

- 1) You want to buy a house. What is the most expensive house you can afford, given that you will have a 30 year loan at 4% interest compounded monthly and you can pay \$500/mo. at the end of each month?(10 pts)

$$500 \left[ \frac{(1 + \frac{.04}{12})^{360} - 1}{(\frac{.04}{12})} \right] = X \left(1 + \frac{.04}{12}\right)^{360}$$

$$500 \left[ 674,049,4043 \right] = X \left(1 + \frac{.04}{12}\right)^{360}$$

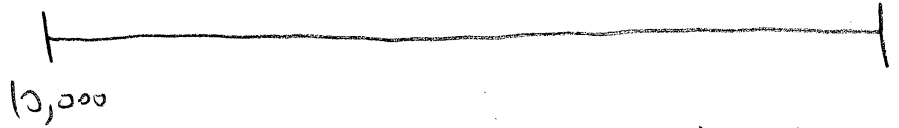
$$347,024,7021 \left(1 + \frac{.04}{12}\right)^{-360} = X$$

$$X = \$104,730.62$$

- loan amount w/out interest  
or

- available money for house

2) Penney Bank pays 3% interest, compounded annually. On January 1 my balance was 10,000. I plan to withdraw \$1,000 at the end of each year until my balance is less than \$1,000 at which point I stop withdrawing money. How many withdrawals can I make?  
 Hint: Find how many withdrawals it will take to make the balance 0. (10 pts)



after  
10  
years

$$10,000 (1.03)^{10} - 1,000 \left[ \frac{(1.03)^{10} - 1}{.03} \right] = 1975.28448$$

after  
12  
years

$$1975.28448 (1.03)^2 - 1,000 \left[ \frac{(1.03)^2 - 1}{.03} \right] = 2075.579305 - 2030 = 45.579305 \text{ after 12 years}$$

after  
11  
years

$$1975.28448 (1.03) - 1,000 \left[ \frac{(1.03) - 1}{.03} \right] = 1034.543 \text{ after 11 years}$$

Therefore after 12 years of withdrawals the amount drops below \$1,000

- 3) I deposited \$1,000 in an account. Over the first two years the discount rate for the account was 3%, over the next three years the force of interest was 4%, and over the last two years the interest rate was 6%. What was my final balance?  
(10 pts)

$$1,000 \left( \frac{1.03}{.97} + 1 \right)^2 = 1062.812201 \frac{(e^{.04})^3}{(1.04810774)^3} = 1198.31741 (1.06)^2$$

$$= \$1346.429442$$

or

$$\$1,346.43$$

- 4) You borrow \$500,000 to buy a house which you finance with a 20 year loan at 4% interest, compounded monthly. What are your monthly payments, paid at the end of each month? (10 pts)

$$500,000 \left(1 + \frac{.04}{12}\right)^{240} = P \left[ \frac{\left(1 + \frac{.04}{12}\right)^{240} - 1}{\left(\frac{.04}{12}\right)} \right]$$

$$1,111,291.043 = P [366.7746261]$$

$$P = 3,029.901645$$

or

\$3,029.90  
monthly  
payments

- 5) You take out a loan for \$300,000 at 3% interest compounded monthly for which you pay \$1300 at the end of each month. You plan to refinance the loan immediately after the 120th payment. How much will you need to borrow to pay off your original loan?  
(10 pts)

$$300,000 \left(1 + \frac{.03}{12}\right)^{120} = 1300 \left[ \frac{\left(1 + \frac{.03}{12}\right)^{120} - 1}{\frac{.03}{12}} \right] + X$$

$$300,000 (1.34935547) = 1300 [139.7414189] + X$$

$$404826.2641 - 181663.8446 = X$$

$$X = 223142.2195$$

or

\$ 223,142.22

Need to be

borrowed

**WITHOUT**

interest accounted for.

- 6) Southside Music Company offers a "rent to own" program which charges the customer \$200/month rental on a new Howitzer piano paid at the end of the month. After 5 years the customer can buy the piano for only \$P. Find P given that Southside wants the present value of all of the payments the customer makes over the 5 year rental period (monthly rent together with P) at 2% interest compounded monthly to equal the price of a new Howitzer, which is \$15,000.  
(10 pts)

$$15,000 = \left( 200 \left[ \frac{(1 + \frac{.02}{12})^{60} - 1}{\frac{.02}{12}} \right] + P \right) \left( 1 + \frac{.02}{12} \right)^{-60}$$

$$\frac{15,000}{(1.01667)^{60}} = \left( 200 [63.04739347] + P \right)$$

$$16576.1839 = 12609.47117 + P$$

$$P = 3966.71273$$

or

$$\$ 3,966.71$$

- 7) I bought \$60,000 of STAT 170 stock on January 1, 2015. I sold \$5000 worth of STAT 170 stock on February 1 and bought \$P worth of STAT 170 stock on July 1. On January 1, 2016, I sold all of my STAT 170 stock for \$58,000. Find P, given that the rate of return on my investment for the year was 2%.  
(10 pts)

~~$$\left(1 + \frac{i}{12}\right)^{12} = 1.02$$~~

~~$$1 + \frac{i}{12} = 1.001651581$$~~

~~$$\frac{i}{12} = 0.001651581$$~~

~~$$i = 0.019818976 \text{ - Monthly rate}$$~~

$$60,000 (1.019818976)^{12} - 5,000 (1.019818976)^{11} + P (1.019818976)^6 = 58,000$$

$$75,932.60774 -$$

$$60,000 (1.02)^1 - 5,000 (1.02)^{1/12} + P (1.02)^{1/2} = 58,000$$

$$56,108.40914 + P (1.02)^{1/2} = 58,000$$

$$P (1.02)^{1/2} = 18,915.9902$$

$$P = 18,721.954003$$

$$\text{or } \$18,721.95$$

of stock was  
bought in July

8) What price should you pay for a \$5,000 redemption value, 8 year bond which has \$300 coupons paid quarterly (four time a year), assuming that you want a 3% yield, compounded annually?  
(10 pts)

$$(1.03) = \left(1 + \frac{i}{4}\right)^4$$

$$\sqrt[4]{(1.03)} = 1 + \frac{i}{4}$$

$$1.007417072 = 1 + \frac{i}{4}$$

$$i = .029668287 \text{ per quarter}$$

$$\text{Price} = \left( 300 \left[ \frac{\left(1 + \frac{.0297}{4}\right)^{32} - 1}{\left(\frac{.0297}{4}\right)} \right] + 5,000 \right) \left(1 + \frac{.0297}{4}\right)^{-32}$$

$$= \left( 300 [35.96703514] + 5,000 \right) (.789409235)$$

$$= (15790.11054)(.789409235)$$

$$\text{Price} = 12464.85908$$

$$\$12,464.86$$



- 9) The bond in question (8) is sold after 3 years, immediately after the payment of the coupon, to an investor wanting a 2% yield, **compounded quarterly**? What should the selling price of the bond be?  
(10 pts)

$$P_{\text{rile}} = \left( 300 \left[ \frac{\left(1 + \frac{.02}{4}\right)^{20} - 1}{\left(\frac{.02}{4}\right)} \right] + 5,000 \right) \left(1 + \frac{.02}{4}\right)^{-20}$$

$$P_{\text{rile}} = \left( 300 [ 20.97911544 ] + 5000 \right) ( .905062909 )$$

$$P_{\text{rile}} = ( 11,293.73463 ) ( .905 \dots )$$

$$P_{\text{rile}} = 10,221.54026$$

or  
 \$10,221.54  
 for  
 bond

- 10) From January 1, 2008 to December 31, 2012, The Piggy Bank paid 2% interest, compounded monthly. On January 1, 2013, they raised their rate to 4% interest, compounded monthly. I deposited \$300 at the end of each month starting in January, 2008. How much will I have in my account immediately after my deposit on December 31, 2016? (10 pts)

$$5 \sim 2\%$$

$$4 \sim 4\%$$

$$B_1 = 300 \times \frac{(1 + 0.02/12)^{12 \times 5} - 1}{0.02/12} = \cancel{1819} 18914.20676.$$

$$B_2 = 300 \times \frac{(1 + 0.04/12)^{12 \times 4} - 1}{0.04/12} = 15587.88029$$

$$\begin{aligned} P_{\text{total}} &= 18914.20676 (1 + 0.04/12)^{12 \times 4} + 15587.88029 \\ &= 22190.12221 + 15587.88029 \\ &= 37778.0025 \checkmark \end{aligned}$$