

Math 111 Finance Worksheet D

1. **Present Value Annuity – Monthly Payment:** Megan Model borrows \$25,000 at 7.53% compounded monthly. If she wishes to pay off the loan after 15 years, how much would the monthly payment be?

<p>N= 180 I%= 7.53 PV= 25000 *PMT= 232.18/mo FV= 0 P/Y= 12 C/Y= 12 PMT: END BEGIN</p>	$A = PMT \left[\frac{1 - \left(1 + \frac{r}{n}\right)^{-nt}}{\frac{r}{n}} \right]$ $25000 = PMT \left[\frac{1 - \left(1 + \frac{.0753}{12}\right)^{-12(15)}}{\frac{.0753}{12}} \right]$	<p>Explorations:</p> <p>(a) Complete the left table below. Compare the effect of decreasing r on the monthly payment. By how much does the monthly payment decrease if r goes down by 1%?</p> <p>(b) Complete the right table below. Compare the effect of decreasing t on the monthly payment.</p>
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notice the loan amount

r	PMT (n=12; t=15; A=250000)
9%	\$2535.67/mo
8%	238.913
7%	224.707
6%	210.964
5%	197.898
4%	184.922

Notice the loan amount & term

t	PMT (n=12; r=.065; A=135000)	Total Cost
10	\$1532.90/mo	\$183.948 Total Cost
15	1175.99	Total cost
16	1132.75	is the product
20	1006.52	of the payment
25	911.53	& # of payments
30	852.29	PMT * N * t
		\$307184.4 Total Cost

Lower rates \Rightarrow lower payments.

Larger terms \Rightarrow lower payments but greater total cost.

2. **Managing Debt: Cost of Home Ownership:** Bob and Barb Noxious took out an \$182,300 loan at 8.5% interest for 30 years for the purchase of a new house. The loan requires monthly mortgage payments.

- (a) What is the monthly payment for this mortgage?

<p>N= 360 I%= 8.5 PV= 182,300 PMT= 1461.73 FV= 0 P/Y= 12 C/Y= 12 PMT: END BEGIN</p>

- (b) If you paid each of the 360 payments over the 30-year period, how much did you pay for the \$182,300 house over the life of the loan?

<p>$\sum \text{Int}(\text{first pmt \#, last pmt \#}) = 322,322$ Total Interest = \$322,322.54 Total Home Cost = \$504,622.54</p>	<p>Explorations:</p> <ul style="list-style-type: none"> What original home value would lead to a total payout of \$1 million? <p style="text-align: center;">A loan for \$361,266.12</p>
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This only works if the loan is in the TVM solver

Total Payout = (Monthly Payment) \times (Number of payments)

Principal Paid = (Original Loan Amount) - (Present Value of Loan). At the end of 30 years, PV = 0.

Interest Paid = (Total Payout) - (Principal Paid)

(c) If you wanted to pay off the loan after having paid 10 years of payments, how much would you have to pay?

N= 120
 I%= 8.5
 PV= 182,300
 PMT= 1401.73
 * FV= 161,522.44
 P/Y= 12
 C/Y= 12
 PMT: [END] BEGIN

(d) How much interest would have been paid over the 10 years?

$\Sigma \text{Int}(\text{first pmt \#, last pmt \#}) = \Sigma 120(1, 120)$
 \$147,429.96

This is $(182300 - 161522.44)(-1) + 120(1401.73)$

(e) How much equity would they have in the house at this time? Assume the value of the house is still \$182,300

$\Sigma \text{Prn}(\text{first pmt \#, last pmt \#}) =$
 \$20,777.56

This is $182,300 - 161,522.44$

(f) Calculate the present value of the loan for different values of t (and hence, N). How does the present value change as t increases?

t	PV (n=12; r=.085; PMT = 1401.73)
1	\$180,921.88
2	\$179,426.95
3	\$177,789.43
5	\$174,078.75
10	\$161,522.44
20	\$113,055.73
25	\$68,321.94
28	\$30,837.28
29	\$16,071.23
30	0

(g) Suppose Bob and Barb bought their home 10 years ago and made monthly payments as scheduled. They plan to move in two years. They could refinance for 7.25% right now on a new 20-year mortgage, but closing costs would be \$1800. Should they refinance? Assume that they will roll over the closing costs into the new mortgage.

N= 240
 I%= 7.25
 PV= 163,322.44
 * PMT= 1290.86
 FV= 0
 P/Y= 12
 C/Y= 12
 PMT: [END] BEGIN

$\leftarrow 161,522.44 + 1800 \text{ in closing costs}$

	Current Mortgage (8.5%)	New Mortgage (7.25%)
Present Value	161,522.44	163,322.44
Monthly Payment?	1401.73	1290.86
Savings per month?	110.87	
Number of months to recoup the closing costs?	about 16 mo.	

includes \$1000

(h) What if the refinance rate was 7.75%? Would the refinance still make sense for Bob & Barb?

Total savings in 2 yrs of about \$1900 if they sell

	Current Mortgage (8.5%)	New Mortgage (7.75%)
Present Value	161,522.44	163,322.44
Monthly Payment?	1401.73	1340.79
Savings per month?	\$60.94/mo savings	
Number of months to recoup the closing costs?	about 29.5 mo.	

%	8.5	7.25	7.75
Loan @ 10 yrs	161,522.44	163,322.44	163,322.44
Payments	1401.73	1290.86	1340.79
Loan @ 12 yrs			155,493.20
Total savings/loss in 2 yrs			\$155,493.20

(i) If, on the original loan, they paid an additional \$100 per month, how long would it take to pay off the loan?

N=	Explorations:
I%=	<ul style="list-style-type: none"> By how many years would the loan term be reduced if an additional \$200 was added to each payment? an additional \$300? What additional payment would be required to reduce the term of the loan to 15 years? When establishing a mortgage, which is usually lower, a 15-year fixed mortgage rate or a 30-year fixed mortgage rate?
PV=	
PMT=	
FV=	
P/Y=	
C/Y=	
PMT: END BEGIN	

Additional \$100: t = 23 yrs 2 mo Years reduced = ~ 7 yrs Savings: \$87k

Additional \$200: t = 19 yrs 4 mo Years reduced = ~ 11 yrs Savings: \$133k

Additional \$300: t = 16 yrs 9 mo Years reduced = ~ 13 yrs Savings: \$163k

If term = 15 years, Additional Payment = 1795.18 - 1401.73 = \$393.45/mo extra.

(j) Ask a friend or relative about their current mortgage. Write the present value, monthly payment, and interest rate of the current mortgage in the table below. Complete the rest of the table. Write a couple of sentences describing the advice you would give your friend or relative.

	Current Mortgage (r = %)	New Mortgage (r = 5%)
Present Value		
Monthly Payment?		
Savings per month?		
Number of months to recoup the closing costs? Assume closing costs are \$2000.		

* bankrate.com

