

**MTH 162**  
**Exam 2**  
**Spring 2011**

Show all work in a neat and organized fashion. Clearly indicate your answers.  
100 points possible.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \quad \text{vertex at } x = \frac{-b}{2a}$$

$$\log(xy) = \log x + \log y, \quad \log\left(\frac{x}{y}\right) = \log x - \log y, \quad \log(x^N) = N \log x$$

$$\log_a b = \frac{\ln b}{\ln a} = \frac{\log_c b}{\log_c a}$$

$$I = Prt, \quad S = P + I$$

$$a_n = a_1 + (n - 1)d, \quad s_n = \frac{n}{2}(a_1 + a_n)$$

$$n = mt, \quad i = \frac{r}{m}, \quad S = P(1 + i)^n = P\left(1 + \frac{r}{m}\right)^{mt}, \quad S = Pe^{rt}$$

$$\text{APY} = \left(1 + \frac{r}{m}\right)^m - 1 = (1 + i)^m - 1, \quad \text{APY} = e^r - 1$$

$$a_n = a_1 r^{n-1}, \quad s_n = \frac{a_1(1 - r^n)}{1 - r}$$

$$R = A_n \cdot \left[ \frac{\frac{r}{m}}{1 - \left(1 + \frac{r}{m}\right)^{-mt}} \right] \quad R = A_n \cdot \left[ \frac{i}{1 - (1 + i)^{-n}} \right]$$

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1. (20 pts.) Logarithms.

(a) Write the equation in logarithmic form.

$$3^5 = 243$$

(b) Solve for  $x$ . (Suggestion: first rewrite the equation in exponential form.)

$$\log_{81} x = -\frac{1}{2}$$

(c) Evaluate

$$\log_a \left( \frac{x}{z} \right)$$

by using properties of logarithms and the following facts.

$$\log_a x = 8.1, \quad \log_a y = 3.8, \quad \log_a z = 5.7$$

(d) How many times more severe is an earthquake that measures 8.5 on the Richter scale, in comparison to one that measured 6.2?

(The formula is  $R = \log(I/I_0)$ , but I would do it a different way, without using this formula.)

2. (10 pts.) If the population of a certain county was 120,000 in 1995 and 182,000 in 2005, and if the formula  $y = P_0e^{ht}$  applies to the growth of the county's population, estimate the population of the county in 2028.

**3.** (10 pts.) Arithmetic sequences.

(a) Find the 58th term of the arithmetic sequence with first term 11 and common difference  $-\frac{1}{2}$ .

(b) Find the sum of the first 106 terms of the arithmetic sequence with first term 9 and common difference  $\frac{1}{4}$ .

4. (10 pts.) Simple interest.

(a) Suppose \$18,000 is invested for 3 months at an annual simple interest rate of 9%. What is the future value of the investment at the end of the 3 months?

(b) If you want to earn 6% annual simple interest on an investment, how much should you pay now for a note that will be worth \$20,000 in 10 months?

5. (10 pts.) Compound interest.

(a) Find the future value if \$6000 is invested for 10 years at 3% compounded quarterly.

(b) What present value amounts to \$27,000 if it is invested for 6 years at 8% compounded monthly?

6. (10 pts.) Annuities.

(a) With a present value of \$186,000, what is the size of the withdrawals that can be made at the end of each quarter for the next 15 years if money is worth 4.8%, compounded quarterly?

(b) An account earns 8.4%, compounded monthly. Suppose an individual makes an initial investment of \$8000 into this account, and makes additional contributions of \$150 at the end of each month for a period of 9 years. After these 9 years, this individual wants to make withdrawals at the end of each month for the next 4 years (so that the account balance will be reduced to \$0). What is the amount of each withdrawal?

7. (10 pts.) Develop an amortization schedule for a loan of \$35,000 with interest at 8%, compounded semiannually, if it is to be repaid in 2 years by making 4 semiannual payments of equal size.

<i>Period</i>	<i>Payment</i>	<i>Interest</i>	<i>Balance reduction</i>	<i>Unpaid balance</i>
				35,000.00
1				
2				
3				

8. (10 pts.) Refer to the graph of  $y = f(x)$  on the last page. For each of these, find the value or state that it does not exist.

(a)  $\lim_{x \rightarrow 5} f(x)$

(b)  $\lim_{x \rightarrow 1^-} f(x)$

(c)  $\lim_{x \rightarrow 1^+} f(x)$

(d)  $\lim_{x \rightarrow 1} f(x)$

(e)  $f(1)$

9. (10 pts.) Find each limit, if it exists.

(a)  $\lim_{x \rightarrow 3} \frac{x^2 + x - 12}{x^2 - x - 6}$

(b)  $\lim_{h \rightarrow 0} \frac{(x + 3h)^2 - x^2}{h}$