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A Case For Using Consumer Debt To Teach Present Value And Accounting Concepts

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Abstract

Time value of money concepts are one of the most important subjects in business education. Often these concepts are taught in conjunction with bond accounting, which is not immediately relevant for most students. This paper presents a handout to supplement the bond accounting chapter in introductory financial accounting with consumer debt examples. The topics include automobile loans and leases and home mortgages; personal economic decisions that nearly all students will encounter. The paper suggests that the use of consumer debt examples may enhance students' learning of time value of money.

Few would argue that one of the more important subjects covered in undergraduate business education is the time value of money. The topic has relevance for many business and consumer financing decisions. In introductory financial accounting classes these concepts are typically taught in conjunction with bond accounting.[1] The majority of students taking introductory financial accounting, however, will not be accounting majors and a much smaller percentage will ever have to account for bonds. But, almost every student will, at some time in his or her life, borrow money for a house or finance or lease a car. A working knowledge of how loans and leases work will not only empower students to make better decisions, but also can provide useful examples for learning the principles and applications of the time value of money.

The Accounting Education Change Commission states that "even if the student takes no additional academic work in accounting," the first accounting "course should help students perform financial analysis, (and) derive information for personal or organizational decisions" (AECC, 1992). Certainly how to finance one's home or automobile is such a personal decision. Too often we assume that students are capable of making the leap from interest on a bond to interest on a home mortgage, or from a capital lease to an automobile lease. Instead this paper provides examples for introductory accounting students to apply time value of money concepts to situations they are likely to face in their personal and professional lives.

Appendixes A through D contain supplementary materials to complement the bond accounting section of a textbook. This paper discusses the intent behind the handout, its usefulness as a teaching tool, and how faculty members may adapt the handout.

Automobile Purchase

An automobile will most likely be a student's first major purchase. Students tend to grasp the importance of being prepared when making this purchase. The typical car salesperson has no idea how purchase or lease payments are calculated, so a potential buyer, armed with a financial calculator and a little knowledge, may have an important advantage.

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[1]The functional area discussed here is financial accounting, but the arguments presented could equally apply to other areas where time value of money is taught e.g. managerial accounting, economics, and finance.

The Automobile Loan example in the handout is a relatively simple calculation of a car payment. The example demonstrates, in time value of money terms, the relationship between the purchase price and payments. A common strategy used by car salespeople is to ask the potential buyer what payment they can afford. The uninformed buyer only knows the payment but not the purchase price. This example connects the two.

The Automobile Loan example also introduces the method for splitting a payment between principal and interest. Once students see how to apportion the payment, the handout introduces amortization tables and how they can be prepared with spreadsheet software. The Handout Appendix (Appendix B) shows a partial amortization schedule for the car loan, and the cell formulas for the amortization schedule. The amortization schedule provides an opportunity to demonstrate how overpayments reduce the life of a loan, and thus the total cost. This can be accomplished by using a computer in class to increase the payments, and then going to the bottom of the schedule to show how many payments have been eliminated. Nothing demonstrates the time value of money better than showing how paying $100 today can save hundreds of dollars in five years. I encourage students to use the formulas to create schedules for their student, car, or home loans.

Cash Back or Cheap Interest

This is another example that applies present value concepts to a choice between cash back or cheap interest on an automobile purchase presented in a newspaper advertisement. In this case the approach may not seem to be obvious, because the cash flows from the interest savings are not evident. By comparing the cash back to the annuity of interest savings, the students can see in real terms how discounted cash flows can be represented by a single amount for use in decision making. Interest savings calculations can also be used to compare different loan terms or refinancing options. The second alternative, a comparison of two payments, is more simple and straight forward.

Automobile Leases

Automobile leases are another example where the monthly payment has become the main focus of the sale. Very few consumers or salespeople understand the derivation of a monthly lease payment. Furthermore, the unwary consumer has little idea what the actual purchase price is or whether that price is negotiable. In the example the lease terms, taken from a local newspaper, are used to calculate the missing sales price. The example demonstrates how residual values are discounted to the present, and thus illustrate again in real terms the time value of money. Lease examples can be adapted to calculate the payments or the implied residual value. Because automobile lease newspaper advertisements are common, it is easy to create these examples.

Home Mortgages

Because home mortgage payments and amortization schedules are no different than the previous automobile loan example, this section focuses more on using present values to calculate loan balances and compare mortgage terms. The handout demonstrates how the carrying value of any loan is no more than the present value of the remaining payments. The comparison between the fifteen-year and the thirty-year mortgages demonstrates one method for paying less interest. An alternative method, which can be demonstrated using Excel in class, reduces the loan principal by overpaying. Like the automobile example above, this is another opportunity to demonstrate how the early reduction of principal, even by small amounts, can have a profound effect on the number of later payments.

Taxes and Mortgages

Very few business decisions are made without considering tax implications, yet these are not always easily quantified. The home mortgage example provides a case for introducing tax considerations as they relate to home mortgages. This instance does not specifically use time value of money concepts, but it does illustrate a formula for calculating tax benefits. In addition, the example introduces such things as marginal tax rates, tax filing status, standard deductions, and itemized deductions. While accounting students will study these in their first tax course, this may be one of the few exposures to tax items for non-majors.

Present Value Tables

One problem with teaching time value of money in the context of loan amortization is that textbook present value factor tables usually do not convert well to monthly payments. A thirty-year eight percent loan will require 360 payments at two-thirds of one percent. Tables can be created for these unusual periods and percentages using a spreadsheet program. To create the factor for a present value of a single sum in Excel, use the power function in the following formula:

=1/POWER(1+$C$2,$C$3) where $C$2 would be the cell with the numerical interest percentage, and $C$3 would be the cell with the number of periods. The "$" in front of the letter and number makes the formula absolute, it will not change when it is copied. This formula is the equivalent of the traditional =1/(1+$C$2)^$C$3.

To create the factor for a present value of an annuity in Excel, use the payment function in the following formula:

=-1/PMT($C$2,$B$3,1) where $C$2 would be the cell with the numerical interest percentage, and $C$3 would be the cell with the number of periods. This formula is the equivalent of the traditional =(1-(1/(1+$C$2)^$C$3))/$C$2.

	A	B	C	D	E
1					
2		Interest Rate	10%		
3		Number of Periods	2		
4					
5	Present Value of $1			0.826446	=1/POWER(1+$C$2,$C$3)
6	Present Value of an Annuity of $1 in Arrears			1.735537	= -1/PMT($C$2,$C$3,1)
7					

Problems and Solutions

Appendix C contains sample problems and Appendix D contains the solutions for those problems. The problems reinforce the topics covered in the handout, but also offer different applications. For example, the description of automobile leases in the handout focuses on calculating the purchase price of a leased vehicle, while the problem asks for the calculation of the payment. This way the students are given an opportunity to apply their knowledge in a different way. The solutions are also used as a teaching tool. The approach here is to reinforce the topics with further explanation.

Conclusion

Every student should understand time-value of money concepts, because they are relevant to not only business, but to everyday life. Bond accounting, however, may not be relevant to many businesses or to students' future lives. This paper provides a supplement to the bond accounting chapter in introductory financial accounting textbooks. Consumer finance offers an opportunity to teach the mechanics of debt accounting in a way that non-majors can embrace and enjoy, and that accounting majors can benefit from as well. It also presents an opportunity to teach a very useful tool to all students; one that can excite the students and generate enthusiasm in class.

Appendix A

Present Value Concepts And Consumer Debt

The present value topics covered in this class can be applied to many situations involving borrowing to purchase expensive items. The intention of this handout is to give you an overview of the application of that knowledge in several areas.

Automobile Loans

When money is borrowed to finance a car, home, or any other expensive item the purchaser is told what the monthly payment is going to be. Very few consumers understand where that payment comes from. In time value of money terms, a string of equal monthly payments is an annuity, and the purchase price is the present value of that annuity. If a consumer knows the purchase price (and hopefully he or she would), the interest rate, and the number of payments, then it is not too difficult to calculate a payment.

Example:

Car purchase
Price - $18,000
Interest rate - 6%
Loan term - 5 years
Rent - the monthly payment

In this example, the purchase price of $18,000 represents the present value of the car payments. The interest rate of 6% represents a monthly interest rate of .5% (6%/12), and the loan calls for 60 payments (5 years x 12 months) to be made. This can be represented by the following formula:

$$\text{Rent}\ (PVA_{n = 60,\ r = .5\%}) = \$18{,}000$$
$$\text{Rent}\ (51.7256) = \$18{,}000$$
$$\text{Rent} = \$18{,}000/51.7256$$
$$\text{Rent} = \$347.99$$

Thus the monthly payment would be $347.99.

Most present value tables do not show factors for .5% or 60 periods, so it is usually helpful to purchase a financial calculator or, for home use, a computer.

Each car payment includes both interest on the loan and the partial repayment of the loan principal. To determine how to apportion each payment, simply multiply the carrying value of the loan (the remaining principal) times the interest rate to get the interest portion of the payment. The remaining amount of the payment goes to principal.

To determine how to divide the first payment for the above example, do the following:

$18,000 x .005 = $90.00 this amount is the interest

Payment	$347.99
Interest	90.00
Principal	$257.99

The Handout Appendix shows how all of the above calculations can be done using a computer spreadsheet (Excel in this case). Table 1 shows the structure of the loan and the amortization for the first 10 payments and the final 5 payments, and Table 2 shows the cell formulas for the calculation of the payment and the amortization schedule. Note that the Excel formula for a payment is =PMT(interest rate, number of periods, present value). The cell formula begins with a "-" to make the payment positive, because Excel assumes payments are outflows rather than inflows from the loan. The interest argument is divided by 12 to make the interest rate monthly, and the number of periods is multiplied by 12 to convert the years into months.

Cash Back Or Cheap Interest

Another choice that automobile buyers are sometimes faced with is the decision to take a rebate today or cheap interest over the life of a loan. Zero or low interest and large rebates have become commonplace. One manufacturer offered the following special deal for purchasers of one of its compact cars. Potential buyers got the choice of $1500 cash back or 1.9% interest over 60 months when car loans were around 9%. How does one choose? Below are two possible approaches to this decision. One is to compare the present value of the interest savings to the cash back.

Example:

Assume the following

	A	B	C
Price	$13,000	$13,000	$11,500
Interest	9.0%	1.9%	9.0%
Term	60 mo.	60 mo.	60 mo.
Payment	$269.86	$227.29*	$238.72
Savings		$ 42.57	

* For interest rates not included on the annuity table it is necessary to use a financial calculator or a computer.

Column A shows what the payment would be if the purchaser keeps the $1,500 and finances the full price of the automobile. Column B shows the payment if the purchaser takes the lower interest rate. Column C shows the payment if the purchaser uses the $1,500 to pay down the amount financed.

Comparison of A and B. The $42.57 represents the interest savings per month. Discounting that amount back at an appropriate interest rate will provide the number to compare to the cash back. For this example, an appropriate interest rate would be the individual's savings rate, assume 4%, because that is the rate he or she would get if the savings were invested.

$$\$42.57\ (PVA_{n = 60,\ r = 4\%/12}) = \$2,311.51$$

Using this method, it appears that taking the cheaper interest is a better deal.

Comparison of B and C. An alternative, and perhaps simpler approach would be to use the $1,500 as partial payment for the automobile and finance the difference. A simple comparison of the payments again shows that the cheaper interest is a better deal.

Automobile Leases

When an auto is leased rather than purchased, the lessee (person leasing) is financing the difference between what the auto is worth today (its purchase price) and what it will be worth when the lease expires (its residual value). This explains why cars that do not lose their value quickly can sometimes be cheaper to lease.

Much of the information for lease terms can be found in the fine print for the lease advertisements. There you will usually find the length of the lease, interest rate, residual value, and any other payments that may be required. Whether or not it is stated, there is an implied purchase price in any automobile lease. Many times the actual price is not disclosed, because the dealer is selling the attractiveness of the payment and hoping the customer will not consider what the purchase price actually is.

For the lessor the calculation of the lease payment is a two-step process. The residual value represents what the auto will be worth when the lease expires (its future value) and that amount must first be discounted to what that amount is worth today. The difference between the present value of the residual value and the purchase price is the amount being financed, and the lease payment is calculated using that amount.

Example:
A local car dealer advertised a new SUV for a $400 per month lease payment. The fine print revealed the following information.

Down payment or trade-in	$4,500
Term	36 months
Residual Value	$22,300
Interest Rate	6%

There is enough information to calculate the implied sales price.

First, calculate the present value of the residual value.

PV = 22,300 ($PV_{n = 36, r = .5\%}$)
PV = 22,300 (.8356)
PV = 18,634

Calculate the present value of the lease payments

PV = 400 ($PVA_{n = 36, r = .5\%}$)
PV = 400 (32.8710)
PV = 13,148

Down Payment	$ 4,500
Lease Payments	13,148
Residual Value	18,634
Purchase Price	$36,282

What this tells us is that the lessee is paying for the difference between what the SUV is worth today, $36,282, and what it will be worth in three years discounted back to today, $18,634, with a down payment of $4,500 and monthly payments of $400.

Leasing can be especially attractive if the manufacturer is subsidizing the interest. That is, sometimes the manufacturer will offer an interest rate that is well below the market rate in order to sell more vehicles. These rates can sometimes be 2% or lower. The smart consumer would use the subsidized interest rate for the first three years and then purchase the vehicle for the residual value when the lease term is over.

Another strategy is to negotiate a purchase price first even though you intend to lease. Because the residual price and the interest rates are fixed, the only way to reduce the monthly lease payment is to negotiate the gap between the purchase price and the residual value down. Once a purchase price is agreed upon, then ask about leasing the same vehicle using the negotiated purchase price. The lease payment should be lower than if you initially offered to lease the vehicle.

Home Mortgages, 30 Year Loans

The calculation of a home mortgage payment is no different than the calculation of a car payment. That is, the purchase price represents the present value of all future mortgage payments.

Example:
Assume that you want to purchase a $250,000 home, interest rates are 9% for 30-year mortgages, and the bank requires a $25,000 down payment. Thus, the payment would be:

Rent (PVA $_{n = 360,\ r = .75\%}$)	= $225,000
Rent (124.2819)	= $225,000
Rent	= $225,000/124.2819
Rent	= $1,810.40

To calculate the principal and interest on the first payment, multiply the loan balance ($225,000) times the monthly interest rate to get the interest.

$225,000 x .0075 = $1,687.50

Payment	$1,810.40
Interest	1,687.50
Principal	$ 122.90

Try creating an amortization schedule for the first five payments.

An amortization schedule is useful in determining the amount of principal and interest for a payment, but for long amortizations they can be time consuming. A quick method for determining the makeup of any individual payment is to calculate the loan balance at any point in time. The loan balance represents the present value of the remaining payments. Therefore, the loan balance of the above loan after 10 years (with 20 years remaining) will be the present value of the last 240 payments.

Balance	= 1,810.40 (PVA $_{n = 240,\ r = ¾\%}$)
Balance	= 1,810.40 (111.1450)
Balance	= $201,217

Amount Financed	$225,000.00
Balance	201,217.00
Amount Paid Down	$ 23,783.00

Interest calculation for next payment:

$201,217 x .0075 = $1,509.13

Payment	$1,810.40
Interest	1,509.13
Principal	$ 301.27

It is obvious from the above example that it takes a long time to pay down the principal on a conventional 30-year mortgage. One alternative is to finance the purchase over 15 years. Payments will be larger, but not double as may be indicated by halving the term. Shorter mortgages have an added advantage of lower interest rates, because the bank's risk is lower due to the shorter term. Assume the same example as above, except the interest rate is now 8% (a 1% difference between a 30-year and a 15-year mortgage is probably unrealistic - ½% is more typical).

Home Mortgages, 15 Year Loan

Rent ($PVA_{n = 180,\ r = .75\%}$) = $225,000
Rent (104.6406) = $225,000
Rent = $225,000/104.6406
Rent = $2,150.22

$225,000 x .0067 = $1,500.00

Payment	$2,150.22
Interest	1,500.00
Principal	$ 650.22
Payment 15-year	$2,150.22
Payment 30-year	1,810.40
Difference	$ 339.82
First Payment	
Principal 15-year	$ 650.22
Principal 30-year	122.90
Difference	$ 527.32

The increase in the monthly mortgage payment from cutting the term of the mortgage in half (with the assumed interest rate change) is more than offset by the increased amount paid to the loan principal. All of the increase in the payment and additionally nearly $200 goes to the principal.

Taxes, Home Mortgages, And Rent Or Buy Decisions

The decision on whether to rent or buy a home is more complicated than comparing rent payments to mortgage payments. The obvious advantage of home ownership is the creation of equity (wealth), but the tax code also allows for certain other advantages. However, homeowners also pay property taxes, homeowner's insurance, and potentially mortgage insurance, which can add hundreds of dollars to the monthly mortgage payment. Comparing a rent payment to a mortgage payment can be a complicated undertaking.

Using the 30-year mortgage example above assume the following information

Property taxes - 18 mils (1.8% of assessed value)
Homeowner's insurance - $600/year or $50 per month

The mortgage lender generally requires homeowner's insurance. If the tax assessor assessed the $250,000 house in the example above at its purchase price (which is not always the case), then the property taxes would be calculated as follows.

$250,000 x .018 = $4,500 per year or $375 per month

Assuming the property taxes and insurance are paid on a monthly basis, the total monthly payment would be:

Mortgage payment	$1,810.40
Property taxes	375.00
Insurance	50.00
Total	$2,235.40

While this is the monthly payment, it does not represent the actual cost. Both mortgage interest and property taxes are deductible expenses for personal Federal income taxes. To calculate the tax advantage of these amounts, they must first be compared to the standard deduction. The tax advantage is the amount that the mortgage interest and property taxes exceed the standard deduction times the marginal tax rate. That is, the tax advantage is the amount of additional tax-deductible expenses that home ownership creates. If the homeowner is married and has an adjusted gross income of $80,000 (necessary to know the marginal tax rate), then the tax advantage would be calculated as follows.

Annual mortgage interest	$17,707 *
Property taxes	4,500
Total home-related expenses	22,207
2006 Married filing joint	
Standard deduction	10,300
Excess over std. deduction	11,907
Marginal tax rate (25%)	.25
After-tax advantage	$ 2,977
Monthly after-tax advantage	$2,977/12 = $248.06

Because of the tax advantages of owning a home, the actual monthly payment is:

Monthly payment	$2,235.40
Tax benefit	(248.06)
Net payment	$1,987.34

*This amount is the sum of the interest amounts on an amortization table for the first year of ownership assuming the home was purchased in early January. In subsequent years this amount will decrease as the loan principal is reduced. The amount will also be smaller in any partial year of purchase. A quick way to estimate this amount is to multiply the loan principal times the annual interest rate. The product will be a little high, but close enough.

Most renters, because they do not pay mortgage interest, do not have enough itemized deductions to exceed the standard deduction. Once the standard deduction is exceeded, itemizable expenses such as charitable contributions or business related expenses could be deducted. Although the calculation above does not capture these amounts, they would realistically reduce the actual cash flow even further. Conversely, replacing a septic system or a roof can easily offset any tax advantage to owning a home.

This example is a simplification that has made numerous assumptions. Mortgage interest rates are currently lower than the example. Property taxes vary considerably, and a single person will have a lower standard deduction and perhaps a different marginal tax rate. However, the format is flexible and adaptable to any situation.

Appendix B

HANDOUT APPENDIX
Table 1 - Amortization schedule

	J	K	L	M	N	O	P
1							
2		AMORTIZATION SCHEDULE FOR A FIVE YEAR CAR LOAN					
3							
4		PRINCIPAL		18000			
5		INTEREST		6%			
6		LENGTH (YEARS)		5			
7							
8		PAYMENT		$347.99			
9							
10	NUMBER	DATE	PAYMENT	INTEREST	PRINCIPAL	BALANCE	
11						$18,000.00	
12	1	06/01/06	$347.99	90.00	$257.99	$17,742.01	
13	2	07/01/06	$347.99	88.71	$259.28	$17,482.73	
14	3	08/01/06	$347.99	87.41	$260.58	$17,222.15	
15	4	09/01/06	$347.99	86.11	$261.88	$16,960.27	
16	5	10/01/06	$347.99	84.80	$263.19	$16,697.08	
67	56	01/01/11	$347.99	8.57	$339.42	$1,374.73	
68	57	02/01/11	$347.99	6.87	$341.12	$1,033.62	
69	58	03/01/11	$347.99	5.17	$342.82	$690.80	
70	59	04/01/11	$347.99	3.45	$344.54	$346.26	
71	60	05/01/11	$347.99	1.73	$346.26	($0.00)	
72							

Table 2 – Cell Formulas

	J	K	L	M	N	O	P
1							
2		AMORTIZATION SCHEDULE FOR A FIVE YEAR CAR LOAN					
3							
4		PRINCIPAL		18000			
5		INTEREST		6%			
6		LENGTH (YEARS)		5			
7							
8		PAYMENT		=-PMT(M5/12, M6*12, M4)			
9							
10	NUMBER	DATE	PAYMENT	INTEREST	PRINCIPAL	BALANCE	
11						=M4	
12	1	06/01/06	=$M$8	=O11*$M$5*1/12	=L12-M12	=O11-N12	
13	2	07/01/06	=$M$8	=O12*$M$5*1/12	=L13-M13	=O12-N13	
14	3	08/01/06	=$M$8	=O13*$M$5*1/12	=L14-M14	=O13-N14	
15	4	09/01/06	=$M$8	=O14*$M$5*1/12	=L15-M15	=O14-N15	
16	5	10/01/06	=$M$8	=O15*$M$5*1/12	=L16-M16	=O15-N16	

Appendix C

PROBLEMS

1. Automobile Loan

Bubba's old car is on its last legs, and he finds himself in need of new transportation. After careful study of his family budget, he determines that he can afford to put $2,000 down and make a $300 per month payment. Assuming car loan interest rates are currently 6%, what is the most expensive auto Bubba could afford to buy if he finances it for three years? Four years? Five years?

2. Automobile Lease

Victoria lives in a snowy climate and needs reliable transportation. She finds just what she's looking for, a new car with a sticker price of $22,000. She is able to negotiate the price down to $20800 when the salesperson suggests that perhaps she should lease the car. The manufacturer is offering a 6% interest rate on leases. Louise is intrigued, because her bank's interest rate is 9%. If the residual value of the car is $12000 after a 3-year lease, what would Victoria's monthly lease payments be? What would her payments be if she purchased the auto and financed it for 5 years? If she decides to purchase the car after the lease is up, what will her payments be if she decides to purchase the car at the end of the lease term for its residual value (assume 9% interest and a two year loan)?

3. Home Mortgage

Barbie and Ken just got married, and they want to purchase their dream home. Ken's parents gave them $50,000 to use as a down payment. Assuming they can afford $1,500 per month for their mortgage payment (ignore taxes and insurance), how expensive a house can they buy using a 15-year mortgage at 8% interest per year? How much of the house will they own after 5 years? 10 years?

4. Taxes

Dick and Jane decide to buy a new home. At the beginning of the year they borrowed $180,000 at 8% for 30 years. Their house was assessed at $200,000, and their tax levy is 17 mils. For the current year, the standard deduction for married filing joint is $10,300. Assuming they make a monthly payment for mortgage and taxes, what is that amount? What is their real (after tax) monthly payment assuming a full year's interest at the beginning mortgage balance? The tax rate is 28%.

Appendix D

SOLUTIONS FOR CONSUMER DEBT HANDOUT PROBLEMS

1. The $300 payments are an annuity, and the present value of the annuity plus the down payment is equal to the value of the car Bubba can afford.

3 years times 12 months = 36 payments
6% interest per month (6%/12) = .5%

Down Payment	$ 2,000.00
$300 (PVA $_{n = 36, r = .5\%}$)	
$300 (32.8710)	9,861.30
	$11,861.30

4 years times 12 months = 48 payments

Down Payment	$ 2,000.00
$300 (PVA $_{n = 48, r = .5\%}$)	
$300 (42.5803)	12,774.09
	$14,774.09

5 years times 12 months = 60 payments

Down Payment	$ 2,000.00
$300 (PVA $_{n = 60, r = .5\%}$)	
$300 (51.7256)	15,517.68
	$17,517.68

2. For the lease Victoria is financing the difference between the negotiated purchase price and what the residual value is worth today. The lease payment is an annuity with a present value equal to that difference. The first step is to value the residual value in today's dollars.

3 years times 12 months = 36 payments
6% interest per month (6%/12) = .5%

Residual Value = $12,000 (PV $_{n = 36, r = .5\%}$)*
Residual Value = $12,000 (.8356)
Residual Value = $10,027.20

* Note: The present value of a single amount table is used here

Next, calculate the amount being financed:

Purchase Price	$20,800.00
PV of Residual Value	10,027.20
	$10,772.80

The PV of the annuity payments is equal to the amount being financed.

Rent (PVA $_{n = 36, r = .5\%}$)	= $10,772.80
Rent (32.8710)	= $10,772.80
Rent	= $10,772.80 /32.8710
Rent	= $**327.73**

If the car is purchased, the purchase price represents the present value of the payment annuity.

5 years times 12 months = 60 payments
9% interest per month (9%/12) = .75%

Rent (PVA $_{n = 60, r = .75\%}$)	= $20,800.00
Rent (48.1734)	= $20,800.00
Rent	= $20,800.00 /48.1734
Rent	= **$431.78**

If the car is purchased after the lease, the residual value represents the present value of the payment annuity.

2 years times 12 months = 24 payments
9% interest per month (9%/12) = .75%

Rent (PVA $_{n = 24, r = .75\%}$)	= $12,000.00
Rent (21.8891)	= $12,000.00
Rent	= $12,000.00 /21.8891
Rent	= **$548.22**

3. The present value of the monthly payment annuity that Barbie and Ken can afford, when added to their down payment, is equal to the value of the home they can afford.

15 years times 12 months = 180 payments
8% interest per month (8%/12) = .67%

Down Payment	$ 50,000.00
$1,500 (PVA $_{n = 180, r = .67\%}$)	
$1,500 (104.6406)	156,960.90
	$206,960.90

Home equity (the amount owned by Barbie and Ken) is the difference between the purchase price and the balance of the mortgage note. The balance of the mortgage note (or any note) is the present value of the remaining payments. After 5 years, there are 10 years remaining.

10 years times 12 months = 120 payments

$1,500 (PVA $_{n = 120, r = .67\%}$)	
$1,500 (82.4215)	$123,632.25
Purchase Price	206,960.90
Mortgage Balance	(123,632.25)
Equity	**$ 83,328.65**

After 10 years, there are 5 years remaining.

5 years times 12 months = 60 payments

$1,500 (PVA $_{n = 60, r = .67\%}$)	
$1,500 (49.3184)	$73,977.60
Purchase Price	206,960.90
Mortgage Balance	(73,977.60)
Equity	**$132,983.30**

4. The $180,000 amount financed represents the present value of 30 years' mortgage payments.

30 years times 12 months = 360 payments
8% interest per month (8%/12) = .67%

Rent (PVA $_{n = 360, r = .67\%}$)	= $180,000.00
Rent (136.2835)	= $180,000.00
Rent	= $180,000.00 /136.2835
Rent	= $1,320.78

The tax rate of 17 mils is equal to 1.7% of the assessed value which is added to the monthly payment.

.017 x $200,000.00 = $3,400.00 / 12 = $283.33 / month

Mortgage note payment	$1,320.78
Property taxes	283.33
Total monthly payment	**$1,604.11**

To calculate the after-tax monthly payment, the tax benefit of being able to deduct mortgage interest and property taxes must be subtracted from the mortgage payment. The benefit is the after-tax effect of the deduction that exceeds the standard deduction (which is the amount that taxpayers who don't itemize get).

Loan Balance	$ 180,000	
Interest Rate	.08	
Annual Interest	14,400	
Annual Taxes	3,400	
Total Deductions	17,800	
Standard Deduction	(10,300)	
Tax Benefit	7,500	
Marginal Tax Rate	.28	
After-Tax Benefit	$2,100	/ 12 = $175.00 per month

Mortgage and Tax Payment	$1,604.11
After-Tax benefit	(175.00)
Net payment	**$1,429.11**

REFERENCES

Accounting Education Change Commission, (1992), *Position Statement No. 2: The First Course in Accounting*, New York, NY: American Accounting Association.