

Mathematics 106  
Test 1, Sample questions

Spring 2009

- A 5-day river cruise is priced at \$1600.00.
  - If the cruise company offers a 10% reduction in the price of the cruise to people who book online, what is the online price of the cruise? \$1440  
 $1600 - .10(1600) = 1600 - 160 = 1440$
  - The website for the cruise company also offers a further 15% reduction in the online price of the cruise to people who book 60 days ahead of the cruise. If a person books online and books 60 days ahead, what price would he or she pay for the cruise? \$1224  
 $1440 - .15(1440) = 1440 - 216 = 1224$
  - The website advertises that people who book early (60 days in advance) and online will receive a 25% savings on the cost of the cruise, based on the discounts above. The FTC would like to dispute that claim. What would the FTC argue is the actual percentage reduction in price for online, early buyers? 23.2% reduction The actual reduction is  $\frac{1224 - 1600}{1600} = \frac{-376}{1600} = -.235$   
 (not 25% as claimed)

2. Scientific Notation:

- The star Proxima Centauri is about 24,870,000,000,000 miles from earth. Rewrite the distance in scientific notation.  $2.487 \times 10^{13}$
- The planet Koosbane is about  $5.02 \times 10^{12}$  miles from earth. Rewrite this distance in standard notation. 5,020,000,000,000

c) Which is closer to earth? Koosbane

d) How many miles closer to earth is the heavenly body you identified in part c than the other one? (Express your answer in scientific notation.)  $1.985 \times 10^{13}$  miles

$$\begin{array}{r} 2.487 \times 10^{13} \\ - .502 \times 10^{13} \\ \hline 1.985 \times 10^{13} \end{array}$$

3. Jane borrows \$1500 from her parents for car repairs. She plans to repay them a total of \$1625 in 9 months,  $t = 9/12 \text{ yr}$

a) How much interest will she pay her parents? \$125 ( $1625 - 1500 = 125$ )

b) What simple interest rate will she pay them? 11.1% interest  $125 = 1500 \cdot r \cdot 9/12$   
 $r = \frac{125}{1500 \cdot 9/12} = .1111$

4. Elizabeth has \$2,400 that she would like to invest for a period of 10 years. Which of the following is the best investment over the ten year period? B - quarterly Show the formula you used and the final balance for each investment to justify your answer.

a) Investing at 4% compounded annually?  $2400 \cdot (1 + .04)^{10} = 3552.59$

Best b) Investing at 3.97% compounded quarterly?  $2400 \cdot (1 + \frac{.0397}{4})^{4 \cdot 10} = 3562.67$

c) Investing at 3.95% compounded continuously?  $2400 \cdot e^{.0395 \cdot 10} = 3562.52$

5. Richard's grandparents want to be able to give him \$24,500 in four years, to buy a car when he graduates from college. They know of an investment that pays 5.5%, compounded monthly.

a) What amount of money should they invest now so that they will have \$24,500 for a car in four years? \$19,671.60  
one deposit - present value  $\frac{24,500}{(1 + \frac{.055}{12})^{12 \cdot 4}} = 19,671.595 \uparrow$

b) What amount would they have to put in the bank at the end of every month for 4 years, if the annual interest rate is 5.5%, compounded monthly, in order to have \$24,500 in 4 years?

\$457.50  $PMT = \frac{24,500 \cdot (\frac{.055}{12})}{((1 + \frac{.055}{12})^{12 \cdot 4} - 1)} = 457.491 \uparrow \sim 457.50$

c) What is the total interest amount earned by the grandparents in part a) above?

\$4828.40 in part b) above? \$2340

$$\begin{array}{r} 24,500 \text{ (amt at end)} \\ - 19,671.60 \text{ (deposit)} \\ \hline 4828.40 \text{ (earnings = interest)} \end{array}$$

Total deposits:  $PMT \times n \times t = 457.50 \times 12 \times 4 = 21960$

$$\begin{array}{r} 24,500 \text{ (amt at end)} \\ - 21,960 \text{ (total deposits)} \\ \hline 2540 \text{ (earnings) interest} \end{array}$$

6. William's credit card has an annual interest rate of 19.8%. In the June 1- June 30 itemized billing, the June 1 unpaid (carry-over) balance was \$2200. A payment of \$700 was received on June 7. There were no other transactions for this billing period.
- a) Complete the table below to calculate the outstanding balance for each day of the billing period.

Time Period	Number of Days	Daily Balance
June 1-June 6	6	2200
June 7-June 30	24	1500

- b) Using the information above, calculate the average daily balance:  $\frac{2200 \cdot 6 + 1500 \cdot 24}{30} = \frac{49200}{30} = 1640$
- c) Calculate the total finance charge for the billing period:  $1640 \cdot 0.198 \cdot \frac{30}{360} = 27.06$
- d) Calculate the balance which he carries over to the next billing period:  $1527.06$  (add finance charge to ending balance)
7. Calculate the Effective Annual Yield (or Effective Annual Rate), to the nearest thousandth of a percent (i.e., to 3 decimal places):

- a) What is the effective annual yield on an account paying 6.5%, compounded continuously?  
 $e^{0.065} - 1 = 0.067159 \approx 6.716\%$
- b) What is the effective annual yield on an account paying 6.5%, compounded every three months?  
 $(1 + \frac{0.065}{4})^4 - 1 = 0.066610$  (n=4 - comp. periods a year)

8. Henry accidentally dropped his computer in the bathtub and destroyed it, so he has to buy a new one immediately. He decides to finance the \$2575.00 cost of the computer with a loan from the computer store, which is offering a 3-year amortized loan at an annual interest rate of 14%.

- a) What would the monthly payments be on that loan?  $PMT = \frac{2575 \cdot (\frac{0.14}{12})}{(1 - (1 + \frac{0.14}{12})^{-36})} = 88.01$
- b) What is the total cost of interest over the 3 years?  $88.01 \cdot 36 - 2575 = 593.36$
- c) Prepare a loan amortization schedule for the first 3 months of the computer loan. Round entries to the nearest penny.

Payment number	Interest	Principal	Loan Balance
1	$2575 \cdot 0.14 \cdot \frac{1}{12} = 30.04$	$88.01 - 30.04 = 57.97$	$2575 - 57.97 = 2517.03$
2	$2517.03 \cdot 0.14 \cdot \frac{1}{12} = 29.37$	$88.01 - 29.37 = 58.64$	$2517.03 - 58.64 = 2458.39$
3	$2458.39 \cdot 0.14 \cdot \frac{1}{12} = 28.68$	$88.01 - 28.68 = 59.33$	$2458.39 - 59.33 = 2399.06$

9. William and Mary are looking for a house. They have found the home of their dreams, a lovely brick home in the heart of London, which they can purchase for \$955,000. Assume that with their parents' help, they can make a 20% down payment.

- a) Find the amount of the down payment:  $955000 \cdot 0.20 = 191,000$
- b) Find the amount of the mortgage:  $955000 - 191000 = 764,000$
- c) Assume they can finance the house with a 30-year mortgage at a rate of 5.7%. What will their monthly payments be?  $PMT = \frac{764000 \cdot (\frac{0.057}{12})}{(1 - (1 + \frac{0.057}{12})^{-360})} = 4434.259$
- d) If they stay in the house long enough to pay off the mortgage (i.e., to amortize the debt), how much total interest will they have paid?  $4434.26 \cdot 360 - 764,000 = 832,333.60$

$4434.26 \cdot 12 \cdot 30 = 1,596,333.60 = \text{total pmts. subtract} = 1,596,333.60 - 764,000 = 832,333.60$

10. Samantha has gotten a new job and is offered an automatic savings plan which will pay 6.3% interest, compounded monthly. If she deposits \$175 at the end of every month into the plan,

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- how much will she have in her account at the end of 6 years?  $A = 175 \cdot \left[ \frac{(1 + \frac{0.063}{12})^{72} - 1}{\frac{0.063}{12}} \right] = 15,264.02$
- How much interest will she have earned in 6 years on her deposits?  $15,264.02 - 12,600 = 2,664.02$

$A = 175 \cdot \left[ \frac{(1 + \frac{0.063}{12})^{72} - 1}{\frac{0.063}{12}} \right] = 15,264.02$

Total deposits:  $175 \cdot 12 \cdot 6 = 12,600$   
 Interest earnings:  $15,264.02 - 12,600 = 2,664.02$   
 amt at end    amt deposited