Name: _______________________

MA 3211 - 2005 B Term     Theory of Interest
December 14, 2005     FINAL EXAM

Please note: Unless otherwise indicated, In order to receive any partial credit on any problem on this exam, a detailed TIMELINE must be sketched for that problem. If you get the problem 100% correct without a timeline, good for you. If you make any mistakes and are hoping to receive some partial credit, a TIMELINE is a requirement.

No TIMELINE = No PARTIAL CREDIT

1. What is the accumulated value of $5,000 invested today at the end of 11 years and 4 months, assuming a nominal rate of discount $d^{(4)}$ of 8%? Do not assume simple discount over the final fractional period. (10 points)
2. You contribute $1000 to your retirement fund at the end of each month 2005 through 2044 (40 years times 12 payments is 480 total contributions). Your fund earns interest at a nominal rate $i^{(12)} = 6\%$ during this period. You retire on January 1, 2045, and you purchase a 20-year annuity-due which pays you $X$ per month, based on an effective rate of interest of 5%.

What is $X$? (10 points)
3. A 100,000 loan is being repaid over 10 years, using a **special sinking fund approach**. Interest is paid annually to the lender, with \( i = 8\% \). Contributions to the sinking fund are not level; instead, they increase each year – the first contribution is \( D \) at time \( t=1 \), then \( 2D \) at \( t=2 \), and so on until the final sinking fund contribution of \( 10D \) is made at \( t=10 \). The sinking fund is credited with 6\% interest each year.

What is the borrower’s total payment at \( t=5 \)? *(10 points)*
4. You are given the following cashflow information for a particular fund:

<table>
<thead>
<tr>
<th>Time</th>
<th>Cashflow</th>
<th>Balance (after cashflow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>0.50</td>
<td>-40</td>
<td>X</td>
</tr>
<tr>
<td>1.00</td>
<td>40</td>
<td>120</td>
</tr>
</tbody>
</table>

It is known that the time weighted return and the dollar weighted return for this fund over the given period are equal. Determine the dollar weighted rate of return. (6 points) Find X. (4 points) Timeline optional.
5. $100 is invested for six years, at a nominal rate of interest $i^{(2)} = 10\%$. Interest is paid every six months, and is reinvested at a nominal rate $j^{(2)} = 8\%$. How much has the $100 grown to at the end of five years? (10 points)
6. Write an expression for the value at time $t=4$ of payments of $300$ at time $t=0$ and $t=10$, plus payments of $400$ at time $t=2$ and $t=8$, plus payments of $300$ at times $t=4$ and $t=6$.  

7. A ten-year 100 par value bond pays 8% coupons semiannually. The bond is priced at 118.20 to yield an annual nominal rate of 6% convertible semiannually. Calculate the redemption value of the bond.  


8. Assuming $d=8\%$, how much does $100 \text{ at } t=0$ accumulate to by $t=5$? 
Timeline optional. 
*(10 points)*

9. If $v=0.95$, calculate $\ddot{a}_\infty$. 
Timeline optional. 
*(10 points)*
FOLLOWING THIS PAGE,
THERE ARE TWO BONUS QUESTIONS.

CHOOSE _ONE_ BONUS QUESTION – CIRCLE THE ONE
YOU ARE ANSWERING – YOU CAN GET BONUS POINTS
FOR ONLY _ONE_ QUESTION!!

PLEASE BE SURE TO ATTEMPT AT LEAST ONE OF
THESE QUESTIONS!! YOU CAN TRY THEM BOTH, AND
THEN MARK THE ONE YOU LIKE! IF YOU DON’T
MARK A QUESTION, I WILL ASSUME THE FIRST ONE
IS THE ONE YOU ARE DOING.

REMEMBER:
THE GRADE YOU SAVE MAY BE YOUR OWN!!!!
**BONUS QUESTION 1:** A loan is repaid with level annual payments based on an annual effective interest rate of 7%. The 8th payment consists of 789 of interest and 211 of principal. Calculate the amount of interest paid in the 18th payment. **Timeline optional.**
BONUS QUESTION 2: A company deposits 1000 at the beginning of the first year and 150 at the beginning of each subsequent year into perpetuity. In return the company receives payments at the end of each year forever. The first payment is 100. Each subsequent payment increases by 5%. Calculate the company’s yield rate for this transaction. (10 points)

**** END OF EXAM ****