As stated above, MIDTERM 1 will be in PKH 319 at 1:00 pm on Sept 26.

The material covered on MIDTERM 1 is the same as that covered on the homework and on the worksheets through §3.3. (Homework is listed over the page.)

I am available after class for questions. In addition, I will be in my office on Friday Sept 26 from about 10:30 am until noon. The MAA will hold a review session which is listed above.

This MIDTERM will be, in part, multiple choice. Half of the points will be for the multiple-choice part, and the other half for the show-your-work part. There will be 5 choices of answer per multiple-choice question and, for each, only one answer will be the correct one. You should do rough work on the MIDTERM or on paper provided by me. You should bring with you to the MIDTERM a scantron form, 882-ES or 882-E, and a number-2 pencil.

A good (& usually effective!) way to review is to go over the homework problems you have not already done & make sure you understand all the homework well, the worksheets well and the quizzes well. This information sheet provides examples of questions you should be able to do before walking into the MIDTERM.

You will spend Tuesday Sept 23 working on these questions individually in class. These practice questions do NOT form a model for the MIDTERM. These questions are intended only to help you identify any gaps in your understanding. In the last 24 hours, reread ALL the homework problems including the worksheet questions, skim through the lecture notes, & go over the quizzes and these practice questions again. Timing yourself while answering questions will give you an indication of whether or not you need to learn to be faster at answering them.

Learn some basic trigonometric substitutions, quadratic formula, pythagorean formula & formulae from this class. Learn some of the simple graphs as given on Page 27 of your book.

Bring with you to the MIDTERM a working calculator (with working batteries!), satisfying the criteria on the first-day handout, & some form of photo ID (I will ask to see the ID when you turn in your MIDTERM to me). In particular, calculators with keyboards or with internet capability are not permitted on the MIDTERM. Cell phones should be out of sight and switched off.

Try to keep your eyes on your own work during the MIDTERM.

If you wish to leave the room during the MIDTERM, you should ask permission first & turn in your MIDTERM to me. Only in exceptional circumstances will I let you continue the MIDTERM should you return. (So it is better to be 3 minutes late to the MIDTERM, rather than ask to go to the bathroom during the MIDTERM.) If you finish early but prefer to stay in the room, then you should NOT get out any work, book nor item, no matter what the subject matter is. Should you wish to leave the MIDTERM early, then you may.

It is your responsibility to be on time.
HOMEWORK

Book = Calculus, 3rd Ed., by Strauss, Bradley and Smith.

8/25 Read pages 2-5 & do §1.1: 3, 4, 25, 33, 34. Read §1.2 (pg 13-17) & do §1.2: 2-11, 49. Learn page 27. Do pg 43 #14, pg 44 #28. Read pg 46, 47.

8/26 Finish Worksheet 1.

8/27 Read §2.1 & do 1-6, 9, 11, 14, 18-24, 29, 30, 35.

9/1 HOLIDAY

9/2 Finish Worksheet 2 (due 9/9/03).

9/3 Learn table on page 61. Read §2.2 & do 1-5, 7, 8, 13, 17, 18, 21, 23, 24, 27, 28, 40, 43, 57. Optional: read pgs A1-3 incl, do §2.2: 60 (hint: think graphs).

9/8 Read §2.3 (especially pg 74) & do 1, 2, 4, 7, 10-12, 15-17, 21, 25, 32, 33, 39, 40, 53.

9/9 Finish Worksheet 3 (due 9/16/03).

9/10 Read §2.4, learn Thms 2.8 & 2.9. Do §2.4: 15-28, 30, 34, 38, 40, 41, 43, 44, 48, 56, 57, 63, 74.


9/16 Finish Worksheet 4 (due 9/23/03).

9/17 Read last paragraph on pg 112 & pg 115.5-117. §3.2: 5, 6, 8-10, 12-15, 17, 20-23, 26, 27, 30, 32, 35-37, 43, 49, 50. Optional: 42, 54, 63.

9/22 Learn Thms 3.7-3.9 (statements only). Read Technology note on pg 124. §3.3: 1-12, 15-20, 33-36, 39-44, 47-49, 51, 52.

9/23 Finish practice questions on information sheet.

9/24 Read §3.4 & do 3, 6, 8, 11, 16, 17, 22, 23, 26, 31, 35, 36, 40, 41, 44.

PRACTICE QUESTIONS

Questions 1-9 are questions occurring on previous midterms of mine.

1. [Sec 2.4: 56, 57] Suppose that the population $P$ of an endangered fish decreases at a rate of 0.19% per year. So, after $t$ years, the population is given by

$$ P(t) = A_0(0.9981)^t $$

where $A_0$ is the initial amount of fish. How long will it take for only half of the fish population to be left?

2. [§2.4] Some money, $P$ dollars, is invested so that, after $t$ years, the total amount of money is given by $P \cdot 2^{kt}$ dollars, where $k$ is a constant. The total amount doubles every 6 years. Find $k$.

3. [Sec 2.3: 39, 40] Find a constant $k$ such that $f(x) = \begin{cases} 3x + k & x \leq -2 \\ 2x & x > -2 \end{cases}$ is continuous for all $x \in \mathbb{R}$. In particular, using your value of $k$, justify why $f$ is continuous on $\mathbb{R}$.
4. [§2.3: 39, 40] Let $a$ and $b$ be constants and define

$$f(x) = \begin{cases} 
-x^2 + a & \text{if } x < 0 \\
x^2 + b & \text{if } x \geq 0
\end{cases}.$$ 

(a) How should $a$ and $b$ be related to each other in order for $f$ to be a continuous function on $\mathbb{R}$?
(b) How should the values of $a$ and $b$ be restricted in order for $f$ to be a continuous function on $\mathbb{R}$?

5. (a) [§2.2: 18] Find the exact limit, $\lim_{x \to 2} \left( \frac{\sqrt{x + 2} - 2}{x - 2} \right)$, if it exists; explain.
(b) [§2.2: 43, 57] Find the exact limit, $\lim_{x \to 1} f(x)$, if it exists, where $f$ is defined by

$$f(x) = \begin{cases} 
2x & \text{if } x \leq 1 \\
2 & \text{if } x > 1
\end{cases};$$

explain.
(c) [§2.2: 21] Find the exact limit, $\lim_{x \to 2} \left( \frac{\sin(x - 2)}{\sqrt{x - 2}} \right)$, if it exists; explain.

6. [“Sec 3.2: 35-37”] Justify the claim that $y = 4x^3 + 9x - 3$ has no horizontal tangent line.

7. In this question, $f(x) = \sqrt{3x + 2}$.

(a) The derivative, $f'$, of $f$ is given by $f'(x) = \frac{3}{2\sqrt{3x + 2}}$. Show that this formula for $f'$ is correct by using only the limit of a difference quotient.
(b) As in (a), $f'(x) = \frac{3}{2\sqrt{3x + 2}}$. Find the equation of the tangent line to the graph of $f$ at the point $\left( \frac{14}{3}, 4 \right)$.

8. The functions $f$ and $g$ and their first derivatives, $f'$, $g'$, are defined on $\mathbb{R}$, and, at $0, 1, 2$, they take on the values given in the following table.

<table>
<thead>
<tr>
<th>$x$</th>
<th>$f(x)$</th>
<th>$g(x)$</th>
<th>$f'(x)$</th>
<th>$g'(x)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5</td>
<td>-1</td>
<td>2</td>
<td>-4</td>
</tr>
<tr>
<td>1</td>
<td>-3</td>
<td>3</td>
<td>1</td>
<td>-10</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>

Let $F(x) = x^5f(x)$ and find $F'(2)$ if it exists; if it does not exist, explain why not.
Let $G(x) = \frac{g(x)}{f(x)}$ and find $G'(0)$ if it exists; if it does not exist, explain why not.
Let $H(x) = \frac{g(x)}{f(2)}$ and find $H'(0)$ if it exists; if it does not exist, explain why not. (Note: this question can be done in less than 1 second! Think!)
Let $h(x) = e^{\ln g(x)}$ and find $h'(1)$ if it exists; if it does not exist, explain why not.
Let $R(x) = e^{\ln g(x)}$ and find $R'(0)$ if it exists; if it does not exist, explain why not.

9. Suppose $f(x) = \sqrt{4x + 3}$. Given that the derivative, $f'$, of $f$ is given by $f'(x) = \frac{2}{\sqrt{4x + 3}}$, find the equation of the tangent line to the graph of $f$ at the point $\left( \frac{11}{2}, 5 \right)$.

(a) $y = \frac{2}{5}x + 7$  (b) $y = 5 + \frac{1}{\sqrt{4x + 3}}(2x - 11)$  (c) $y = \frac{2}{5}x + 18$  (d) $y = \frac{1}{10}(4x + 28)$  (e) none of these
10. If \( g(x) = \begin{cases} 
2x + 1 & \text{if } x \leq -1 \\
3x & \text{if } -1 < x < 1 \\
2x - 1 & \text{if } x \geq 1 
\end{cases} \), then \( g \) is discontinuous at
(a) only (b) 1 only (c) \(-1 \& 1\) only (d) no point of the domain (e) every point of the domain.

11. If \( v(t) = \begin{cases} 
\sqrt{t} & \text{if } t < 0 \\
1 & \text{if } 0 < t \leq 1 \\
\sqrt{t} & \text{if } t > 1 
\end{cases} \), then \( v \) is discontinuous at
(a) 0 only (b) 1 only (c) \(-1 \& 1\) only (d) no point of \( \mathbb{R} \) (e) every point of the domain.

12. If \( u(t) = \frac{|t - 7|}{t - 7} \), then \( \lim_{t \to 7^-} u(t) \) is
(a) \(-\infty\) (b) \(-1\) (c) 0 (d) 1 (e) -7.

13. If \( f(x) = \frac{\sqrt{x^2 - 9}}{2x - 6} \), then \( \lim_{x \to 3^+} f(x) \) is
(a) \(-\infty\) (b) 0 (c) \(\sqrt{6}/2\) (d) \(\sqrt{6}\) (e) \(\infty\).

14. If \( p(s) = \frac{4 - \sqrt{s}}{s - 16} \), then \( \lim_{s \to 16^-} p(s) \) is
(a) \(-\infty\) (b) \(-\frac{1}{8}\) (c) 0 (d) \(\frac{1}{8}\) (e) \(\infty\).

15. If \( s(v) = \frac{v^2 + 2v - 8}{v^4 - 16} \), then \( \lim_{v \to 2} s(v) \) is
(a) \(-\infty\) (b) \(\frac{3}{16}\) (c) 1 (d) \(\frac{3}{2}\) (e) \(\infty\).

16. If \( f(x) = \begin{cases} 
\sqrt{-x} & \text{if } x < 0 \\
4 - x & \text{if } 0 \leq x < 4 \\
(x - 4)^2 & \text{if } x > 4 
\end{cases} \), then \( \lim_{x \to 0} f(x) \) is
(a) 0 (b) \(\frac{1}{2}\) (c) 1 (d) does not exist (e) not enough information given.

17. If \( f(x) = \begin{cases} 
\sqrt{-x} & \text{if } x < 0 \\
4 - x & \text{if } 0 \leq x < 4 \\
(x - 4)^2 & \text{if } x > 4 
\end{cases} \), then \( \lim_{x \to 4^-} f(x) \) is
(a) 0 (b) \(\frac{1}{2}\) (c) 1 (d) does not exist (e) not enough information given.

You should also look over your old quizzes, worksheet questions and the homework assigned from the book so far.