

# MATH 141

## MIDTERM EXAM II

November 7, 2000

- (20pts)** Suppose that  $f(x) = x^3 - 2x + 1$ .
  - What is  $f'(x)$  ?
  - At what places is the tangent line to the graph of  $f(x)$  horizontal ?
  - At what places is the slope of the tangent line equal to 1 ?
  - Find the tangent line to the graph when  $x = 2$ .
- (10pts)** Answer each of the following questions.
  - Let  $f(x) = \frac{x-2}{x+2}$ . What is  $f'(0)$  ?
  - If  $s(t) = \tan(t)$ , what is  $s'(\frac{\pi}{4})$  ?
- (20pts)** Differentiate each of the following functions:
  - $(x+8)(x-8)$
  - $e^x(1+x)$
  - $\frac{\sin x}{x^2+1}$
  - $\frac{1}{1+\sqrt{x}}$
- (10pts)** Evaluate the following limits (note: some of them may be  $+\infty$ ,  $-\infty$ , or may not even exist):
  - $\lim_{h \rightarrow 0} \frac{\sin(\pi+h) - \sin(\pi)}{h}$
  - $\lim_{x \rightarrow 0} \frac{\sin(x^3)}{x^2}$

5. (10pts) Differentiate each of the following functions:

(a)  $e^{(e^x)}$

(b)  $(\sin(x^2))^2$

6. (15pts) The position of the weight attached to the end of the spring is given by  $s(t) = 2 \sin(2t)$ .

(a) What is the velocity of the weight at time  $t$  ?

(b) At which times is the weight momentarily at rest (i.e. at which times is the velocity zero) ?

(c) What is the acceleration of the weight at time  $t$  ?

7. (15pts) Suppose you have the following information about the functions  $f$  and  $g$ :

$f(1) = -2$	$g(1) = 3$
$f'(1) = 3$	$g'(1) = 2$
$f(3) = 2$	$g(3) = -1$
$f'(3) = -1$	$g'(3) = -1$

Use this information to find:

(a)  $(f + g)'(1)$

(b)  $(fg)'(3)$

(c)  $(f \circ g)'(1)$

8. (10pts) Find the second derivatives of the following functions:

(a)  $x \sin x$

(b)  $3^x$