a) (7.5) Solve for x: $4^{x+1} = 8^{x-3}$.

(b) (7.5) A sample of a radioactive element is decaying over time. The mass present at time t is given by according to $M(t) = 139e^{-0.003t}$ grams, where t is in months. When will the mass present reach 50 grams?

6. You are traveling by donkey along a straight line road starting from $x = 0$ (miles) at time $t = 0$ (hours). For the first two hours, you move in the positive x-direction at 5 miles per hour. At $t = 2$, you realize you have dropped an important item from your saddle bag. So you turn around and retrace your steps at 5 miles per hour. You find the item at $t = 3$. Then you turn back around and continue at 5 miles per hour for an additional 2 hours.

   (a) (7.5) Sketch the graph of your position x as a function of time t for $0 \leq t \leq 5$.

   (b) (7.5) Give your position x as a piecewise-defined function of t.