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Real Estate Finance

Revised: July 28, 2008

Loan Underwriting Case

Objective: The objective of this assignment is to introduce students to the loan underwriting process. This includes but is not limited to preparing amortization tables and qualifying the buyer using alternative financing methods which include a 30 year fixed rate, 3/1 hybrid, and a buydown among others.

Assignment: Please download the spreadsheet Affordability_Spr2009.xls from my website and answer the following questions. Please highlight your answers in yellow and turn in a hard copy of your results. Do ***NOT*** email me your spreadsheets! ***This is an individual assignment***. Please prepare this project in a professional manner since you can use this for job interviewing purposes.

Description of the Neighborhood[1] (Zip Code 85255): McDowell Mountain Ranch, or The Ranch, is a 3,200-acre master planned community nestled in the foothills of the McDowell Mountains in northeast Scottsdale. It has served as a model for development of Sonoran desert communities. The community, was first conceived in 1992 when Long-time Valley residents and philanthropists, the Herberger family sold its 3,200-acre ranch to Newhall Land & Farming Company. It was opened to the public in April 1995, when eight builders began sales offering 21 models in 11 neighborhoods with prices ranging from the mid-$120's to more than $500,000. In July of 2003, the last builder models closed and McDowell Mountain Ranch was sold out.

McDowell Mountain Ranch is made up of 26 distinct neighborhoods, built by 14 different builders, and comprises almost 4,000 homes. This diverse, family oriented community has a wide range of amenities[2] including a five-acre park and community center with a swimming pool, spa, basketball court, tennis courts, a sand volleyball court and the very popular splash fountain. There are also two shopping centers within The Ranch offering a variety of dining experiences, a large supermarket, and many unique and wonderful shopping and service opportunities. Miles of improved trails connect neighborhoods to each other and to the Scottsdale Public Library, Citizen Service Center, elementary/middle school and the recreation center. Residents enjoy access to the mountain preserve consisting of nearly nine hundred acres of land (dedicated to Sonoran Desert preservation by McDowell Mountain Ranch) via the improved trail system. The city will soon be breaking ground on an expansive aquatic park and eventually on a gateway center for the McDowell Sonoran Preserve.

[1]The community's website is http://www.mcdowellmountainranch.org/.
[2]Over $130,000,000 was spent on infrastructure and site improvements

Loan Information: Loan rates are found in the worksheet labeled "Subject Property". These rates are current (as of July 25, 2008 when this case was constructed) and are the rates that you will use in this assignment. The current and historical loan limit on the size of single-family home mortgages that Fannie Mae and Freddie Mac buys from banks is located in the worksheet named "FNMA Limits (2008)". Mortgages that fall within these government sponsored enterprises (GSE) purchase limits are called conforming loans and are cheaper for consumers[3] because banks and thrifts can readily sell them to Fannie Mae and Freddie Mac or swap them for mortgage-backed securities. The GSEs are able to provide a lower cost largely because their government affiliation allows them to borrow at a lower rate than other finance companies. Fannie Mae and Freddie Mac sell large amounts of bonds and other debt securities and use the proceeds to finance their purchases of home mortgages. Loans that exceed the Fannie Mae/Freddie Mac loan limits are known as non-conforming or Jumbo loans.

Other Loan Criteria of the Lender: Like other lenders, your financial institution requires that buyers must purchase private mortgage insurance (PMI)[4] if they put down less than 20% of the purchase price of the home. Currently PMI is .005 or ½ of 1% of the outstanding loan balance. The buyers are required to maintain their PMI until their loan balance is less than 80% of the contract sales price of the home. (Note: Unless the borrower terminates PMI when the 80% balance is reached, the borrower continues to pay PMI). Any loan whose contract loan amount ***exceeds*** the Fannie Mae/Freddie Mac loan limits is considered a Jumbo loan. Borrowers are required to set up an escrow account, which includes principal, interest, property taxes, and insurance, for 3 months.[5] This escrow amount is included in the total closing costs, which is discussed below. The bank requires that all points and fees be paid in cash (this is part of the total closing costs) rather than rolled into the mortgage e.g., the bank will not finance the points and fees by increasing the mortgage amount. The bank uses the following ratios in qualifying the homebuyer:

Housing Expense-to-Gross Income Ratio: 28%
Long Term Debt-to-Gross Income Ratio[6]: 36%

where

> **Monthly housing expenses (PITI)**: The sum of monthly payments for **p**rincipal, **i**nterest, property **t**axes, homeowner's **i**nsurance[7], hazard insurance (if required), private mortgage insurance (if required), and condo or homeowner's fees (if required).

[3]Mortgages bought by Fannie Mae and Freddie Mac typically have a rate about 0.30 percentage points lower than loans they are not eligible to buy.
[4]For more information on private mortgage insurance, please visit the industry's website at http://www.privatemi.com/
[5]The rationale for this escrow account is in the event that a homebuyer loses his or her job. Time is required to find a new job.
[6]Lenders are sometimes flexible in these ratios. For example, if the LT Debt to Gross Income Ratio is say 36.4% they might round to 36%.
[7]Like your car insurance the cost of your homeowner's insurance will be dependent on the age, location, and type of home you have. Typically the insurance shouldn't cost more than .5% of the appraised value of your home. In cases of total loss, the insurance would cover the replacement value of the home,

Monthly Debt Payments: The sum of monthly payments on long-term debt, including the debt service payments on your potential home (including private mortgage insurance), car payments, student loan payments, and other personal loans requiring a periodic payment. Include your minimum monthly payment required on credit card balances carried over from month-to-month; but do not include credit card balances that you pay off entirely each month. Also, do not include your current mortgage payment if you are selling that property.

Gross Income: household's total monthly income before taxes. Alimony and child support payments, whether incoming or outgoing, should be reflected in the estimate.

In evaluating the income/salary of the borrower(s), the bank you go to WILL NOT count any bonus money due to its uncertain nature and frequency of payment (usually a lump sum payment rather than monthly payments).[8] In terms of necessary documentation, the bank requires 3 years of income tax returns, together with one year of receipts for the payment of utilities (phone, water, and electric/gas).

Closing costs: Closing costs are one-time fees paid at closing for the loan and expressed as a percentage of the mortgage amount. This *includes* points and origination fees paid to the lender and transfer fees required to complete the transaction. Assume that the total closing costs (including points and origination fees) are 3% of the contract loan amount[9]. Note: You should ask your lender for a copy of the "Good Faith Estimate of Closing Costs" which itemizes fees commonly charged in your area. These fees include but are not limited to appraisal fees ($305 average), credit report ($37), application fee ($288), document preparation fee ($186), and flood certification ($18) among others. Closing costs to the buyer typically do not include the realtor's commission, which is paid by the seller, in general. Please refer to the "Closing Costs (AZ vs US)" worksheet for a sample of closing costs in Arizona.

The Homebuyers: Gordon Carey and his wife, Sharon, are alumni of the W.P. Carey School of Business at Arizona State University. Gordon has an MBA in Real Estate and has worked full-time for Shilder Investment Group as an acquisition analyst for the past 7 years and earns $115,000 per year. Sharon works for Success Realty and earns $45,000 a year as a realtor. They have $160,000 in savings. Their FICO score is 710. The couple has one car, a Prius, which they just purchased on a 4-year lease. Lease payments are $321 per month. They also have on average a $25,000 balance on their credit card which charges a 21% annual percentage rate (apr) that they carry over from

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excluding the value of the land. For this case, assume that homeowner's insurance ***per year*** is .5%*Purchase Price of House.

[8]Lenders typically include the bonus in the household income if: 1) The bonus is part of a collective bargaining agreement and must be paid; or 2) The bonus is included in the computation of income by the employer or if there is a history of bonuses. If there is a history of bonuses but the applicant does not know if a bonus is planned, nor does the employer divulge its plans for a bonus nor the projected bonus amount, the lender typically uses an average of past two years' bonuses to calculate income. A bonus history for compliance purposes is to be considered one year or more. However, the bonus is NOT included in household income if the bonus is totally discretionary by the employer, there is no previous bonus history, and the wages of the applicant are the basic source of income.

[9]In a typical real estate deal, closing costs total 2% to 5%. Exact fees vary by property cost and location.

month to month and for which they typically make payments of $1,000 per month[10]. In addition to this, Sharon has a student loan outstanding. Payment on the student loans is $250 per month. The outstanding balance on her student loan is $4,000. They have no other debts outstanding.

The Careys' have already seen several houses in the McDowell Mountain Ranch community and have chosen to put in an offer on the house (shown to the right) with a Multiple Listing Service (MLS) number of 2989503. The description of this house is given in the "Subject Property" worksheet. They have come to your firm for financing and would like you to help them in getting the deal done.

1. Home Prices in the Neighborhood (20 points): Homes that have sold recently in McDowell Mountain Ranch are found in the worksheet labeled "Homes Sold (McDowell Mt Ranch)".

   a. Constructing New Variables from the Data: Since Gordon has taken a course in statistics, he would like to use a regression model in helping him to price the house. Prior to doing a regression, he first transforms the data of sold properties using the worksheet "1a. Transform Variables" and filling in the section highlighted in yellow:

      Time: Is the number of months from July 23, 2008. To calculate this in Excel, insert 7/23/2008 in cell Q1.

      To calculate the number of months from July 23rd using Excel e.g. calculate the number of months between two dates, in cell Q3 enter

      =(YEAR($Q$1)-YEAR(D3))*12+MONTH($Q$1)-MONTH(D3)

      Note: If you press the **F2** function key at the top of your keyboard, you will be able to see what cells are associated with the formula. Intuitively, you are subtracting the years and multiplying by 12 to convert it into months and then subtracting the months. For example, since 7/23/2008 is in cell Q1 (we use an absolute cell reference of $Q$1 using the **F4** function key), Year($Q$1) converts it into 2008. Similarly, since 7/14/2008 is in cell D3, Year(D3) converts it into 2008. Using a similar logic process, the Month function e.g. MONTH($Q$1) converts 7/23/2008 into 7 months and MONTH(D3) is converts 7/14/2008 into 7 months. Thus,

      =(YEAR($R$1)-YEAR(D3))*12+MONTH($R$1)-MONTH(D3)

[10]There are many credit card calculators available on the Internet. One such java applet is http://www.dinkytown.net/java/DebtAmount.html. Note that credit card companies calculate interest based on the annual percentage rate (apr) stated on the card. Caveat: Do not be fooled by basing your monthly payments on the low promotional interest rate that is only good for a short period of time. Your minimum monthly payment is typically calculated as 2% of your current outstanding balance. This is one of the most common methods used by credit card companies to calculate minimum payments.

=(2007-2007)*12 + 7 - 7 = 0 months

Why use time as a variable: In most real estate markets, prices tend to increase over time and so more recent sales have higher prices relative to those that sold several months ago. This is especially true in a “hot” market. The converse exists in “cold” markets.

BldgAge2008: This is how old the comparable property is relative to the year 2008. For example, since the comparable property located at 10247 E Hillery Drive was built (YearBuilt) in 1999, the age of the building is 9 years old. We can model this in Excel using the formula =2008-G3

Dum_Pool: Is a dummy or indicator variable[11]. The variable is equal to 1 if the house has a pool e.g., there is a “Yes” in the Pool column L otherwise the variable is set equal to zero. This variable indicates whether buyers tend to put a premium on having a pool. Since the house at 10247 E Hillery Drive does not have a pool, the Dum_Pool is set equal to 0. You can use the IF function in Excel to do this as follows: =IF(L3="Yes",1,0) and then copy this function for the rest of your column.

Dum_TLot: Is another dummy or indicator variable. The variable is equal to 1 if the house is located where one road intersects another road forming a T such that the house experiences the headlights of cars at night (road runs right up to the property). If the house has a "T" lot location, then 1 (Yes), otherwise the variable is set equal to zero. This variable indicates whether buyers tend to put a discount on this type of location. Since the house at 10247 E Hillery Drive is not a “T” lot, the Dum_TLot is set equal to 0. You can use the IF function in Excel to do this as follows: =IF(N3="Yes",1,0) and then copy this function for the rest of your column.

Dum_Corner: Is another dummy or indicator variable. The variable is equal to 1 if the house is on the corner (corner lot) e.g., there is a “Yes” in the Corner Lot column N otherwise the variable is set equal to zero. This variable indicates whether buyers tend to put a premium or discount for having a corner lot. Since the house at 10247 E Hillery Drive is not a corner lot, the Dum_Corner is set equal to 0. You can use the IF function in Excel to do this as follows: =IF(O3="Yes",1,0) and then copy this function for the rest of your column.

Dum_CuldeSac: Is another dummy or indicator variable. The variable is equal to 1 if the house is located in a Cul-de-Sac e.g., there is a “Yes” in the Cul-de-Sac column O otherwise the variable is set equal to zero. This variable indicates whether buyers tend to put a premium or discount for living in a Cul-de-Sac since there is less traffic. Since the house at 10247 E Hillery Drive is not in a cul-de-sac, the Dum_CuldeSac is set equal to 0. You can use the IF function in Excel to do this as follows: =IF(P3="Yes",1,0) and then copy this function for the rest of your column.

[11]Recall from statistics that you must have n-1 dummy variables so that the matrix is of full rank.

DOM (Days on Market): This is the number of days between the Sold Date and List Date. Since the house at 10247 E Hillery Drive was sold on 7/14/2008 and was listed on 6/9/2008, it remained on the market for 35 days (=D3-C3).

Sold/List: This is the discount or premium paid from the original list price calculated as (Sold Price/List Price). Since the property at 10247 E Hillery Drive sold for $326,500 and was listed at $365000 the Sold/List is .89 (=F3/E3). This means that there was an 11% (1-.89) discount from the list price. On the other hand, since the property at 10516 E Acacia Drive sold for $570,000 but was listed at $564,000, the Sold/List is 1.01 which represents a 1% premium (1.01 - 1) from the list price.

Sprice PSF (Sold price per square foot): A lot of the difference between the sales price for houses in the same neighborhood can be accounted for by house size known as square feet of building area. As such real estate people, typically think in terms of price per spatial unit where the spatial unit depends on the type of property. For most property types such as houses, industrial, office, or retail buildings, this is square feet. A per unit metric is used for apartments while for hotels, a per room measure is used. Since the property at 10247 E Hillery Drive sold for $326,500 and has 1,481 square feet, the price per square foot is $220.46 (=F3/J3)

Sprice/(Tax*100): In addition to sales price per square foot, another frequently used measure to value houses is the sales price relative to annual property taxes multiplied by 100. The reason that this works is that property tax is based on the property's assessed value[12]. Since the annual property tax for 10247 E Hillery Drive is $1,864, the ratio is 1.75 (=F3/(M3*100)).

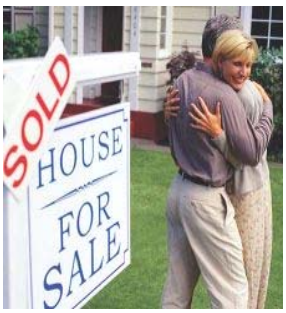
b. Relationship between days on market (DOM) and Premium/Discount (Sold/List). Graph the relationship between premium/discount (Y axis) and days on market (DOM) using an XY(Scatter) graph option. Appendix A in this handout shows you how to do this. Add a trendline to this scatterplot by first clicking on the dots to highlight them, right clicking on the mouse and then selecting the add Trendline option. You can try the different options e.g. linear vs. polynomial (set it for example to 4 for 4th power). Report the regression equation and R-squared of the regression you select (linear or polynomial). Discuss why a relationship should exist.

c. Relationship between Sold Price per square foot and Time: Graph the relationship between Sold price per square foot (Y axis) and Time (X axis) using a Line graph option. To do this, calculate the average sold price per square foot for each month and then graph this average sold price per square foot from August 2007 until July 2008. Add a polynomial (4) trendline to this line and also report the regression equation and R-squared. Discuss why a relationship should exist.

[12]In Arizona, the assessed value for owner-occupied residential property is 10 percent of full cash (market) value

d. Relationship between Sold Price per square foot and Annual Property Taxes: Graph the relationship between Sold price per square foot (Y axis) and Annual Property Taxes (X axis) using an XY(Scatter) graph option. Add a linear trendline to this scatterplot. Discuss why a relationship should exist.

e. Estimating the Sales Price vis-à-vis Regression: Perform a regression of Sales Price (dependent Y-variable) on the following X independent variables: Bedrooms, Bathrooms, House Size (Bldg Sqft), Garage Size, Property Tax, Time, Age of Building, Dum_Pool, Dum_TLot, Dum_Corner, Dum_CuldeSac, and the Number of Days on the Market. Appendix B in this handout gives a primer on how to do a regression using Excel. What is the estimated sales price for our subject property located at 15727 N 104th Place, Scottsdale, AZ 85255 whose characteristics are in the "Subject Property" worksheet? Assume that DOM (days on the market) and Time (in Months) are both equal to 0.



How good a job does our regression model do in predicting the cross-sectional variation in sold prices to the cross-sectional variation in the independent variables? Should we include all of the variables in our regression estimate even if their T-statistic is not statistically significant at the 5% level (Hint: look at the F-statistic)? Which of our independent variables is statistically significant using the T-test? In other words, what are the key drivers of price as indicated by the statistically significant variables (T-statistics)? How close are we to Zillow.com's estimate of $545,000 for this house in terms of the dollar amount difference and also the percentage difference? Given the listing price relative to your regression estimate, is this house priced to sell (priced at a discount to its true value), correctly priced or is it overpriced?

2. Amortization Table (Base Case) (15 points): If Gordon and Sharon put down 20% of the purchase price (1 - Loan to Value Ratio) given that lenders are adhering very closely to their underwriting criteria given the subprime crisis and want a 30 year fixed rate mortgage, what will their monthly payments be if they were to purchase the subject property assuming that they agree to the full list price of $624,900?

   a. Using Excel, construct a 360-month amortization table showing the beginning balance, debt service payment, interest payment, principal payment, and ending balance. Also show what their total monthly payment to the lender will be if this amount differs from their monthly debt service payment. Given these flows[13], calculate the annual percentage rate (APR), which is the true borrowing cost. Recall that the lender's IRR known as the APR is equal to the true borrowing cost. Hint: you might have to put in a guess value such as .001 in order to calculate the IRR. Remember that this IRR is a monthly IRR and as such, you will need to multiply it by 12 in order to obtain the APR. Since there are points and loan origination fees, your APR should *exceed* the contract interest rate.

[13]Even though the lender collects PMI, he passes this payment on to the insurer.

b. Next, graph the interest payments and principal payments using the charting function in Excel. Explain why interest is declining and principal is increasing over time.

c. On another graph, plot the outstanding mortgage balance over time. Explain why the outstanding mortgage balance is declining over time. Discuss how a mortgage, which is a type of corporate bond, differs from the traditional corporate bond in terms of its principal amount?

3. Amount of Money Required by Borrowers (Base Case) (5 points): Using the "3. Downpymt" template, what is the total amount of money including closing costs that the Gordon and his wife Sharon must come up with (i.e., the amount of equity) assuming that their offer price equals the list price of $624,900?

4. Qualification of Buyers (5 points): Using the template "4. Qualify Buyer", what are the total long-term debt payments per month for Gordon and his wife given the facts in question #2 above? What is the monthly housing expense e.g., principal, interest, property taxes, and property & casualty insurance per month? Assume that

   - Current ANNUAL property taxes are as given in the "Subject Property" worksheet
   - Homeowner's Insurance is .5% of sale price. Example: if the sale price was $350,000 then the annual insurance is $350,000*.5% = $1,750 per year or $145.83 per month
   - Private Mortgage Insurance (PMI) is 1/2 of 1% of the outstanding loan balance. Example: If the initial loan balance is $315,000, then PMI for the first month is ($315,000*.5%)/12 months = $131.25 for month 1. Borrowers pay PMI only if the loan to value ratio is above 80%.

   Based on your bank's housing expense-to-total gross income ratio (28%) and the long-term debt-to-total gross income ratio (36%), do Gordon and Sharon qualify for the mortgage?

5. Some Deal Structuring Alternatives (10 points): David, Sharon's uncle, suggests that Gordon and Sharon consider the following alternatives:

   - Alternative #1: Reduce the offer price by 5% (95% of List Price) with no paying down of any credit card debt or debt on student loans.
   - Alternative #2: Reduce the offer price by 5% (95% of List Price) and pay off Shardon's student loan[14].
   - Altenative #3: Reduce the offer price by 8% (92% of List Price) and pay off Shardon's student loan.

[14]Recall that the outstanding balance on Sharon's student loan is $4,000.

- Altenative #4: Reduce the offer price by 8% (92% of List Price), increase the FICO score to 750, and pay off Sharon's student loan.

Do Gordon and Sharon qualify for based on any of these three alternatives? Can they qualify without reducing either their credit card debt? Please explain.

6. Creative Financing using a 3/1 Hybrid Arm: Gordon's uncle, Flash, suggests that they should consider taking out a 3/1 hybrid loan. Under this type of loan, the contract rate of interest is fixed for the first 3 years. It is "as if" they have a fixed rate loan (with the monthly payment calculations the same as taking out a 30 year fixed rate loan) for 3 years. After three years, the loan converts to an adjustable rate mortgage wherein the rate adjusts annually based either on the COFI or treasury rate depending on the index that they choose. What is the total mortgage payment per month for the first 3 years assuming that they can get the seller to agree to accept an offer price of $593,665 (5% discount off the list price)? For this scenario, assume that Gordon and Sharon do not pay down either their credit card debt or their student loan. What are the total long-term debt payments per month? What is the monthly housing expense? What are the total housing expense-to-gross income ratio and the long-term debt-to-gross income ratio? Do the Careys' qualify for the mortgage? Please discuss.

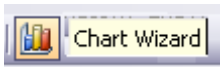
7. Buying Down the Loan: Candace, a friend of Sharon's, suggests that they buy down the loan for 3 years to a contract interest rate of 7 1/8% (7.125%) in lieu of taking out a 3/1-hybrid loan. Her reasoning is that at the end of 3 years, both Gordon and Sharon should be earning a higher salary and should thus be in a better position to cover the mortgage payments. This is essentially a graduated payment mortgage with one-step or gradation. How much must Gordon and Sharon pay to the lender in order to buy down the loan for 3 years assuming that their offer price for the house is $593,665 (5% off the list price)? Do the Careys' qualify for the mortgage based on the initial payments from the buydown? In particular, what is the total housing expense-to-gross income ratio and the long-term debt-to-gross income ratio based on the initial payments from the buydown? Is this a viable alternative for the Gordon and Sharon? Why or why not?

8. Decision: Best Way to Structure the Deal: Assuming that Gordon and Sharon want to purchase the house, under what terms (financing and offer price) would they qualify for the house? Which alternative(s) would you recommend that they choose and why? Please explain. Remember that they have $160,000 in savings.

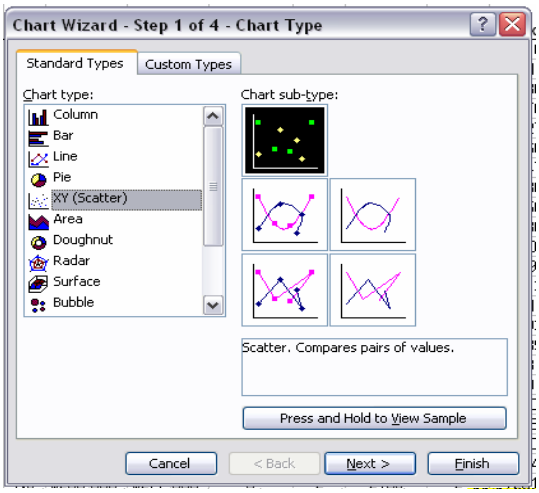
Reminder: This is an individual assignment. Please turn in a hardcopy of your analysis. Your analysis should be prepared in a Wall Street, Investment Banker format so that you can use this project in a job interview.

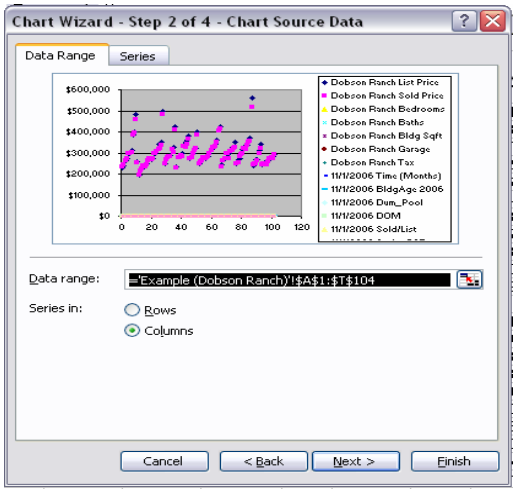
Appendix A: Using Excel to Create a Scatterplot

In this example we will use the data for Sales in Dobson Ranch located in the "Example (Dobson Ranch)" worksheet to demonstrate how to create a scatterplot using Excel. Double click on the Chart Wizard icon located at the top of the Excel worksheet



If you do not see this icon in your Excel toolbar, pull down the **Tools** menu, select **Customize…**, go to the **Commands** tab, scroll down and highlight Drawing, click on the

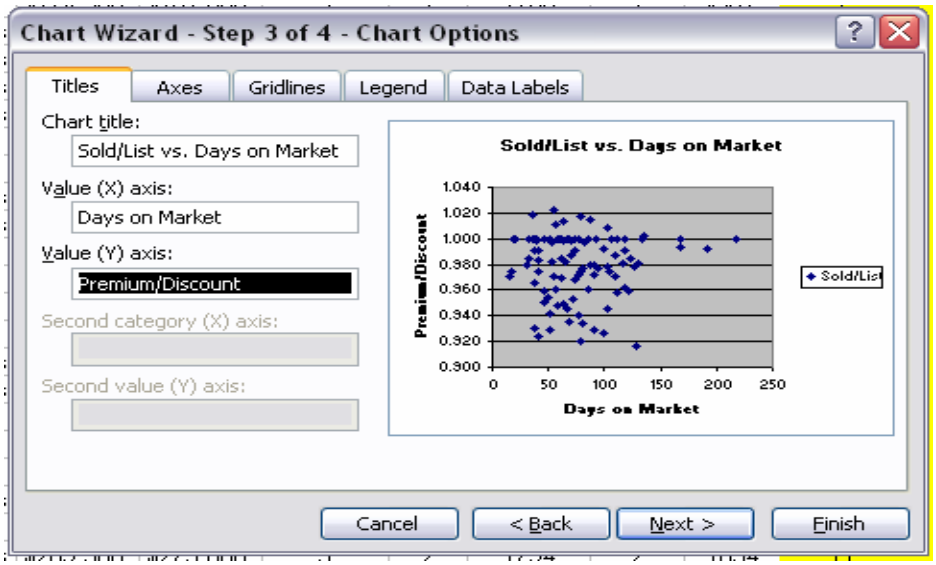




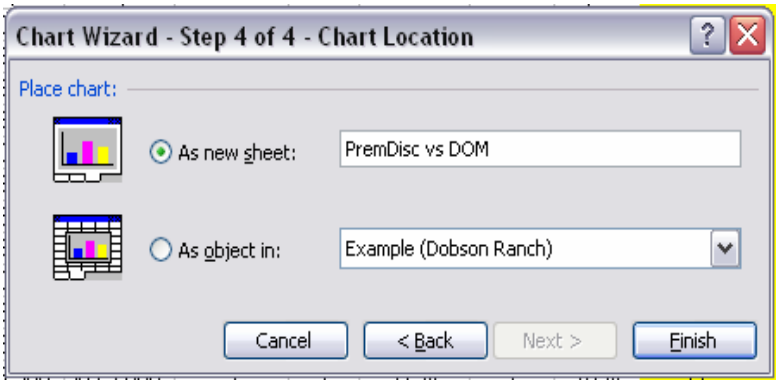
Charting icon and then drag the **Chart wizard** icon to the Excel toolbar. The following screen (on left) will appear after you double click on the Chart wizard icon. Under **Chart type:** select the **XY(Scatter)** plot, then click on the **Next>** button at the bottom of the screen. The screen on the right will appear. At the top of the screen, it will say Step 2 of 4 – Chart Source Data. Move your cursor to the box labeled **Data range:**, click in the box and use the backspace key to erase the data range. Alternatively, you can use the **Delete** key on your keyboard. Next, click and highlight the columns that you want to chart making sure to put a comma between the columns. In our example, we wish to plot the relationship between Sold/List (premium/discount) and Days on the Market (DOM). The following should appear in the **Data range:** box after you have finished highlighting the columns

='Example (Dobson Ranch)'!$R$2:$R$104,'Example (Dobson Ranch)'!$Q$2:$Q$104

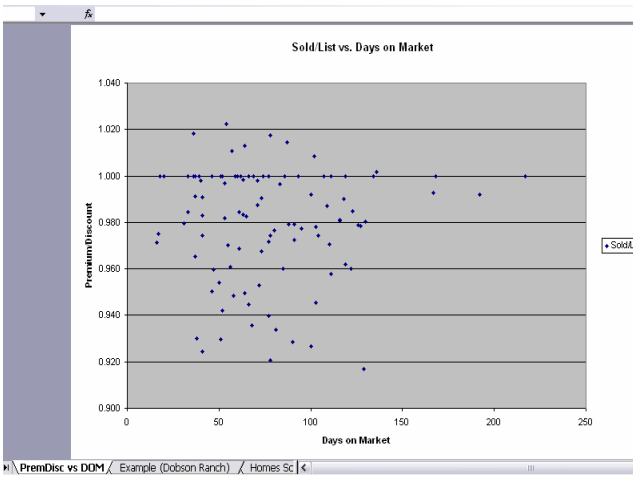
Since both series are in columns, make sure that the **Series in: Columns** is checked. This is the default and is located immediately beneath the **Data range:** line. Click on the **Next>** button at the bottom of the screen. In the screen that appears, type in Sold/List vs. Days on Market for the **Chart title:**, Days on Market for **Value (X) axis:**, and Premium/Discount for **Value (Y) axis:** then click on the **Next>** button.

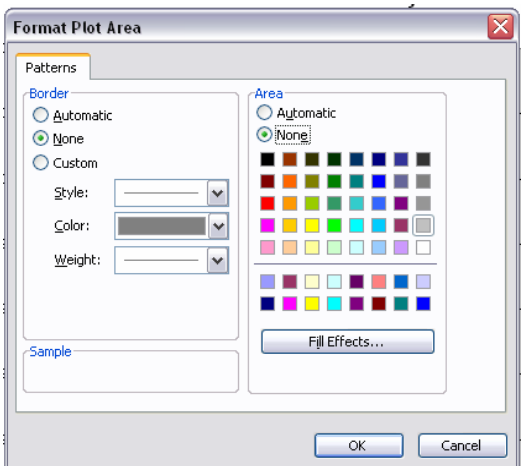


In the last Chart Wizard box – Step 4 of 4, it gives you the option of either placing the chart in the existing "Example (Dobson Ranch)" worksheet, another existing worksheet, or **As a new sheet**. We will select the **As a new sheet** option and label this new Chart PremDisc vs DOM as follows:

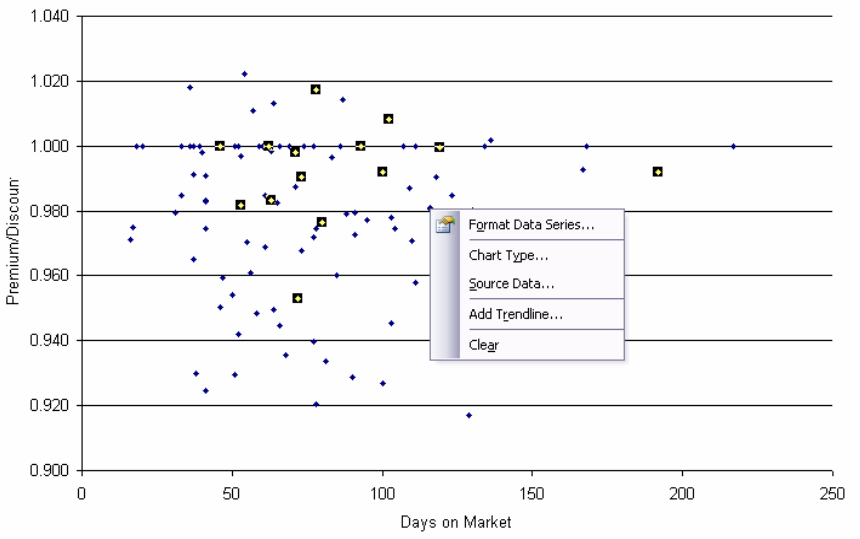


Click the **Finish** button to finish your chart. To tidy up your new chart, double click on the gray area inside the chart. In the resulting Format Plot Area screen, select **None** for both **Border** and **Area** and then click the **OK** button.

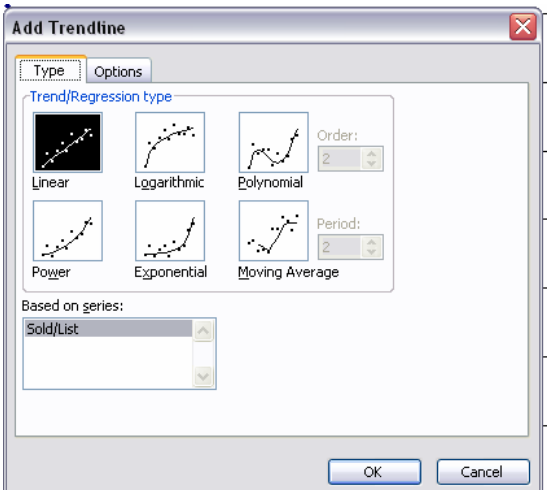


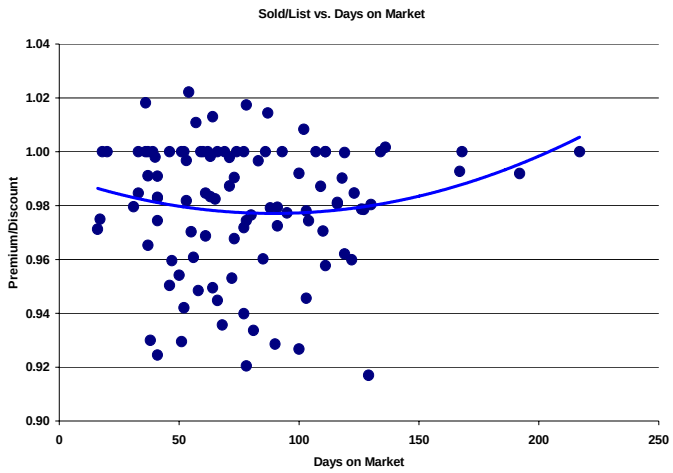


To get rid of the Sold/List legend, simply click on it then use the **Delete** key. Move your cursor to a dot/observation and right click on your mouse.



From the menu that appears, select **Add Trendline…** which will result in the following **Add Trendline** screen. We want to use a **Polynomial** trend. Click on the **Polynomial** box and then click on the **OK** button.

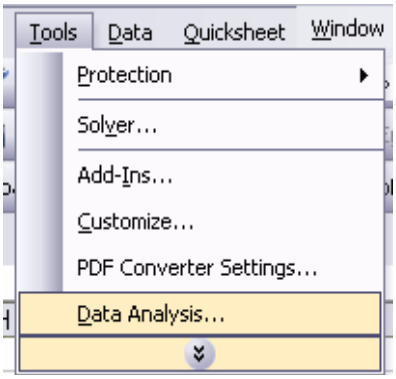


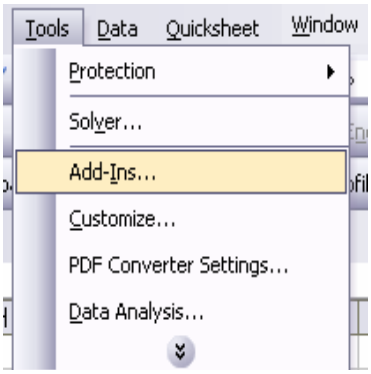


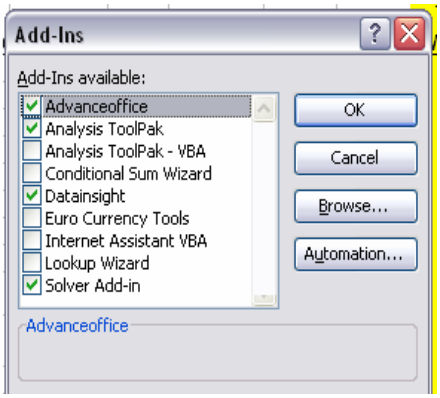
Interpretation of graph: Observe that the graph takes a quadratic shape decreasing and then increasing over time. What this tends to indicate is that the longer that a property remains on the market, the greater the likelihood that the seller will have to accept a lower price from his or her listing price. However, to the extent that a seller is willing to wait for the market to “catch up” to his or her list price, a premium over the list price is possible. It appears that over the time period for which we did this analysis, there was approximately a 2% discount (1 - .98 = 100% - 98%) off the list price for sales occurring between 50-120 days on the market. Caveat: The upward sloping line that we observe after 150 days on the market is driven by just a few data points (4 observations).

Appendix B: Using Excel to Do a Regression

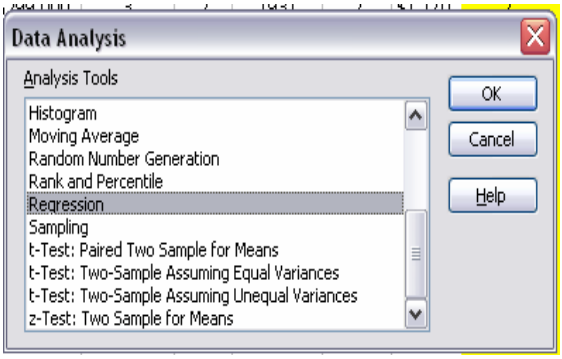
We will continue to use the data for Sales in Dobson Ranch located in the "Example (Dobson Ranch)" worksheet to demonstrate how to do a regression using Excel. First, pull down the **Tools** menu and select **Data Analysis…**. If you do not see the **Data Analysis….** Option in the **Tools** menu, select the **Add-Ins…** option and in the next

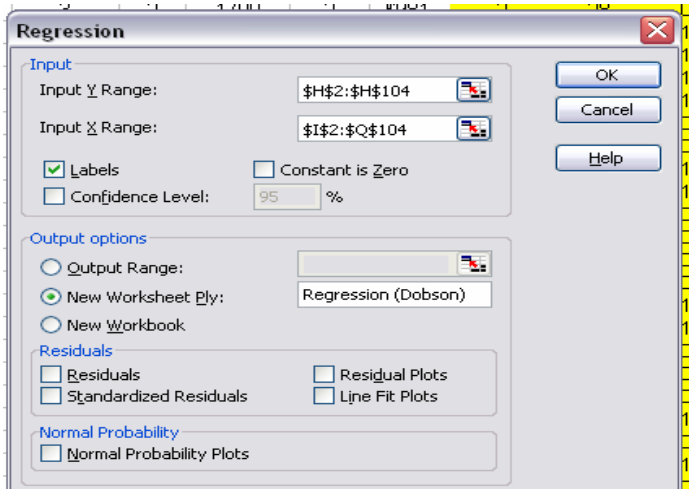




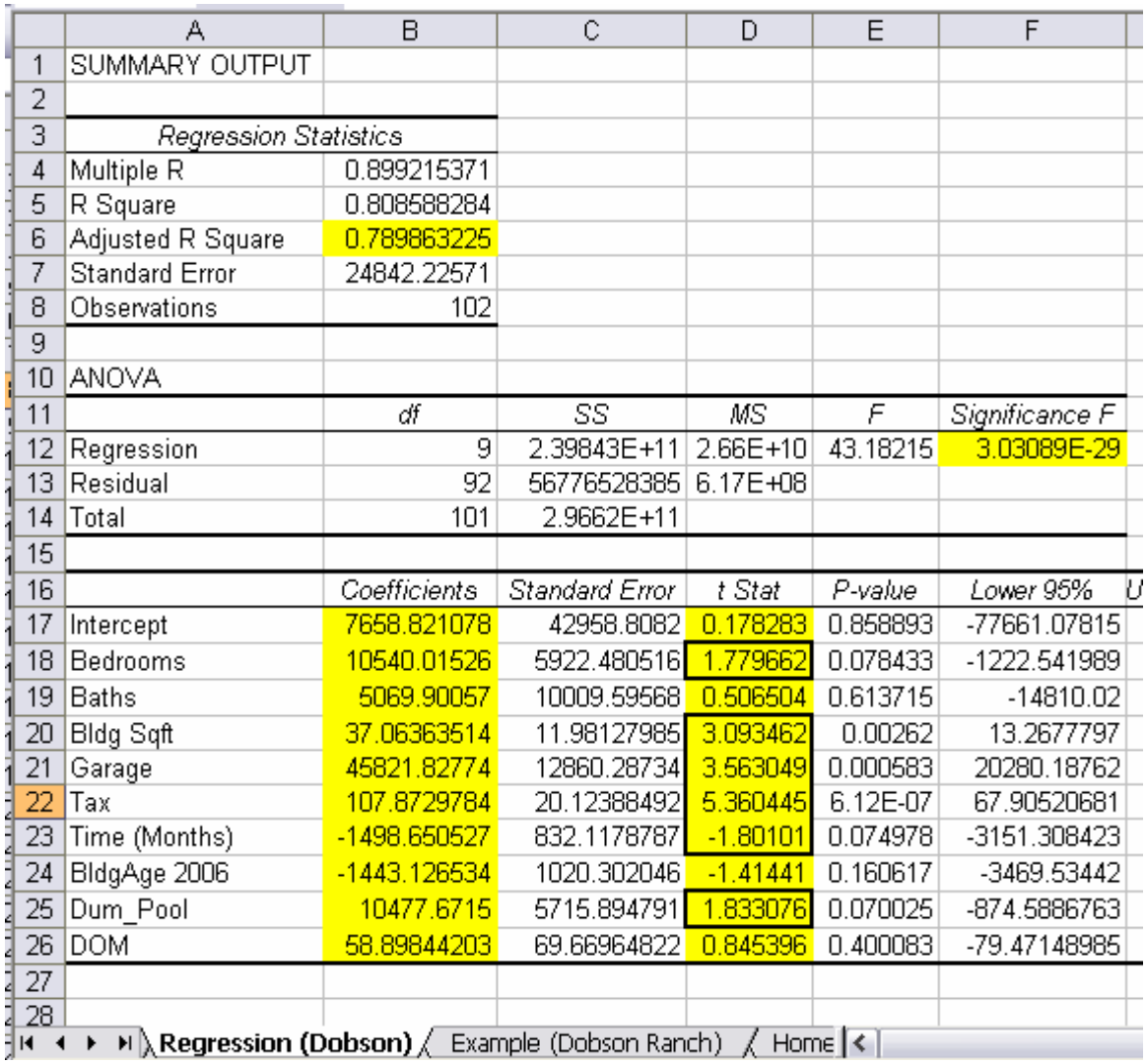


screen that appears, select **Analysis ToolPak** then click on the OK button. When the **Tools** menu is now pulled down, you will see the **Data Analysis…** option. In the Analysis Tools box, click the tool you want to use. In our example, we will use the Regression option. Enter the input range and the output range, and then select the options you want. The only catch to using Excel to do a regression is that all of your data – both your dependent variable (Y) and your independent variables (X) must all be in adjacent columns. For purposes of our example, our dependent variable (Y) is Sold Price located in column H while our independent variables (X) are located in column I through column Q. Click on box for **Input Y Range:** then using your mouse highlight the column including the label. Repeat the process for **Input X Range:** wherein you will use your mouse to highlight the section of the spreadsheet starting from cell I2 through cell Q104. Note that Excel will automatically convert it into absolute cell reference ($). Make sure to check the **Labels** box. We will put the results in a **New Worksheet Ply:** and title this new worksheet Regression (Dobson). After clicking the **OK** button, your regression results can be





found in “Regression (Dobson)” worksheet shown below.



	A	B	C	D	E	F
1	SUMMARY OUTPUT					
2						
3	*Regression Statistics*					
4	Multiple R	0.899215371				
5	R Square	0.808588284				
6	Adjusted R Square	0.789863225				
7	Standard Error	24842.22571				
8	Observations	102				
9						
10	ANOVA					
11		*df*	*SS*	*MS*	*F*	*Significance F*
12	Regression	9	2.39843E+11	2.66E+10	43.18215	3.03089E-29
13	Residual	92	56776528385	6.17E+08		
14	Total	101	2.9662E+11			
15						
16		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*
17	Intercept	7658.821078	42958.8082	0.178283	0.858893	-77661.07815
18	Bedrooms	10540.01526	5922.480516	1.779662	0.078433	-1222.541989
19	Baths	5069.90057	10009.59568	0.506504	0.613715	-14810.02
20	Bldg Sqft	37.06363514	11.98127985	3.093462	0.00262	13.2677797
21	Garage	45821.82774	12860.28734	3.563049	0.000583	20280.18762
22	Tax	107.8729784	20.12388492	5.360445	6.12E-07	67.90520681
23	Time (Months)	-1498.650527	832.1178787	-1.80101	0.074978	-3151.308423
24	BldgAge 2006	-1443.126534	1020.302046	-1.41441	0.160617	-3469.53442
25	Dum_Pool	10477.6715	5715.894791	1.833076	0.070025	-874.5886763
26	DOM	58.89844203	69.66964822	0.845396	0.400083	-79.47148985
27						
28						

Regression (Dobson) | Example (Dobson Ranch) | Home

There are a couple of key things to note in this regression analysis. First is the adjusted R-square which varies between 0 and 1, indicates the proportion of the (corrected) total variation in the Sales Price (our Y variable) attributed to the variation in our set of X variables - Bedroom, Bathrooms, House Size, Number of Cars in the Garage, Property Tax, Time, Age of Building, if a Pool exists, and the Number of Days on the Market. It is “adjusted” for the degrees of freedom. The degrees of freedom are equal to the number of observations (N) minus the number of parameters (Coefficients) estimated. Since we have N = 102 houses for which we have the sold price, and we have estimated 10 coefficients (Intercept, Bedrooms, Baths, Bldg Sqft, Garage, Tax, Time (Months), BldgAge 2006, Dum_Pool, and DOM), this means that we have N – k = 102 – 10 = 92 “free” observations that are used to do the actual statistics. Most beginning statistics books assume that the degrees of freedom needs to be at least 30 or that there are at least 30 “free” observations in order to do decent statistical analysis. Suppose for example that you did a regression with only 10 home sales and you used 9 independent

variables in addition to the intercept term (the same variables that we use in the current example). This means that the number of degrees of freedom is N – k = 10 – 10 = 0. Thus, we have no observations left in order to do our statistical analysis which means that our confidence interval is negative infinity to positive infinity. So we don't have much "confidence" in our results given this large range of correct answers. Our adjusted R-square of 79% indicates that approximately 79% of the variation in the sales price of a home is associated with the variation in our 9 independent variables. The remaining 21% variation, (1-.79 = .21) is due to other factors such as whether the house is on a major street, whether the house is located on a lake, etc.

Coefficients (β): In the regression output, we can use the coefficients to price a property that is currently on the market. Our regression (prediction) equation from the output (see previous page) is as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9$$

In real estate, this pricing equation is known as a hedonic model and is written as

$$P = p_0 q_0 + p_1 q_1 + p_2 q_2 + p_3 q_3 + p_3 q_3 + p_4 q_4 + p_5 q_5 + p_6 q_6 + p_7 q_7 + p_8 q_8 + p_9 q_9$$

where p = price for an attribute, say the price per bedroom ($p_{bedroom}$)
q = quantity of that attribute, say the number of bedrooms ($q_{bedroom}$)

Expected Sales Price = 7658.82*Intercept + 10540.015*Number of Bedrooms +
5069.90*Number of Bathrooms + 37.06*House Size (Sq Ft)
+ 45821*Garage Size (Number of Cars that can fit in garage)
+ 107.87*Property Tax -1498.65*Time -1443.12*Building Age
+ 10477.67*Pool (1= Yes, there is a pool, 0 = No pool)
+ 58.89*DOM (Days on the market)

The coefficients represent the price (p) per unit quantity (q). For example, each additional bedroom ($p_{Bedroom}$) is worth $10,540 while each additional bathroom has an incremental value of $5,070 ($p_{Bathroom}$). Buyers are also willing to pay $37.06 for every additional square foot of living area. The addition of a pool adds roughly $10,478. However, houses that sold earlier are worth less (-$1,498.65) per month relative to more recent sales. Buyers are tend to discount the house's price by $1,443 for every year of the house's age.

Predicting the price of a property: We can use our regression equation to price MLS 2577147 located at 2664 S NOCHE DE PAZ in the Dobson Ranch subdivision of Mesa, AZ (see row 106). The 1977 built house is currently listed at $300,000. The 1,672 square foot house has 3 bedrooms, 2 bathrooms, with an attached 2 car garage and features an in ground pool. Property taxes are only $891 per year. In doing regression, we always set the Intercept equal to one (1). Assuming that our house is just listed so that Time and Days on the market are both 0, our predicted price is

Sales Price = 7658.82*1 + 10540.015*3 (Bedrooms) + 5069.90*2 (Bathrooms)
+ 37.06*1672 (SqFt) + 45821*2 (Cars) + 107.87*891 (Property Tax)
-1498.65*0(Time) -1443.12*29 (Building Age) + 10477.67*1(Pool)
+ 58.89*0 (Days on the market)
= $267,775

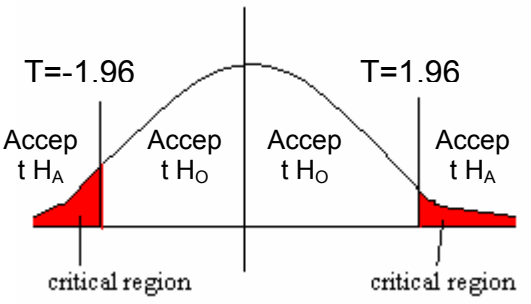
According to Zillow.com which also uses a regression algorithm, their estimated price of the house is $249,436 versus the seller's list price of $300,000.

F statistics versus T Statistics: Observe that a T statistic exists for each independent variable. As a rule of thumb, if the absolute value of the T statistic is greater than 2 e.g. T≥|2|, then that independent variable is statistically significant. To see the actual level of significance however, one should look at the P-value which is located in the next column to the right of the t-stat column. If we look at the Number of Bedrooms, we see that the T-statistic is 1.779 say 1.78 and it has a P-value of .078. This indicates that there is a 7.8% chance that this variable is insignificant in accounting for any variation in the sales price. Alternatively, there is a 92.2% likelihood that the number of bedrooms is a statistically significant variable in accounting for the variation in sales price of a home. In other words, the P-value of .078 indicates that it is not statistically significant at the 5% level but IS significant at the 10% level from a statistics perspective. Most statistics textbooks use either a 5% or 10% level of significance. The t-statistics reported in Excel are associated with two-tailed (two sided) test of significance.

	Two Sided Two Tailed:	One Sided Left Tail	One Sided Right Tail
Null Hypothesis (H_O)	$\beta_i = 0$	$\beta_i = 0$	$\beta_i = 0$
Alternative Hypothesis (H_A)	$\beta_i \neq 0$	$\beta_i < 0$	$\beta_i > 0$

In a two sided test, the ≠ indicates that β_i can be $\beta_i < 0$ or $\beta_i > 0$. In contrast, in a one sided left tail test, the values for which we can reject the null hypothesis, H_0 are located in the left tail of the probability distribution. To formalize this concept in statistical terms, let us revisit the test to see if the number of bedrooms is statistically significant at the **5%** level.

Null Hypothesis (H_O): $\beta_{Bedroom} = p_{Bedroom} = 0$
Alternative Hypothesis (H_A): $\beta_{Bedroom} \neq p_{Bedroom} \neq 0$



Since the computed T statistic is 1.779 say 1.78 which is less than the critical T of 1.96, we accept the null hypothesis that the price per bedroom isn't statistically significant. However, if we had used a 10% level of significance (critical T is 1.645) then we accept the alternative hypothesis.

If we look at our output, we immediately notice that the only variables which are statistically significant at the 10% level of significance are the number of bedrooms, square feet of living area, garage size, property taxes, when the sale was made, and if the house sold had a pool.

Question: Should we simply use a regression equation which uses only these significant variables? We could although when we look at the F statistic of 43.18 and the P-value (Significance F) of 3.031E-29 we see that the regression equation is statistically significant. In other words, the combination of all the independent variables is statistically significant for predicting the sales price. If this appears to be confusing, think of a sports team consisting of all star players. Will this team necessarily go to the Super Bowl relative to a team where none of the players have gone to the Pro-Bowl? The answer is that the group of players that work as a team and execute well has a better chance of going to the Super Bowl even though they have no star players relative to a group of star athletes that refuse to work together as a single unit.

Appendix C: Using Excel to Do an Amortization Table

An amortization table shows repayment parts of the loan amount over time. More specifically, the table shows the beginning and ending loan balance as well as the payment per period. The payment per period is further broken down into interest payments and principal payments.

Interest portion – is necessary since interest is tax deductible

Principal portion – is not tax deductible; represents the build up of equity through the loan repayment process. The process of paying off the loan through reductions in principal payments is known as *amortization*.

There are several ways to construct an amortization table.

❶ Method 1: Using the PMT function

❷ Method 2: Using the IPMT function, PPMT, and the PMT function

Method 1: Using the PMT function. The syntax of the PMT function is

PMT(rate,nper,pv,fv,type)

where

Rate is the interest rate for the loan.

Nper is the total number of payments for the loan.

Pv is the present value

Fv is the future value; If fv is omitted, it is assumed to be 0

Type is the number 0 (end) or 1 (begin) and indicates when payments are due. If type is omitted, it is assumed to be 0

Example: A borrower wishes to buy a house listed at $300,000. He has $60,000 in equity and wants to finance the rest ($240,000) using a mortgage. The mortgage is payable monthly (at the end of each month) with an amortization term of 30 years and an annual contract rate of interest of 8%. The payment is the same each month.

Rate = 8%/12 monthly interest
Nper = 30*12 (30 years*12 months per year or 360 payments)
PV = 240000 loan amount; PV of all payments is equal to the loan amount

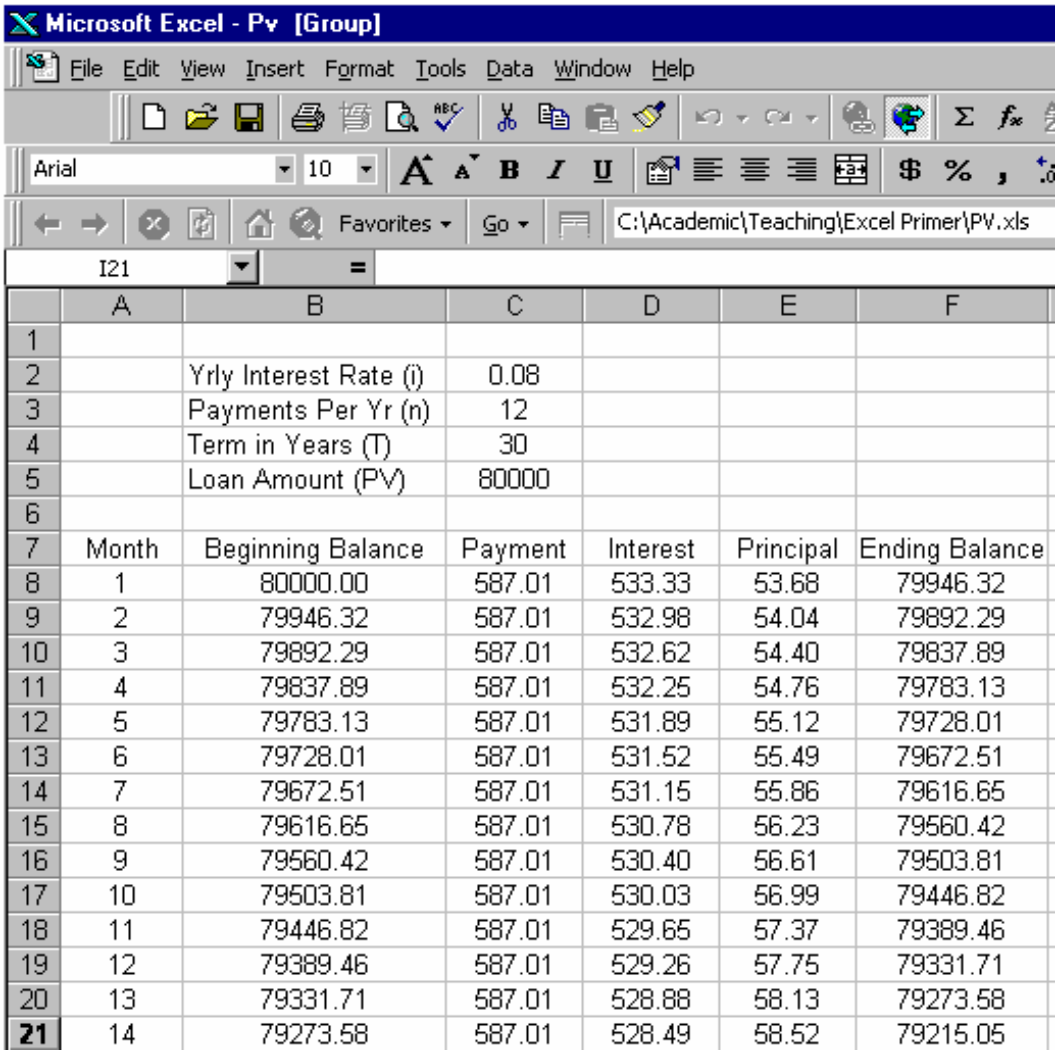
In constructing our amortization table, please input the following into a new Excel worksheet

Cell(s)	Type in the following	Comments
B2	Yrly Interest Rate (I)	
C2	.08	
B3	Payments per Yr (n)	
C3	12	Months
B4	Term in Years (T)	
C4	30	Amortized over 30 years
B5	Loan Amount (PV)	
C5	80000	
A7	Months	
A8 – A367	Type in 1 through 360	Use Fill, Series commands
B7	Beginning Balance	
B8	=C5	Loan balance changes each month
C7	Payment	
C8	=PMT($C$2/$C$3,$C$4*$C$3,-$C$5)	Absolute cell referencing
D7	Interest	
D8	=B8*$C$2/12	Interest changes in each period; Interest is based on the beginning balance
E7	Principal	
E8	=C8-D8	Principal = Payment - Interest
F7	Ending Balance	
F8	=B8-E8	Ending Balance = Beginning Balance - Principal
B9	=F8	Ending Balance in the previous period is equal to Beginning Balance in the following period
B10–B367	Copy from B9 and Paste to B10–B367	Do not be alarmed if you see 0.00. These numbers will change as the other columns are filled in.
C9 – C367 D9 – D367 E9 – E367 F9 – F367	Copy from C8 and Paste to C9–C367 Copy from D8 and Paste to D9–D367 Copy from E8 and Paste to E9–E367 Copy from F8 and Paste to F9–F367	You can copy from C8-F8 and then paste to C9 – F367.

Tip: To get to the top of the spreadsheet, hold down the **Ctrl** key and then press the **Home** key.

Tip: An easy way to copy and paste a long column is to go to the cell that you wish to copy, click on that cell e.g., cell B9, hold down the Ctrl key and then press the **C** key. Next, press the down arrow key ↓, Holding the **Shift** key down, scroll down the page using the scroll bar located on the right hand side of the spreadsheet. You can use the **Page Down** key in lieu of the scroll bar. When you have come to the last cell that you want to highlight, while still holding the Shift key down, click on the cell e.g. cell B367. The area you wish to be highlighted is highlighted e.g. cell B10 to cell B367. Next, while holding down the **Ctrl** key, press the **V** key. The copied cell is now pasted to the highlighted area.

Your spreadsheet should resemble the following:



	A	B	C	D	E	F
1						
2		Yrly Interest Rate (i)	0.08			
3		Payments Per Yr (n)	12			
4		Term in Years (T)	30			
5		Loan Amount (PV)	80000			
6						
7	Month	Beginning Balance	Payment	Interest	Principal	Ending Balance
8	1	80000.00	587.01	533.33	53.68	79946.32
9	2	79946.32	587.01	532.98	54.04	79892.29
10	3	79892.29	587.01	532.62	54.40	79837.89
11	4	79837.89	587.01	532.25	54.76	79783.13
12	5	79783.13	587.01	531.89	55.12	79728.01
13	6	79728.01	587.01	531.52	55.49	79672.51
14	7	79672.51	587.01	531.15	55.86	79616.65
15	8	79616.65	587.01	530.78	56.23	79560.42
16	9	79560.42	587.01	530.40	56.61	79503.81
17	10	79503.81	587.01	530.03	56.99	79446.82
18	11	79446.82	587.01	529.65	57.37	79389.46
19	12	79389.46	587.01	529.26	57.75	79331.71
20	13	79331.71	587.01	528.88	58.13	79273.58
21	14	79273.58	587.01	528.49	58.52	79215.05

Option 2: Using the IPMT, PPMT, and PMT functions. The syntax is

IPMT(rate,per,nper,pv,fv,type) payment on the interest for a given period
PPMT(rate,per,nper,pv,fv,type) payment on the principal for a given period
PMT(rate,nper,pv,fv,type) principal and interest for a given period

The only new argument is per

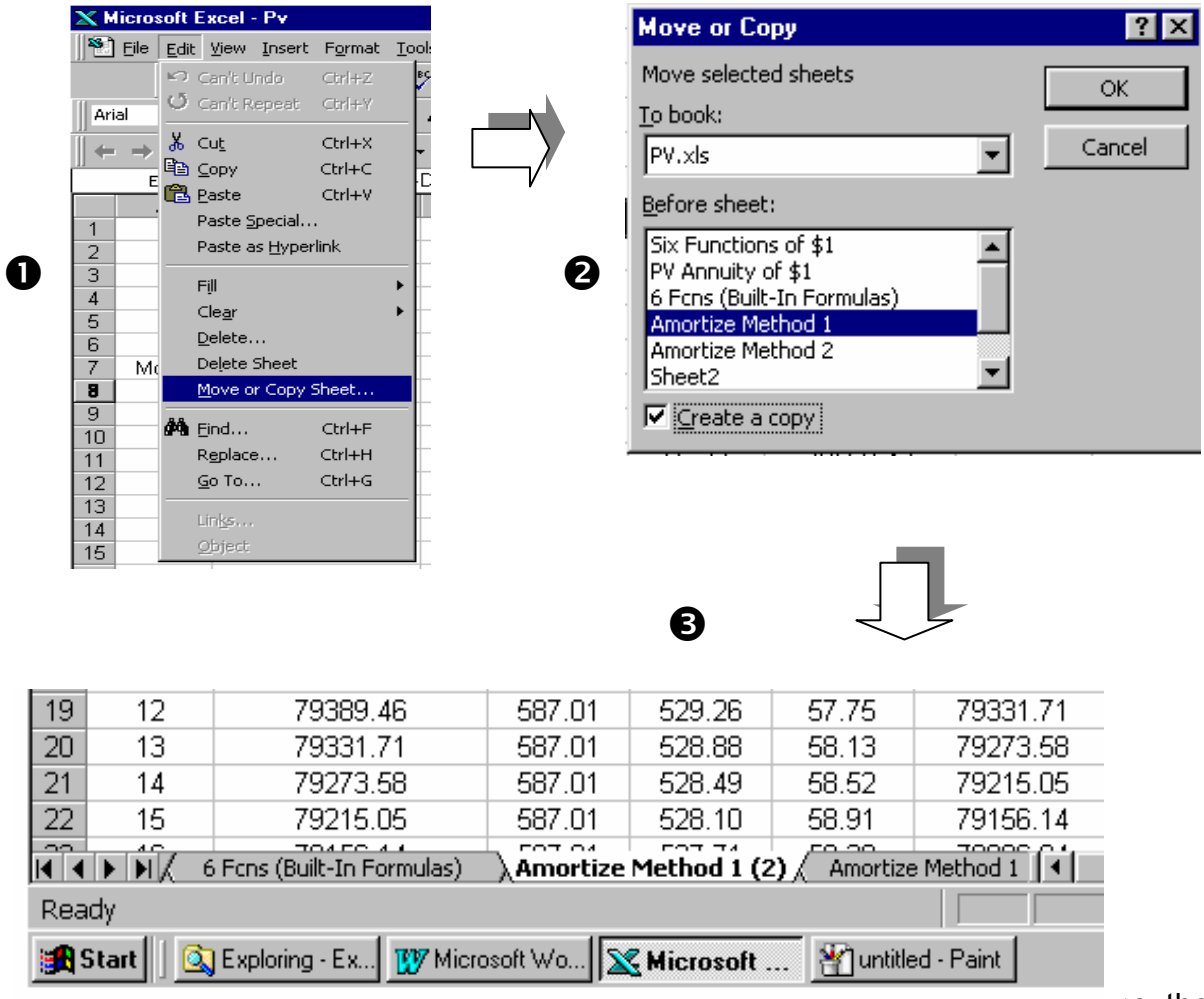
Per is the period for which you want to find the interest and must be in the range 1 to nper.

Using a new worksheet, input the following (the new changes are in bold)

Cell(s)	**Type in the following**	**Comments**
B2	Yrly Interest Rate (I)	
C2	.08	
B3	Payments per Yr (n)	
C3	12	Months
B4	Term in Years (T)	
C4	30	Amortized over 30 years
B5	Loan Amount (PV)	
C5	80000	
A7	Months	
A8 – A367	Type in 1 through 360	Use Fill, Series commands
B7	Beginning Balance	
B8	=C5	Loan balance changes each month
C7	Payment	
C8	=PMT($C$2/$C$3,$C$4*$C$3,-$C$5)	Absolute cell referencing
D7	Interest	
D8	=IPMT($C$2/$C$3,A8,$C$4*$C$3,-B8)	Interest changes in each period; Interest is based on the beginning balance
E7	Principal	
E8	=PPMT($C$2/$C$3,A8,$C$4*$C$3,-$B$8)	In contrast to Interest, the principal is based on the contract (initial) loan amount so (-$B$8)
F7	Ending Balance	
F8	=B8-E8	Ending Balance = Beginning Balance - Principal
B9	=F8	Ending Balance in the previous period is equal to Beginning Balance in the following period
Cell(s)	Type in the following	Comments

B10–B367	Copy from B9 and Paste to B10–B367	Do not be alarmed if you see 0.00. These numbers will change as the other columns are filled in.
C9 – C367 D9 – D367 E9 – E367 F9 – F367	Copy from C8 and Paste to C9–C367 Copy from D8 and Paste to D9–D367 Copy from E8 and Paste to E9–E367 Copy from F8 and Paste to F9–F367	You can copy from C8-F8 and then paste to C9 – F367.

Tip: If your new worksheet resembles your old worksheet and thus, you want to save yourself some work, you can make a copy of your old worksheet by going to **Edit** in the TITLE bar. Select the **Move or Copy Sheet**… option. In the **Before Sheet:** window of the box which appears, click on the worksheet that you wish to copy. Next, click on the box labelled **Create a copy**. Following is a graphical depiction of the steps used to create a copy of the worksheet named Amortize Method 1:



Other Amortization Functions: In addition to the IPMT, PPMT, and PMT functions, there are two other built-in Excel functions.

CUMIPMT Cumulative interest paid between two periods
CUMPPMT Cumulative principal paid between two periods
The syntax for these functions are as follows:
CUMIPMT(rate,nper,pv,start_period,end_period,type)
CUMPRINC(rate,nper,pv,start_period,end_period,type)

Where

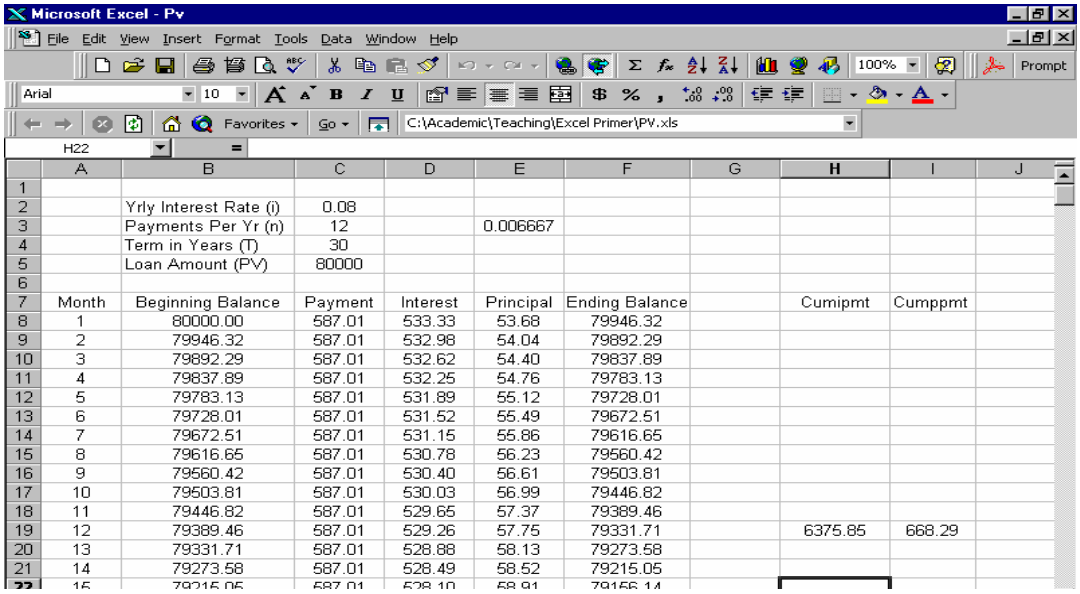
Rate is the interest rate.
Nper is the total number of payment periods.
Pv is the present value.
Start_period is the first period in the calculation.
End_period is the last period in the calculation.
Type is the timing of the payment.

Example: Continuing with our preceding example, suppose that we wish to calculate the total interest paid and the total principal paid in the first year of payments (months 1 through 12). We will add to our amortization table the following cells:

Cell(s)	Type in the following	Comments
H7	Cumipmt	Cumulative interest pymts
H19	=-1*CUMIPMT($C$2/$C$3,$C$4*$C$3,$C$5,A8,A19,0)	
G7	Cumprinc	Cumulative principal pymts
G19	=-1*CUMPRINC($C$2/$C$3,$C$4*$C$3,$C$5,A8,A19,0)	

We could just as easily have used the SUM function in cell H19 and cell G19 in lieu of the CUMIPMT and CUMPRINC functions. In this case

Cell(s)	Type in the following
H19	=SUM(D8:D19)
G19	=SUM(E8:E19)



	A	B	C	D	E	F	G	H	I	J
1										
2		Yrly Interest Rate (i)	0.08							
3		Payments Per Yr (n)	12		0.006667					
4		Term in Years (T)	30							
5		Loan Amount (PV)	80000							
6										
7	Month	Beginning Balance	Payment	Interest	Principal	Ending Balance		Cumipmt	Cumppmt	
8	1	80000.00	587.01	533.33	53.68	79946.32				
9	2	79946.32	587.01	532.98	54.04	79892.29				
10	3	79892.29	587.01	532.62	54.40	79837.89				
11	4	79837.89	587.01	532.25	54.76	79783.13				
12	5	79783.13	587.01	531.89	55.12	79728.01				
13	6	79728.01	587.01	531.52	55.49	79672.51				
14	7	79672.51	587.01	531.15	55.86	79616.65				
15	8	79616.65	587.01	530.78	56.23	79560.42				
16	9	79560.42	587.01	530.40	56.61	79503.81				
17	10	79503.81	587.01	530.03	56.99	79446.82				
18	11	79446.82	587.01	529.65	57.37	79389.46				
19	12	79389.46	587.01	529.26	57.75	79331.71		6375.85	668.29	
20	13	79331.71	587.01	528.88	58.13	79273.58				
21	14	79273.58	587.01	528.49	58.52	79215.05				
22	15	79215.05	587.01	528.10	58.91	79156.14				

What is the benefit of using CUMIPMT and CUMPRINC? In our example, it is not that clear what is the benefit of using these functions. However, if we need the annual or cumulative amount of principal and interest, then these functions will expedite our calculations without the need to actually calculate the entire amortization table.

Appendix D: Using Excel to Calculate an IRR (APR)

The internal rate of return (IRR) is the interest rate received for an investment consisting of payments (negative values) and income (positive values) that occur at regular periods. The IRR is also known as the Annual Percentage Rate (APR) in terms of lending money. The IRR or APR to the lender represents the true borrowing cost to a borrower.

From the perspective of a mortgage, the lender advances an effective loan amount (this is the negative outlay) for which he or she receives principal and interest known as debt service payments (positive cash flows) at regular intervals. Suppose for example, that the lender will finance the purchase of a condominium on the following loan terms:

Loan Amount: $125,000 Interest Rate: .075
Points: .025 Amortization Period: 30 years
Origination Fees: .005 Term: 3 years

This means that at the end of the 3rd year (36 months), the borrower will have to pay the monthly debt service in addition to the unpaid loan balance.

Initial negative outlay: - Loan Amount* (1 - (Points + Origination Fees))
= - 125,000*(1 - (.025+.005)) = - $121,250 = Effective Loan Amt

However, the monthly debt service payments are based on the Contract Loan amount of $125,000 so the payments are

Monthly payment = Contract Loan Amount * Mo. Mortgage Constant (.075/12,30*12)
= 125,000 * 0.00699214508552778 = $874

In Excel, this results in the following spreadsheet only of which a portion is shown:

	A	B	C	D	E	F	G	H
1	Loan Amount	125000						
2	Points	0.025						
3	Orig. Fees	0.005						
4	Interest Rate	0.075						
5	Amort Pd (yrs)	30						
6	Loan Term (yrs)	3						
7								
8		Month	BegBal	Pymt	Interest	Principal	EndBal	CF
9		0		=-B1*(1-(B2+B3))				=IF(B9=36, D9+G9,D9)
10		1	=B1	=PMT($B$4/12,$B$5*12,-$B$1)	=C10*$B$4/12	=D10-E10	=C10-F10	=IF(B10=36, D10+G10,D10)
11		2	=G10	=PMT($B$4/12,$B$5*12,-$B$1)	=C11*$B$4/12	=D11-E11	=C11-F11	=IF(B11=36, D11+G11,D11)
12		3	=G11	=PMT($B$4/12,$B$5*12,-$B$1)	=C12*$B$4/12	=D12-E12	=C12-F12	=IF(B12=36, D12+G12,D12)
13		4	=G12	=PMT($B$4/12,$B$5*12,-$B$1)	=C13*$B$4/12	=D13-E13	=C13-F13	=IF(B13=36, D13+G13,D13)
14		5	=G13	=PMT($B$4/12,$B$5*12,-$B$1)	=C14*$B$4/12	=D14-E14	=C14-F14	=IF(B14=36, D14+G14,D14)
15		6	=G14	=PMT($B$4/12,$B$5*12,-$B$1)	=C15*$B$4/12	=D15-E15	=C15-F15	=IF(B15=36, D15+G15,D15)
16		7	=G15	=PMT($B$4/12,$B$5*12,-$B$1)	=C16*$B$4/12	=D16-E16	=C16-F16	=IF(B16=36, D16+G16,D16)
17		8	=G16	=PMT($B$4/12,$B$5*12,-$B$1)	=C17*$B$4/12	=D17-E17	=C17-F17	=IF(B17=36, D17+G17,D17)
18		9	=G17	=PMT($B$4/12,$B$5*12,-$B$1)	=C18*$B$4/12	=D18-E18	=C18-F18	=IF(B18=36, D18+G18,D18)
19		10	=G18	=PMT($B$4/12,$B$5*12,-$B$1)	=C19*$B$4/12	=D19-E19	=C19-F19	=IF(B19=36, D19+G19,D19)

These formulas result in the following output

Loan Amount	125,000						
Points	0.025						
Orig. Fees	0.005						
Interest Rate	0.075						
Amort Pd (yrs)	30						
Loan Term (yrs)	3						
	Month	BegBal	Pymt	Interest	Principal	EndBal	CF
	0		-121,250				-121,250
	1	125,000	874	781	93	124,907	874
	2	124,907	874	781	93	124,814	874
	3	124,814	874	780	94	124,720	874
	4	124,720	874	779	95	124,625	874
	5	124,625	874	779	95	124,530	874
	6	124,530	874	778	96	124,435	874
	7	124,435	874	778	96	124,338	874
	8	124,338	874	777	97	124,241	874
	9	124,241	874	777	98	124,144	874
	10	124,144	874	776	98	124,046	874
	11	124,046	874	775	99	123,947	874
	12	123,947	874	775	99	123,848	874
	13	123,848	874	774	100	123,748	874
	14	123,748	874	773	101	123,647	874
	15	123,647	874	773	101	123,546	874
	16	123,546	874	772	102	123,444	874
	17	123,444	874	772	102	123,342	874
	18	123,342	874	771	103	123,238	874
	19	123,238	874	770	104	123,135	874
	20	123,135	874	770	104	123,030	874
	21	123,030	874	769	105	122,925	874
	22	122,925	874	768	106	122,819	874
	23	122,819	874	768	106	122,713	874
	24	122,713	874	767	107	122,606	874
	25	122,606	874	766	108	122,498	874
	26	122,498	874	766	108	122,390	874
	27	122,390	874	765	109	122,281	874
	28	122,281	874	764	110	122,171	874
	29	122,171	874	764	110	122,061	874
	30	122,061	874	763	111	121,949	874
	31	121,949	874	762	112	121,838	874
	32	121,838	874	761	113	121,725	874
	33	121,725	874	761	113	121,612	874
	34	121,612	874	760	114	121,498	874
	35	121,498	874	759	115	121,383	874
	36	121,383	874	759	115	121,268	122,142

Aside: To view your formulas for the entire worksheet at any time, hold down the **Ctrl** key and press the ~ key (known as Tilde pronounced Till – dah). The ~ key is located above the **Tab** key. To return to the numbers again, simply hold down the **Ctrl** key and press the ~ key (known as Tilde pronounced Till – dah) again.

To calculate the IRR use the Excel syntax: IRR(values,guess) where we set our guess equal to .001 and the IRR equal to =IRR(H9:H45,0.001)*12 where we multiply by 12 months because the IRR is monthly and we need to convert it to an ANNUAL percentage rate (APR). This results in the following spreadsheet of formulas:

	A	B	C	D	E	F	G	H
1	Loan Amount	125000						
2	Points	0.025						
3	Orig. Fees	0.005						
4	Interest Rate	0.075						
5	Amort Pd (yrs)	30						
6	Loan Term (yrs)	3					IRR	=IRR(H9:H45,0.001)*12
7								
8		Month	BegBal	Pymt	Interest	Principal	EndBal	CF
9		0		=-B1*(1-(B2+B3))				=IF(B9=36, D9+G9,D9)
10		1	=B1	=PMT($B$4/12,$B$5*12,-$B$1)	=C10*$B$4/12	=D10-E10	=C10-F10	=IF(B10=36, D10+G10,D10)
11		2	=G10	=PMT($B$4/12,$B$5*12,-$B$1)	=C11*$B$4/12	=D11-E11	=C11-F11	=IF(B11=36, D11+G11,D11)
12		3	=G11	=PMT($B$4/12,$B$5*12,-$B$1)	=C12*$B$4/12	=D12-E12	=C12-F12	=IF(B12=36, D12+G12,D12)
13		4	=G12	=PMT($B$4/12,$B$5*12,-$B$1)	=C13*$B$4/12	=D13-E13	=C13-F13	=IF(B13=36, D13+G13,D13)
14		5	=G13	=PMT($B$4/12,$B$5*12,-$B$1)	=C14*$B$4/12	=D14-E14	=C14-F14	=IF(B14=36, D14+G14,D14)
15		6	=G14	=PMT($B$4/12,$B$5*12,-$B$1)	=C15*$B$4/12	=D15-E15	=C15-F15	=IF(B15=36, D15+G15,D15)
16		7	=G15	=PMT($B$4/12,$B$5*12,-$B$1)	=C16*$B$4/12	=D16-E16	=C16-F16	=IF(B16=36, D16+G16,D16)
17		8	=G16	=PMT($B$4/12,$B$5*12,-$B$1)	=C17*$B$4/12	=D17-E17	=C17-F17	=IF(B17=36, D17+G17,D17)
18		9	=G17	=PMT($B$4/12,$B$5*12,-$B$1)	=C18*$B$4/12	=D18-E18	=C18-F18	=IF(B18=36, D18+G18,D18)
19		10	=G18	=PMT($B$4/12,$B$5*12,-$B$1)	=C19*$B$4/12	=D19-E19	=C19-F19	=IF(B19=36, D19+G19,D19)
20		11	=G19	=PMT($B$4/12,$B$5*12,-$B$1)	=C20*$B$4/12	=D20-E20	=C20-F20	=IF(B20=36, D20+G20,D20)
21		12	=G20	=PMT($B$4/12,$B$5*12,-$B$1)	=C21*$B$4/12	=D21-E21	=C21-F21	=IF(B21=36, D21+G21,D21)
22		13	=G21	=PMT($B$4/12,$B$5*12,-$B$1)	=C22*$B$4/12	=D22-E22	=C22-F22	=IF(B22=36, D22+G22,D22)
23		14	=G22	=PMT($B$4/12,$B$5*12,-$B$1)	=C23*$B$4/12	=D23-E23	=C23-F23	=IF(B23=36, D23+G23,D23)
24		15	=G23	=PMT($B$4/12,$B$5*12,-$B$1)	=C24*$B$4/12	=D24-E24	=C24-F24	=IF(B24=36, D24+G24,D24)

The actual IRR or APR is 8.65% which as you can see differs from the contract interest rate of 7.5% due to prepaid interest in the form of points and origination fees and the payment of the unpaid loan balance in month 36. You can think of this type of mortgage as a 3-1 hybrid loan wherein the first 3 years of the loan are at a fixed rate and then after the third year, the loan converts into a 1 year adjustable rate mortgage (interest rate adjusts every year) so most people tend to either sell the house or refinance.