

College of the Holy Cross, Fall Semester, 2017  
MATH 133 Midterm 1  
Friday, September 22

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	/ 20
2	/ 20
3	/ 20
4	/ 20
5	/ 20
Total	/100
Extra Credit	/ 10

1. (a) (10) Express the set of all  $x$  satisfying  $|3x - 9| \leq 6$  as an interval or union of intervals.

- (b) (10) What is the domain of the function  $f(x) = \frac{\sqrt{3-x}}{x}$ ? Any correct form is OK.

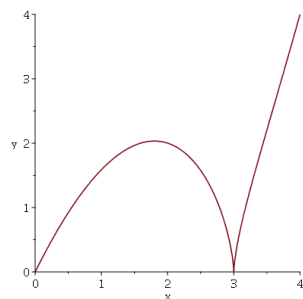


Figure 1: The graph  $y = f(x)$

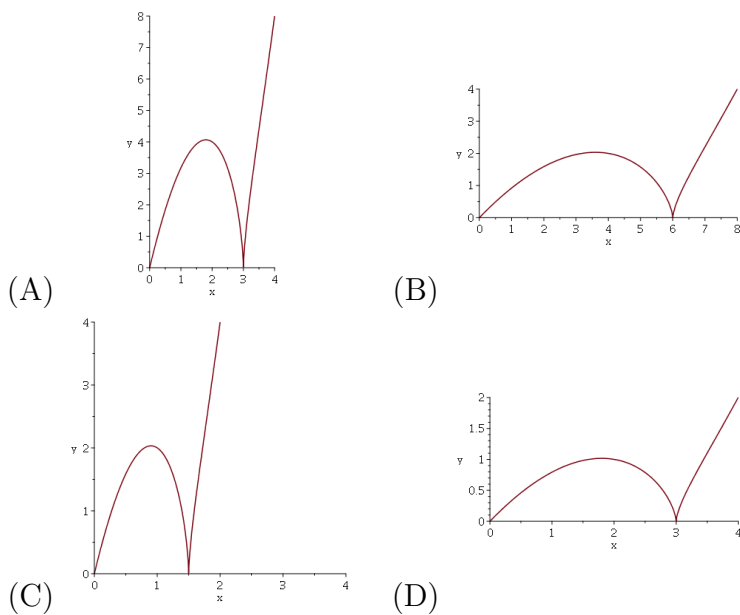


Figure 2: The transformed graphs

2. (20) The graph  $y = f(x)$  and four graphs obtained by transforming it are shown in Figures 1 and 2. Match the given formulas with the corresponding graph.

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

(d) Note that there is an extra graph that does not match any of the formulas. *Circle it.*

3. (a) (15) Complete the square:  $q(x) = 4x^2 - 16x + 24$ .

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

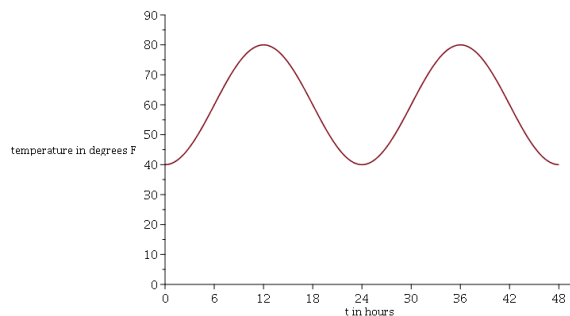


Figure 3: Graph of temperature as a function of time.

4. The temperature  $f(t)$  at a desert location varies sinusoidally from a low of  $40^\circ\text{F}$  at  $t = 0$  hours (midnight) to a high of  $80^\circ\text{F}$  at  $t = 12$  hours (noon). (See graph in Figure 3, which shows the temperature over two complete days.)
- (6) What is the period of this sinusoidal oscillation? \_\_\_\_\_
  - (6) What is the amplitude? \_\_\_\_\_
  - (8) Give a possible formula for  $f$  as a function of  $t$ .

5. You are traveling on a horse 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) (10) Sketch the graph of your position  $x$  as a function of time  $t$  for  $0 \leq t \leq 5$ .

(b) (10) Give your position  $x$  as a piecewise-defined function of  $t$ .

6. (Extra Credit) (10) 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. Solve the equation  $50 = 139e^{-0.003t}$  for  $t$  to find the time when the mass reaches 50 grams.