

June 21, 2001

Name \_\_\_\_\_

The total number of points possible is 118. **SHOW YOUR WORK**

1. (10 points) . Find the relative maxima and relative minima, if any, of  $g(x) = x^2 + 16/x^2 + 4$ . Demonstrate that you understand either the first derivative test or the second derivative test that distinguishes relative maxima from relative minima.

2. (20 points) Suppose you have differentiated a function  $f(x)$  and found that

$$f'(x) = \frac{(x-4)(x+3)^2}{(x-2)(3x)(x+5)}.$$

- (a) Find the intervals over which  $f$  is increasing.
- (b) Find an equation for the horizontal asymptote of the function  $f'$ , if there is one.
- (c) Find equations for all vertical asymptotes of the function  $f'$ .

3. (10 points) Let  $f(x) = \frac{1}{2}x^4 + x^3 - 6x^2 + 3x - 2$ .

(a) Find the interval(s) where  $f$  is concave upward.

(b) Find the inflection points of  $f$ , if there are any.

4. (10 points) Solve each of the equations below for  $x$  in terms of the other letters.

(a)  $4a \cdot b^{2x} = \sqrt{a}$

(b)  $\frac{a}{1+b^x} = b^4$

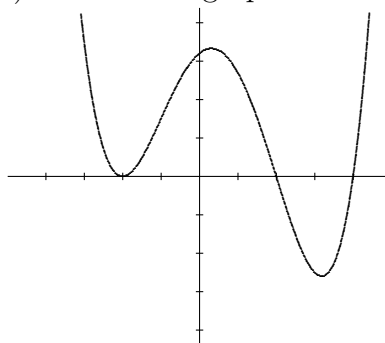
(c)  $4e^{2x-3} = 28$ .

5. (8 points) Find the rate of change of  $s(t) = e^{3t} \cdot \ln t$  when  $t = 1$ .

6. (12 points) A radioactive substance has a half-life of 28 years. Find an expression for the amount of the substance at time  $t$  if 30 grams were present initially.

7. (16 points) Questions (a) through (d) refer to the graph of the fourth degree

polynomial function  $f$  given below.



- (a) The number of roots of  $f''(x) = 0$  is  
(A) 0    (B) 1    (C) 2    (D) 3    (E) 4
- (b) The number of roots of  $f'(x) = 1$  is  
(A) 0    (B) 1    (C) 2    (D) 3    (E) 4
- (c) The number of roots of  $f(x) = 1$  is  
(A) 0    (B) 1    (C) 2    (D) 3    (E) 4
- (d) A good estimate of  $f'(2)$  is  
(A) -2    (B) 0    (C) 1    (D) 1.8    (E) 3.2

8. (12 points) An amount of \$1000 is invested at an interest rate of 9 percent per year with interest compounded a. monthly and b. continuously?
- (a) How long does it take the monthly compounded account to double in value?
- (b) How long does it take the continuously compounded account to triple in value? Express your answer to the nearest tenth of a year.
9. (20 points) Compute the following derivatives.
- (a) Find  $f'$  when  $f(x) = x^3 \cdot e^{2x}$ .
- (b) Find  $g'$  when  $g(x) = \ln(2x^3)$ .
- (c) Find  $f'$  when  $f(x) = x \ln x - x$ .
- (d) Find  $f'$  when  $f(x) = e^{x^3}$ .
- (e) Find  $f'$  when  $f(x) = x^3/e^{2x}$ .