

MA 1012/1312

Polytechnic University

EXAM 2

DECEMBER 14, 2004

EXAM 1: \_\_\_\_\_

EXAM 2: \_\_\_\_\_

GRADE: \_\_\_\_\_

Print Name:

Signature:

ID #:

Instructor/Section:

**Directions:** You have **90 minutes** to answer the following questions. ***You must show all your work*** as neatly and clearly as possible and indicate the final answer clearly. You may use only a TI-30 calculator.

The last page contains formulas that you might find useful. You may tear that page out.

If you are feeling ill you should inform the proctor. The proctor will note your name, Poly ID and accept any written statement(s) that you may wish to make regarding your illness.

Problem	Possible	Points
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
7	10	
8	10	
9	10	
10	10	
Total	100	

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(1) (Page 103, Problems 1–20) Determine whether each of the following statements is TRUE or FALSE. You do not need to show your work.

(a) The derivative of a linear function is constant.

(b) If  $y = g(x)$  is a vertical shift of  $y = f(x)$ , then  $f'(x) = g'(x)$ .

(c) If a function  $h$  is not differentiable at  $x = a$ , then  $h$  cannot be continuous at  $x = a$ .

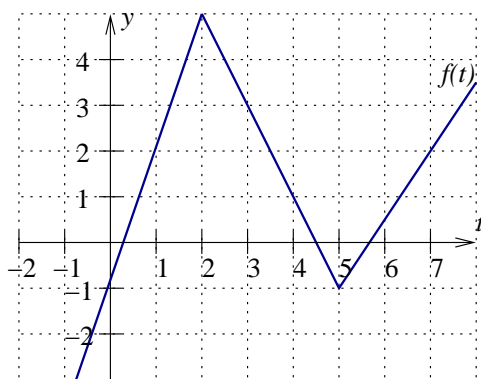
(d) Assume that  $g(v)$  is the fuel efficiency, in miles per gallon, of a car going at a speed of  $v$  miles per hour. The value  $g'(55) = -0.54$  tells us that if the car speeds up from 55 mph to 56 mph, the fuel efficiency decreases by 0.54 miles per gallon.

(e) Let  $N = f(t)$  be the total number of cans of cola Sean has consumed by age  $t$ , where the units of  $t$  are years.  $(f^{-1})'(450) = 1/70$  means that, at the time Sean has consumed 450 cans of cola, it took one year to consume 70 additional cans.



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(3) (Page 77, Problem 23) The graph of a function  $f$  is drawn below.



Fill in the blanks. You do not have to explain.

(a)  $f(5) =$  \_\_\_\_\_.

(b) The average rate of change of  $f$  over the interval  $1 \leq t \leq 4$  is \_\_\_\_\_.

(c)  $\lim_{t \rightarrow 4} \frac{f(t) - 1}{t - 4} =$  \_\_\_\_\_.

(d)  $f'(6) =$  \_\_\_\_\_.

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- (4) (Page 76, Problems 10–14) Use algebra and the limit definition of the derivative to find a formula for the derivative of the function

$$f(x) = \frac{1}{2x - 1}.$$

Show your work.

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- (5) (Page 112, Problem 56) A ball is dropped from the top of the Empire State building to the ground below. The height,  $h$  in feet, of the ball above the ground is given as a function of time,  $t$  in seconds, by

$$h = 1250 - 16t^2.$$

What is the velocity of the ball at the time just before it hits the ground? Show your work and include units in your answer.

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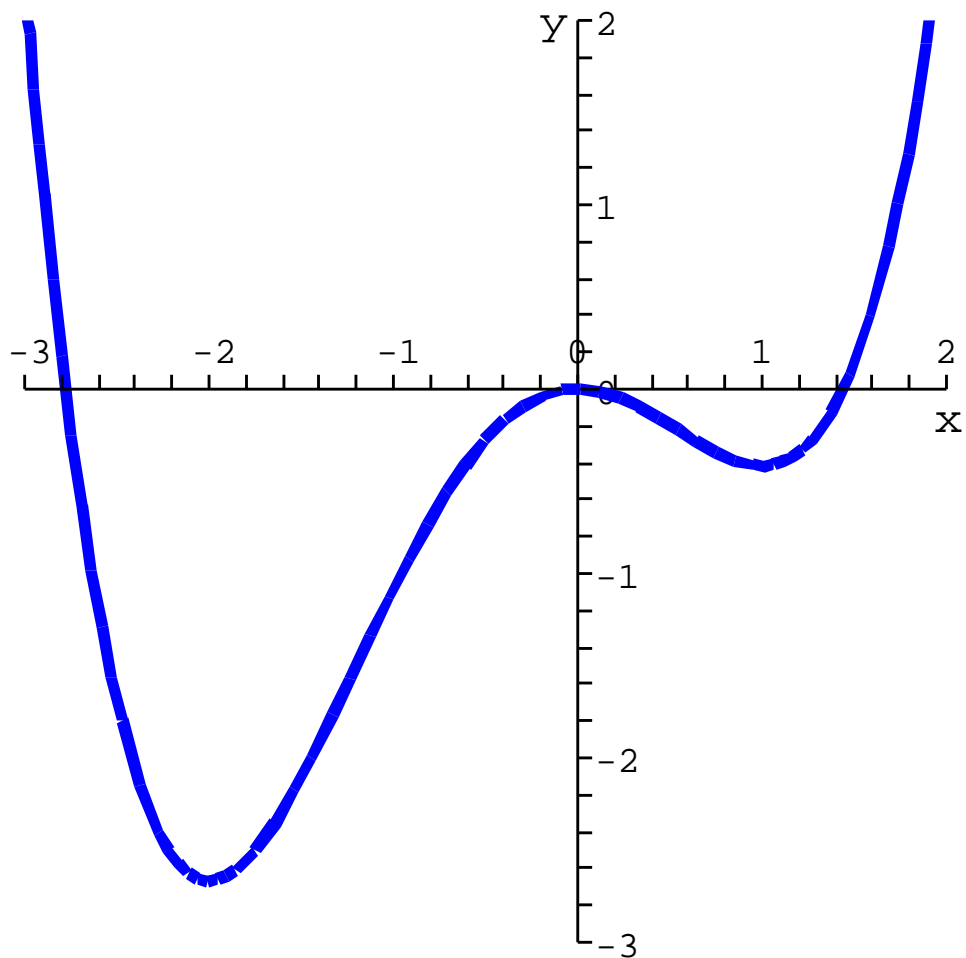
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(6) (Page 117, Problem 10) Consider the function  $h(x) = e^2 + x^e$ .

Find the equation of the tangent line to the graph of the function at the point  $(0, e^2)$ . Show your work.

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- (7) (Page 83, Problems 1–9) Let  $f$  be the the function graphed below. Sketch the graph of its derivative on the same set of axes.



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(8) Fill in the blanks. You do not have to explain.

(a) (Page 69, Problem 7)  $\lim_{\theta \rightarrow 0} \frac{\sin(2\theta)}{\theta} = \underline{\hspace{2cm}}$

(b) (Page 69, Problem 20)  $\lim_{t \rightarrow 1^-} \frac{|1-t|}{1-t} = \underline{\hspace{2cm}}$

(c) (Page 69, Problem 36)  $\lim_{x \rightarrow \infty} \frac{e^{-x} + e^x}{e^{-x} - e^x} = \underline{\hspace{2cm}}$

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(9) In each of the following parts, choose **all** the numbers which complete the sentence correctly. You do not need to explain.

(a) (Page 47, Problems 13) Let

$$f(x) = \begin{cases} (k+1)^2x & \text{if } 0 \leq x < 3, \\ (k+1)x^2 & \text{if } x \geq 3, \end{cases}$$

The function  $f$  is continuous at  $x = 3$ , if  $k$  is

- (i)  $-2$                       (ii)  $-1$                       (iii)  $0$                       (iv)  $1$                       (v)  $2$ .

(b) (Page 114, Example 1)  $\lim_{h \rightarrow 0} \frac{e^h - 1}{h} =$

- (i)  $-2$                       (ii)  $-1$                       (iii)  $0$                       (iv)  $1$                       (v)  $2$ .

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(10) (Page 27, Problems 2–16) Solve for the exact value of  $x$ . You must show work.

$$2 \cdot 7^{3x-1} = 4e^{17x}$$

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### Formulas you might find useful

- The derivative of a function

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

- $\frac{d}{dx} x^n = nx^{n-1}$
- $\frac{d}{dx} e^x = e^x$