MAT 195 – Spring Quarter 2002
TEST 2

NAME_____
Show work and write clearly.

1. The displacement (in meters) of an object moving in a straight line is given by $s = 1 - \dfrac{t}{4} + 2t^2$,

where t is measured in seconds.

a. Find the average velocity over the following time periods:
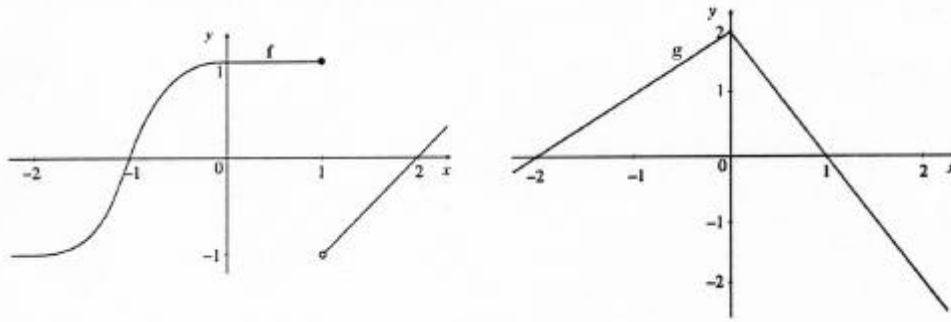(i) [1, 2]
(ii) [1, 1.5]
(iii) [1, 1.1]

b. Estimate the instantaneous velocity (to 4 decimal places) when $t = 1$. Explain.

2. Referring to the graphs below, find each limit, if it exists. If the limit does not exist, explain why.

a. $\displaystyle\lim_{x \to 0} \frac{f(x)}{g(x)}$

b. $\displaystyle\lim_{x \to 1}[f(x) \cdot g(x)]$

c. $\displaystyle\lim_{x \to -1} \frac{g(x)}{f(x)}$

d. $\displaystyle\lim_{x \to 2}[x \cdot g(x)]$

e. $\displaystyle\lim_{x \to -1}[f(x) + g(x)]$

f. $\displaystyle\lim_{x \to 1^-}[x + f(x)]$

g. $\displaystyle\lim_{x \to 1^+} \frac{g(x)}{f(x)}$

3. $f(x) = \begin{cases} \sqrt{3-x} & x \leq 1 \\ x^2 & 1 < x < 3 \\ 27/x & x \geq 3 \end{cases}$

a. Evaluate each limit, if it exists. If the limit does not exist, explain why.

i. $\lim\limits_{x \to 1^-} f(x)$

ii. $\lim\limits_{x \to 1^+} f(x)$

iii. $\lim\limits_{x \to 1} f(x)$

iv. $\lim\limits_{x \to 3^-} f(x)$

v. $\lim\limits_{x \to 3^+} f(x)$

vi. $\lim\limits_{x \to 3} f(x)$

vii. $\lim\limits_{x \to 9} f(x)$

viii. $\lim\limits_{x \to -6} f(x)$

b. What is the domain of $f(x)$.
c. Where is $f(x)$ discontinuous? Explain.
d. Where is $f(x)$ *not* differentiable? Explain.

4. Find the limits, algebraically.

a. $\lim\limits_{x \to \infty} \dfrac{\sqrt{x^2 - 9}}{2x - 6}$

b. $\lim\limits_{x \to 0} \dfrac{(1 + h)^4 - 1}{h}$

c. $\lim\limits_{x \to -\infty} \left(x - \sqrt{x}\right)$

d. $\lim\limits_{x \to \infty} \left(x + \sqrt{x}\right)$

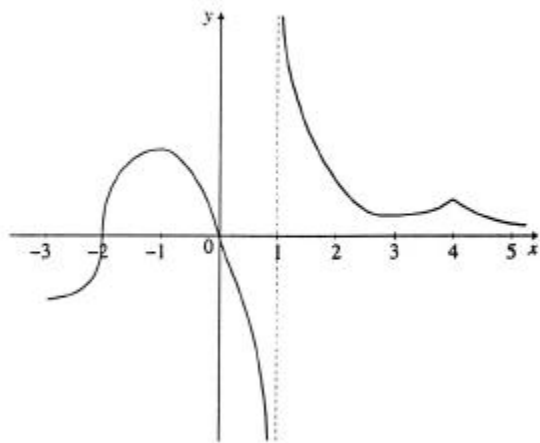5. Find the vertical and horizontal asymptotes for $f(x) = \left(a^{-1} + x^{-1}\right)^{-1}$, where $a > 0$.

6. Use the definition of a derivative of f at a:

a. $f(x) = x^3 - 2x$, a = 2.
b. Find the equation of the tangent line to f at $x = 2$.

7. If $f(x) = x - \dfrac{2}{x}$, estimate $f'(3)$ to 4 decimals. Explain.

8. The graph of g is given below.

a. For what value(s) of x is $g(x)$ not differentiable? Justify your answer(s).