

15 September 2000

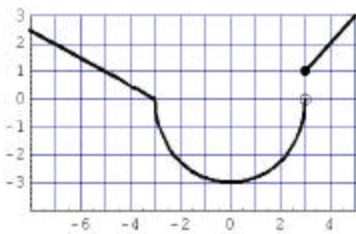
100 Points

"Show enough work to justify your answers."

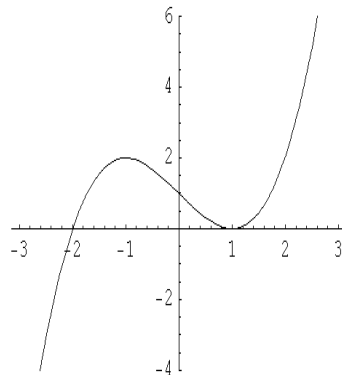
- Let  $f(x) = x^2 - x$ .
  - Without looking at the graph of  $f$ , how do you know that the point  $(3, 6)$  is on the graph? (4 points)
  - Let  $m(x)$  be the slope of the line passing through the points  $(3, 6)$  and  $(x, f(x))$  for  $x \neq 3$ . Find a formula for  $m(x)$  and simplify as much as possible. (13 points)
- What are the natural domain and range of  $h(x) = -\sqrt{5-x}$ ? Explain. (15 points)
- Determine the piecewise formula for the function shown (below). (15 points)
- Three copies of the graph of a function  $f$  are shown. (The original exam had three copies, only one is shown below.) On the left copy draw the graph of  $g$  defined by  $g(x) = f(x) - 1$ . On the middle copy draw the graph of  $h$  defined by  $h(x) = f(x - 1)$ . On the right copy draw the graph of  $k$  defined by  $k(x) = -f(x)$ . (15 points)
 

Graph of $g$	Graph of $h$	Graph of $k$
- Let  $f(x) = x^2 - \sin x$ . Use a graphing calculator or *Mathematica* to determine approximations for the minimum value of  $f$  and where it occurs. If you use your calculator, be sure it is set in radians! Give your approximations to three decimal places. All I can go on are the numbers you put here, so be careful! Very little partial credit! (10 points)
 

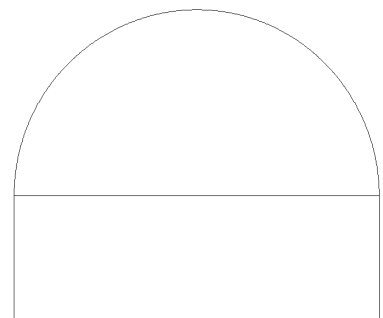
Min value:	Where it occurs:
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- Let  $f(x) = 2^x$  and  $g(x) = 3 \log_2 x$ . Give the formulas for  $h(x) = (f \circ g)(x)$  and  $k(x) = (g \circ f)(x)$  and simplify as much as possible. (16 points)
- A figure is constructed by putting a semicircle over a rectangle as shown. The width of the rectangle is three inches less than the length. Give a formula for the area of the entire figure as a function of the length. (12 points)
- (Extra Credit) Suppose that  $f$  is a function and that the range of  $f$  is the interval  $[-11, 8]$ . What is the range of the function  $g$  defined by  $g(x) = |f(x)|$ ? Explain. (5 points)



Problem 3



Problem 4



Problem 7

Selected answers and hints.

1.  $m(x) = x + 2$ .

3. The middle part is  $-\sqrt{9 - x^2}$  for  $-3 < x < 3$ .

6.  $h(x) = x^3$

7. Remember the formula for the area of a circle! The picture contains half of a circle, and its radius is half of the length of the rectangle.