TEAM Consulting LLC

Math Tutorial

for

IAAO Course 101

TEAM Consulting LLC

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December 2007

Math Tutorial for IAAO 101

Math is not an easy subject for everyone. This study guide is a chance to improve or refresh your math skills prior to attending the course or if you are challenging the exam. It is the intent to explain the math processes with everyday application and then how it applies to the appraisal practice. This is not a tutorial produced or endorsed by IAAO. At the end of the tutorial is a complete list of the formulas used.

Section 1

I. Dots and Points (Decimals)

We need to remember and refresh ourselves on how to use and read decimals in order to understand rates. The number on the left side of the decimal is the whole number and those numbers on the right side of the decimal are a fraction or portion of the whole. Those numbers to the right of the decimal are first tenths, then hundredths and then thousandths. Example: 2.4 where the 2 is the whole number and the 4 being in the tenths position. This is the same as 2 and 4 tenths. If the number is 2.48 then the 8 is in the hundreds position and would be 2 and 48 hundredths. The last position we will use is a third number to the right of the decimal and that is the thousandths position. Thus the number 2.485 would be 2 and 485 thousandths. Again, if it is to the right of the decimal, it is a number less than one. Think of dollars and cents. If you have a dollar, you would write it as 1.00. If you have less than a dollar, say 42 cents, you would write it as 0.42. When you have more than a dollar, you would write it as say $1.42.

II. Number to decimals and back to whole numbers

Mathematically we need to be able to convert a number from a whole number to a decimal format and the reverse from a decimal to a whole number. Let's continue with the money example. If you have 142 pennies, we would normally write that in a dollar and cents format but how do we mathematically know how to do that?

MEMORY TIP: Multiply to get to a whole number from a decimal and divide to get from a whole number back to a decimal.

So we know there are a hundred pennies in a dollar, so we would take 142 ÷ 100 to get 1.42. We know we could then read that as one dollar and 42 cents. Using that memory tip, we could find how many pennies there are by multiplying 1.42 by 100 and get back to 142 pennies. This is the same process that is used to establish a tax rate or mill levy and will be discussed in Section 5.

III. Fractions

Fractions are a decimal written in a different format. Think back to the money example of where we had 42 cents. We wrote it as a decimal of 0.42 by dividing 42 by 100. It can also be expressed as a fraction as 42 over 100 or 42/100. We use fractions in our daily life such as you can pay one-fourth (1/4) down and finance the rest of the cost of the new car. Or if we buy something and pay over the year then our payments are one-twelfth (1/12). Remember that the calculation of rates was really fractions and by dividing the numerator (top number) by the denominator (bottom number) we find a rate. In the 1/12 example, the rate of monthly payment would be 1 ÷ 12 or 0.0833. We can use fractions to convert to percentages and will do so in the next section.

Section 2

I. Portions Of (Percentages)
We talked about fractions being part of something; percentages are also part of something or a portion of it. Percentages are a ratio of a number to 100. Percent means per hundred. Percentages are used constantly in our daily lives: Interest rate on your home is 6%, your salary increase is 3% per year, that new entertainment center you want is on sale for 30% off. We need to know how to calculate using percentages for our daily life and for assessment purposes.

Often we see numbers that are then converted into percentages. If we hear that 1 in 5 people will obtain a college degree in five years, what would be the percentage? Just like calculating a rate above, it is the smallest number divided by the largest number.

MEMORY TIP: A rate always has to be a number less than 1. Therefore, a rate is always calculated by dividing the smallest number by the largest number.

In this example, the 5 is the total and the 1 is a portion of that so the percentage would be 1 ÷ 5 = 0.20. That is a decimal format so we can use the other memory tip about converting from a decimal to a whole number.

MEMORY TIP: Multiply to get to a whole number from a decimal and divide to get from a whole number back to a decimal.

If you have all of something then you have 100%. Think back to the dollar. If you have a dollar you have 100 cents. Percentages are the same. So above we have 0.20 as a decimal and using the conversion tip it would be 0.20 x 100 = 20%.

To continue the discussion, if there are 16,000 students on a college campus and 20% of them will graduate in five years, how many students would that be? There are several ways to calculate this but the easiest is probably to use the decimal format. The decimal was shown as 0.20 and if we multiply that by the 16,000 students then the answer would be 16,000 x 0.20 = 3,200 students. Later in this tutorial you will be required to use the decimal format in several calculations so become comfortable with this now.

Problem 2-1
You have made application for a new position that has just been created. Because it is a very desirable position you are one of 60 people who have applied. Rounding to three places to the right of the decimal, what percent are you of the total applicants?

Problem 2-2

You have won the lottery and will receive a total of $2,000,000 but will only be paid 10% per year. How much will you receive each year? If income taxes are 15% of your annual monies received, what would the income taxes be?

II. Calculation of property taxes

Calculation of property taxes works very much in the same way as we often use percentages. It is common that the 100% market value is determined for most property types and then a portion or fraction of that value is used to base the property tax on. Whenever a portion of the value is used it is referred to as a fractional assessment. A formula is shown below that will help us use the fractional assessment and the tax rate to estimate property tax for a jurisdiction or for a single property.

Memory tip formula: MV x AR = AV x TR = TAXES

MV = Market Value and also referred to as appraised value and 100% value.
AR = Assessment Rate, assessment ratio or assessment level. This is a fraction of market value.
AV = Assessed Value is the product of multiplying and is the base value used to determine the amount of property tax.
TR = Tax Rate that is multiplied against the assessed value to determine the taxes.

Let's take the formula calculation one step at a time. If a property is determined to have a market value of $156,000 and the assessment rate is 20%, what would be the assessed value?

First get the percent to a decimal 20% ÷ 100 = 0.20
$156,000 x 0.20 = $31,200

Even though the market value is $156,000 only the assessed value is used for the tax calculation.

Now we have to remember how tax rates work. Tax rates can be expressed as dollars per hundred, dollars per thousand or mills. Mills means thousands. For this example the tax rate is $6.84 per hundred. Just like percentages we want to get to a decimal format by $6.84 ÷ 100 = 0.0684. Now we can complete the formula to determine the property tax.

AV of $31,200 x TR of 0.0684 = TAXES of $2,134.08

These are the same steps we used to answer Problem 2-2. So let's compare the terms used in that problem and this example.

Lottery winnings = Market Value
% per year = Assessment Rate
$ per year = Assessed Value
% taxes = Tax Rate
Taxes = Taxes

Problem 2-3

An individual just received his valuation notice from your office with a value of $248,300 and wants to know what an estimate of his taxes would be. If the assessment rate is 40% and the tax rate is 38.35 mills, what would the estimated taxes be?

We also need to realize that we can back into some answers by reversing the math steps. Example: 4 x 2 = 8. If we multiply to get an answer on the right side of the equal sign, we can divide that answer by one of the known on the left side of the equal sign to find the other component, therefore 8 ÷ 2 = 4 and 8 ÷ 4 = 2.

That process can be applied with the values and rates by using the formula of **MV x AR = AV x TR = TAXES**. Example: AV = $25,000 and MV = $100,000, what is the AR?

$25,000 ÷ $100,000 = 0.25 or a 25% assessment rate

Section 3

I. All Things Change (Time)

Change is a constant factor in our lives. We see change in the price of goods and services we use and often in the value of property. Change is normally recognized as a percentage but can also be used in a decimal format. A common recognition of change is through the term Consumer Price Index (CPI). We see this term used to indicate that the cost of living has increased by say 2.4%. That would be saying that the average cost of goods and services we use has increased by 2.4% from the previous year. Example: An item you generally buy at the grocery store cost $4.00 the year before, but now cost 2.4% more. The cost now would be as follows by remembering how to convert from percentage to decimals from the previous sections.

2.4% ÷ 100 = 0.024 x $4.00 = $ 0.096 or a $0.10 increase
New cost would be $4.00 + $0.10 = $4.10

You see this same concept if your salary increases, whether by a merit increase or by a cost of living adjustment. Often cost of living adjustments are based upon the CPI. Using the 2.4% CPI increase from above, what would be your new salary if you are currently making $10.20 per hour?

2.4% ÷ 100 = 0.024 x $10.20 = $0.2448 or a $0.24 increase
New salary would be $10.20 + $0.24 = $10.44

Changes in property values are estimated in the same manner. Example: A house sold one year ago for $134,000 and it has been shown that the value has increased by 3% in the last year. What is the current market value of the property?

3% ÷ 100 = 0.03 x $134,000 = $4,020 increase
New value would be $134,000 + $4,020 = $138,020

Problem 3-1

Lumber costs have increased by 7.5% since last year. If a new home last year cost $237,400, what would be the new cost?

Problem 3-2

Your salary is projected to increase by the cost of living rate of 2.3% for the next year. If you are currently earning $10.35 per hour, what will be your new hourly wage?

II. Resale method of calculating change

Change in the market will not just magically appear for your use, we have to use valid market sales to calculate the most typical change. This can be done by two different methods: Resales and Paired-Sales.

Resales are the same property that sold previously and then sold again with no substantial change to the characteristics of the property. Any change in the sale prices would reflect an adjustment for time. This is saying that the market is always changing and any difference in the sale prices will show if the market is going up, going down or staying the same. It is the principle of change. In appraisal it is referred to as a time adjustment.

A property sold 14 months ago for $156,000 and sold again recently for $162,000. This is a resale of the same property and we can use those two sales to determine the overall and monthly percent of change. Change is always measured from the oldest sale.

The formula for calculating the dollar amount and percent of change is:

(Newest sale – oldest sale) ÷ oldest sale
$162,000 - $156,000 = $6,000 dollars of change
$6,000 ÷ $156,000 = 0.0385 as a decimal

Problem 3-3

A property sold 18 months ago for $325,000 and just resold for $340,000. What is the percent of change in a decimal and percentage format?

III. Paired-sale method of calculating change

The second method of calculating change was by paired-sales. Paired-sales mean that a property sold and at a later date a different property that is exactly like it sold. The difference between the sales should reflect any change in the market (adjustment for time). The formula is exactly the same as that used above for the resale method.

Problem 3-4

The property at 324 W. Elm just sold for $210,000. In the same subdivision a property at 819 W. Cherry also sold 8 months ago for $206,000 and the properties are identical. What is the change as a decimal and percent?

Problem 3-5

A property sold 20 months ago for $150,000 and resold 8 months ago for $154,000. What is the change as a decimal and percent?

IV. Monthly changes

Although discussions on changes in property values may be on an annual basis, measuring the changes is done on a monthly basis. In the example above, the annual increase was 3%. To find what the monthly increase is we would divide by 12 after converting the whole percentage to a decimal. Do you keep seeing a pattern of converting percentages into a decimal format? When calculating change in real property values it is typical that you go to four places to the right side of the decimal.

3% ÷ 100 = 0.03 ÷ 12 = 0.0025 per month of change

How we use that monthly term will be explained in the next section. The formula to convert the change to monthly is:

Change ÷ Number of months between sales

If the change was calculated to be 0.0426 and there were 14 months between sales, the monthly change factor would be:

0.0426 ÷ 14 = 0.0030 per month
0.0030 x 100 = 0.30%

Whenever we will use monthly time factors it will be in the decimal format.

Problem 3-6

Calculate the monthly time factor for each sold property using your answers and the number of months between sales from Problems 3-3, 3-4 and 3-5.

Section 4

I. Up or Down (Trending)

Someone is always developing or changing a product that becomes a new fad or trend. You see trends in our shopping habits in the products we desire and buy. Trends are nothing more than a change. When a product becomes trendy, the demand increases, the supply is often limited and thus the price will increase. Real estate values really work in a similar fashion. Increases in demand can cause increases or upward trends in the market. If demand becomes less, the trend can be downward.

Trending is the application of change or factors for time. Trending is the recognition that costs or values will change and that an older value can be adjusted to reflect the current value. In the applications below and in IAAO Course 101 the trends applied are straight-line and not compounded. This is saying that if the trend is 1% per month it results in the same dollar amount each month. Example: Sale is for $100,000, then the dollars of trend each month would be $100,000 x 0.01 or $1,000.

Problem 3-6 was the calculation of a monthly time trend based upon property sales. Those time trends can help in adjusting older sales to reflect current values. A typical change was 0.0024 per month. We could use this factor for a property sold in the past and to project what it would sell for today. Otherwise stated, trends are calculated from a set of sales and can be applied to all similar properties. Example: A property sold 9 months ago for $267,000, using the factor of 0.0024 per month, the current trended value would be:

0.0024 x 9 months = 0.0216 total percent of increase for the 9 months
$267,000 x 0.0216 = $5,767 total dollar increase for the 9 months
$267,000 + $5,767 = $272,767 trended sale price

Problem 4-1

Your market analysis has indicated that the monthly time trend for residential sales in a neighborhood is 0.0035. A property sold 12 months ago for $375,000. What would be the time adjusted sale price for that property?

Problem 4-2

If a property sold for $148,500 six months ago and the monthly time trend is .0062, what is the time adjusted sale price?

Problem 4-3

A property recently sold for $177,600 and had previously sold for $172,500 seven months ago. The subject of your appraisal sold four months ago for $192,000. Calculate the time trend and determine the subject property's trended value.

II. Trending by using an index

In Section 3 we started the discussion with making adjustment for increases in the cost of goods and services for the CPI. The process to do that was trending.

The last refrigerator you purchased cost $600. In doing your research to buy a new one you find a consumer report stating that since you purchased your current one, the price has increased by 25%. You can then trend up your original cost to what a current cost would be.

> 25% ÷ 100 = 0.25
> $600 x 0.25 = $150 increase
> $600 + $150 = $750 trended new cost

What if instead of the percent of increase, the report simply said what the new cost is? Can we determine what the percent of increase is? Any calculation for increase or change can be done in the same manner as for increases between home sales. In this example it would be:

> $750 - $600 = $150 total dollar increase
> $150 ÷ $600 = 0.25 = 25% percentage increase

Another method of recognizing the trend is through a term called indexing. Indexing allows for an old cost to be brought current by just a few calculations. Using the refrigerator example above, indexing would work as follows:

> $750 ÷ $600 = 1.25

The one (1) is the 100% of value or the same as saying $600 ÷ $600. The 0.25 is the amount of increase or the same as saying $150÷ $600. If your friend also bought a refrigerator at about the same time for $800, you could trend his original cost to estimate a current cost by $800 x 1.25 = $1,000.

Indexing can be used to trend up an original cost to a current cost estimate. If someone built an unusual home or recently constructed a home, maybe looking at the original cost may be beneficial to check if your cost estimates are reasonable. Example: A property owner shows documentation that the cost to construct his home three years ago was $256,400. At the time of construction, a nationally recognized costing manual stated the cost index to be 210 and the current index is 222. Two processes to make the calculations are shown below.

222 – 210 = 12 amount of change
12 ÷ 210 = 0.0571 percent of change
$256,400 x 0.0571 = $14,640 dollar amount of change
$256,400 + $14,640 = $271,040 trended cost

Or

222 ÷ 210 = 1.0571 or otherwise stated, a 5.71% increase
$256,400 x 1.0571 = $271,040 trended cost

Now the terms of cost manual and cost index has been introduced. A cost manual allows for an estimate of the replacement cost new. Whenever a manual is first created or totally updated, the cost index is 1.00 which means the manual is accurately reflecting the current cost to build new. Developing a cost manual is extremely difficult, time-consuming and costly. What occurs are periodic updates to measure the increase in costs and apply them by the use of a cost index.

Problem 4-4

A new home was constructed four years ago at a cost of $210,300 when the cost index was 167 and the index is now 182. What is the current home cost?

Section 5

I. Some Are High, Some Are Low (Rates)

A rate means a measurement of something. You rate your car better than your friends, the interest rate at one bank is superior to another and a quality rating on a Cadillac is better than an economy car. Rates are also used to measure the amount of taxes owed. When you receive a paycheck, taxes are normally deducted. The amount of tax deducted is based upon the amount of gross salary. The amount of taxes is then determined by multiplying the salary by the tax rate. Example: Your salary was $1,000 and the federal tax rate is 12%. Total taxes would then be $1,000 x 0.12 or $120. Property taxes work in the same manner only the appraised value is used and then the property tax rate is applied.

Tax rates are the rate used to determine property taxes based upon the budgetary need of the taxing jurisdiction and the assessed value. These rates can be expressed as dollars per hundred, dollars per thousand or mills. Mills means 1000. So remember our previous decimal discussion. If it is dollars per hundred, then the rate would be 2 places to the right side of the decimal when expressed in a decimal format. If the rate is dollars per thousand or mills, then the rate would be 3 places to the right side of the decimal when expressed in a decimal format.

Examples: The tax rate was stated to be $4.58 per hundred. Using a previous memory tip, to get to a decimal format we would divide. As this is in hundreds, it would then be (4.58 ÷ 100 = 0.0458). If the rate was stated to be $118.34 per thousand, we would then divide by 1000 (118.34 ÷ 1000 = 0.11834). It would be the same if the rate was stated as being 118.34 mills as mills means 1000.

A jurisdiction needs $40,000,000 from property taxes to support their budget and has a total assessed value of $300,000,000. What would be the required tax rate on all property to obtain the needed budget?

MEMORY TIP: A rate always has to be a number less than 1. Therefore, a rate is always calculated by dividing the smallest number by the largest number.

Using that memory tip, we can solve for the tax rate. Zeroes mean nothing, so we can cancel out a large number of zeroes.

40,~~000,000~~
300,~~000,000~~ So we actually have 40 ÷ 300 = 0.1333

Notice it is a number less than one. Now that we have it in a decimal format, we should be able to convert it to a whole number. The rule is to multiply to go from a decimal to a whole number. So now we can convert the tax rate to dollars per hundred, dollars per thousands or mills.

0.1333 x 100 = $13.33 per hundred
0.1333 x 1000 = $133.33 per thousand
0.1333 x 1000 = 133.33 mills

Problem 5-1

A jurisdiction needs property taxes of $1,000,000 from an assessed value of $20,000,000. What would be the tax rate as a decimal, then dollars per hundred, dollars per thousands and mills?

Problem 5-2

If your city needs $6,500,000 of tax dollars and the assessed value for the city is $600,000,000, what is the tax rate as a decimal, then dollars per hundred, dollars per thousand and mills?

II. Other revenue sources

Not all revenue that jurisdictions receive is from property tax. Therefore, if other revenues are received, they must be accounted for in the tax rate calculation. The less revenue required from property tax, the lower the tax rate would be.

In the previous example above we needed $40,000,000 from an assessed value of $300,000,000. Now it has been determined that we will receive $5,000,000 from other sources. What would the new tax rate be, again dropping all the unnecessary zeroes?

40,~~000,000~~ – 5,~~000,000~~
300,~~000,000~~ So we actually have 35 ÷ 300 = 0.1167

Problem 5-3

Using the information from Problem 5-1, what would be the rates if they received $200,000 of revenue from other sources?

Problem 5-4

Using the information from Problem 5-2, what would be the rates if they received $1,000,000 of revenue from other sources?

Problem 5-5

The tax levy is listed at 78.23 mills. How would that be written as a decimal?

III. Effective versus nominal rate

Rates are often expressed in different forms. If you walk into a bank you may see a sign advertising an interest rate for a certificate of deposit (a safe investment to grow your money faster than a savings account). The sign may read something like 5.5% compounded monthly with an effective rate of 5.97%. The rate of 5.5% is often called the face rate, base rate or nominal rate. The effective rate is the actual rate earned on your investment because of the compounding of interest. Thus the rates are different.

There are also different rates for real estate taxes. In the above problems we calculated a tax rate based upon the budgetary requirements of a jurisdiction and the assessed value within that jurisdiction. That tax rate is a nominal rate. An effective tax rate is also used for property tax. The effective tax rate is determined by considering the tax rate and the percent of assessment. . "(1) The tax rate expressed as a percentage of market value, (2) The relationship between dollars of tax and dollars of market value of a property. The rate may be calculated either by dividing tax by value or by multiplying a property's assessment rate by the tax rate," (IAAO Glossary). The effective tax rate is often shown as ETR. Using Problem 2-3 again, we should be able to calculate the effective tax rate in the two different methods given in the IAAO definition.

An individual just received his valuation notice from your office with a value of $248,300 and wants to know what an estimate of his taxes would be. If the assessment rate is 40% and the tax rate is 38.35 mills, what would the estimated taxes be?

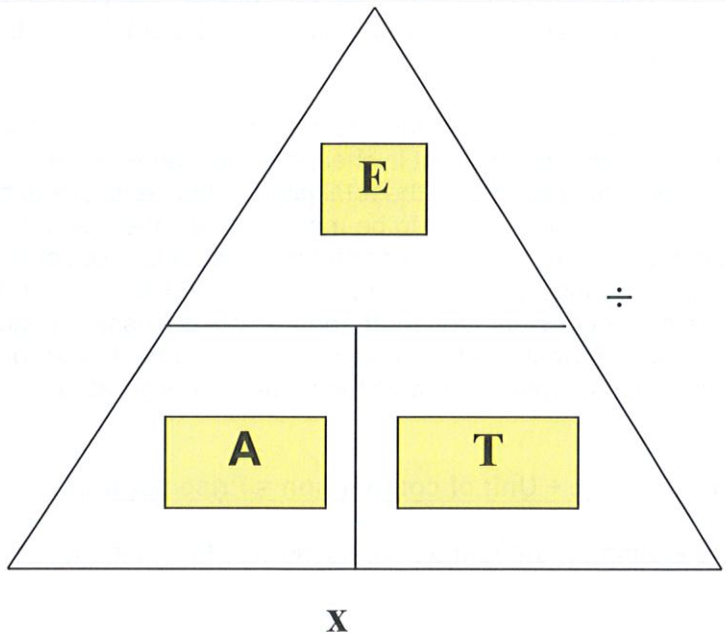
MV x AR = AV x TR = TAXES
40% ÷ 100 = 0.40   38.35 mills ÷ 1000 = 0.03835 now we can use the formula.
$248,300 x 0.40 = $99,320 x 0.03835 = $3,808.92

In the definition above, Method 1 was taxes divided by market value. Therefore, the effective tax rate would be: $3,808.92 ÷ $248,300 = 0.0153. Normally the ETR will be expressed as a percentage so 0.0153 x 100 = 1.53%. This is stating that for every dollar of value, you would be paying 1.53% or $1.53 in taxes.

The second method in the definition is multiplying the assessment and tax rates. In the above example it would be 0.40 x 0.03835 = 0.0153. The ETR will be the same by use of either method.

A tool to help calculate the ETR is the EAT formula. The letters in EAT stand for:

E = Effective Tax Rate
A = Assessment Level, Assessment Rate or Assessment Ratio
T = Tax Rate



There are actually three formulas by use of the EAT triangle. If you know any two of the parts, you can find the third. The three formulas are:

E = A x T   A = E ÷ T   T = E ÷ A

Problem 5-6

What is the ETR if the tax rate is $4.40 per hundred and the assessment rate is 50%?

Problem 5-7

What is the ETR if the tax rate is 125 mills and an assessment rate of 20%

Section 6

I. What is the Best Deal (Units of Comparison?)

Oh the joy of shopping – at least for some people. It may be for clothes, groceries, appliances or cars but we all have to do some shopping. Often the shopping results in comparison shopping. We will compare the cost of one item to another by looking at such factors as size, quality and reputation of the manufacturer/producer.

When grocery shopping it may come down to comparing one similar quality item to another and purchasing the one that is cheaper. If the items are the same size, the unit of comparison may simply be the total price. If the items are of different size, then the comparison would have to be more than just the total price. A typical unit of comparison may be on a per ounce basis. One product is selling for $2.35 and has eight ounces. The comparison item is $3.79 and has 12 ounces. Which is the better buy? One math formula will get us to an equal unit of comparison. This math formula can be used in any type of price, cost or value comparison. Price, cost or value is always the numerator or what the unit is divided into.

MEMORY TIP: Price ÷ Unit of comparison = Price per unit

Using the above examples, the formula would indicate the best buy is the one for $2.35.

$2.35 ÷ 8 ounces = $0.29 per ounce
$3.79 ÷ 12 ounces = $0.32 per ounce

After making this purchase, you move down the aisle to the beverage area and see your favorite drink is on sale. Again, you have options about what size to purchase. As a six-pack with each can containing 12 ounces, the price is $4.50. The other option is a 32-ounce bottle for $1.40. How can we determine which is the best buy as they are totally different sizes? The first step would be to get them to the same unit of comparison and in this example it would be on a per ounce basis.

6 cans x 12 ounces = 72 ounces $4.50 ÷ 72 ounces = $0.06 per ounce
$1.40 ÷ 32 ounces = $0.04 per ounce

Problem 6-1

You have two options to lease a car. Option 1 is for $5,000 per year and you receive 10,000 miles. Option 2 is for $4,500 per year and you receive 8,500 miles. Which is the better lease option if all other costs are the same?

Purchasing real estate is also comparison shopping and we have to have some type of measure to compare one property to another. This would be in affect whether you are purchasing land or an improved property that has a house on it.

When purchasing land, some of the units that we may consider are price per acre, price per square foot and price per front foot. Front foot means the number of feet from the side lot line to the other side that faces on the street. As not all land is the exact same size, units of comparison will show the value relationship between them. Example: A lot that has a frontage of 80 feet and a depth of 150 is for sale at $24,000. A lot close to the other lot is for sale for $28,000 and has frontage of 90 feet with the same depth of 150. Which is the better buy?

$24,000 ÷ 80 front feet = $300 per front foot
$28,000 ÷ 90 front feet = $311 per front foot

The same comparisons can be made on a square foot and per acre basis. If a tract of land was for sale for $80,000 and the size is 150 front foot by 200 foot of depth, we could calculate a price per front foot, per square foot and per acre. Front foot price would be the same calculation as above:

$80,000 ÷ 150 front foot = $533 per front foot

To find a price per square foot we must find the total square footage which is calculated by multiplying side times side, or front of 150 times depth of 200. This would indicate a total square footage of 30,000 (150 x 200). The price per square foot would then be:

$80,000 ÷ 30,000 square feet = $2.67 per square foot.

Just as we did in the square foot method, we will have to calculate the number of acres for the tract.

MEMORY TIP: There are 43,560 square feet in an acre.

Thus we would need to calculate the number of acres by:

30,000 square feet ÷ 43,560 square feet in an acre = 0.69 acres
$80,000 ÷ 0.69 acres = $115,942 per acre

Problem 6-2

There are two lots for sale in the subdivision you wish to build in. They are both larger lots and are selling on a per acre basis. Lot 1 is 1.20 acres with an asking price of $50,000 and Lot 2 is 1.10 acres with an asking price of $46,000. What are the prices per acre for the lots?

Problem 6-3

Using the information from Problem 6-2, what is the price per square foot for each of the lots?

Units of comparison can also be used for improved properties (land and building). The units of comparison will be different. If it is a house, the units of comparison are normally only per sale price and per square foot. Apartment buildings are better examples in that units of comparison may be per square foot, per unit and per number of bedrooms. The same formula of sale price divided by the unit of comparison is used. Example: An apartment with 30 units sold for $4,000,000 and has 40,000 square feet with each unit having two-bedrooms. What are the various units of comparison?

$4,000,000 ÷ 30 units = $133,333 per unit
$4,000,000 ÷ 40,000 square feet = $100 per square foot
$4,000,000 ÷ 60 bedrooms = $66,667 per bedroom

Problem 6-4

Recently an apartment complex sold for $6,500,000 and contained a total of 30 units with 60 bedrooms and 75,000 square feet. What is the dollar amount of all units of comparison?
When we were shopping for items in the grocery store we selected the one that was the least per unit. When we are valuing property, the criteria has to be different. The valuation of property should be based upon the unit of comparison that best reflects the actions of the buyers and sellers. Otherwise stated, what unit of measure are they using when buying and selling the property. Determination of the appropriate unit of measure will use the formula in this section and our knowledge of percentages and the formula to calculate change from Sections 2 & 3.

Example: After we calculate the unit of comparison for each of the comparable sales being used to value the subject property we then will determine the percentage of spread between the highest and lowest value per unit. The subject property is the property we are appraising.

The formula and example from Section 3 on change is shown below.

The formula for calculating the dollar amount and percent of change is:

(Newest sale – Oldest sale) ÷ Oldest sale
$162,000 - $156,000 = $6,000 dollars of change
$6,000 ÷ $156,000 = 0.0385 as a decimal
0.0385 x 100 = 3.85%

Using the sales data above, now we substitute highest sale for newest sale and lowest sale for oldest sale and then use the same process for the four sales shown below. Four sales were found and you have determined the following rates per unit from the sale.

$112,000 $123,500 $118,400 $122,200

$123,500 - $112,000 = $11,500 dollars of spread
$11,500 ÷ $112,000 = 0.1027 spread as a decimal
0.1027 x 100 = 10.27% of spread

Anytime we need to calculate a percent of spread or difference we can use that same formula from Section 3.

Problem 6-5

Recent analysis of apartment sales showed the following price per square foot. What is the percent of spread?

$123.10 $135.30 $140.00 $133.33 $119.45

If there is only one unit of comparison it is easy to calculate the amount of spread, but in the appraisal process there are generally several units of comparison. Therefore, it is necessary to calculate all units of comparison and then determine the percent of spread between each of the values per unit. As previously stated the unit of comparison that is the smallest percent of spread is the one that is most reflective of the market.

Problem 6-6

Given the information below, which is the unit of comparison that should be used to value the subject property based upon the comparable data?

Comp #	Sale Price	# Units	# Square Foot	Bedrooms/Unit
1	$1,600,000	6	20,000	3
2	$1,800,000	8	22,000	3
3	$1,000,000	5	16,000	3

After a unit of comparison is selected it can be used to value other similar items. Your water bill for instance may be $0.03 per gallon. If you use 3,000 gallons for the month then the bill would be 3,000 x $0.03 or $90. This is a unit of comparison to estimate price, cost or a value. Knowing the cost is $0.03 per gallon, you could then estimate the water bill for other properties by knowing how many gallons was used. This is the same concept for real property. By determining the appropriate unit of measure from the sales of similar properties we can apply those to unsold properties we are appraising.

Example: From market extraction a rate per square foot is determined to be the best market indicator. If the subject has 14,300 square foot and the market rate per square foot is $130, what would be the indicated market value?

14, 300 x $130 = $1,859,000

Problem 6-7

Using the three units of measure for Comp #1 in Problem 6-6, find the three indicated values for a subject property that has 8 units containing 26,000 square feet with each unit having 2 bedrooms.

Units of comparison are often a difficult concept so just keep remembering the memory tip.

MEMORY TIP: Price ÷ Unit of comparison = Price per unit

Section 7

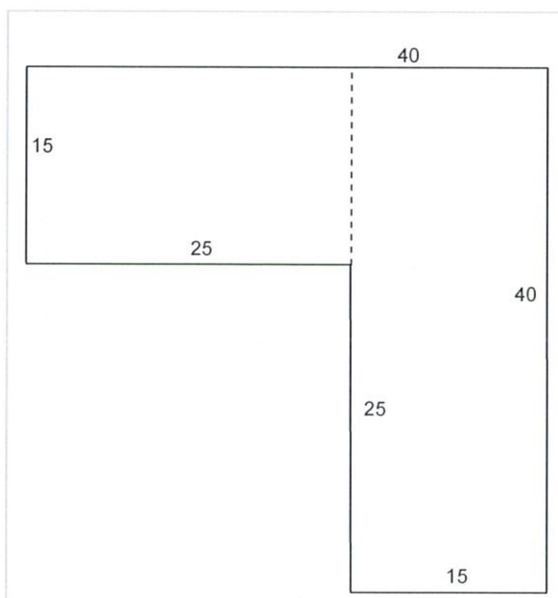
I. How Big Is It (Area)

We are always taking measurements for something. Will the new refrigerator we want fit into the space? How high up from the floor do we want the wallpaper border? Often in our measurements it also deals with area or the square foot of something. You need to replace your concrete driveway and a local contractor has agreed to give you an estimate if you tell him the area. Area is the number of square feet and is calculated by:

Side x side   or   Length x width

If the driveway measures 20 feet wide and 80 feet long, then the area or square foot would be 20 x 80 or 1,600. But what if the driveway was an "ell" shape?

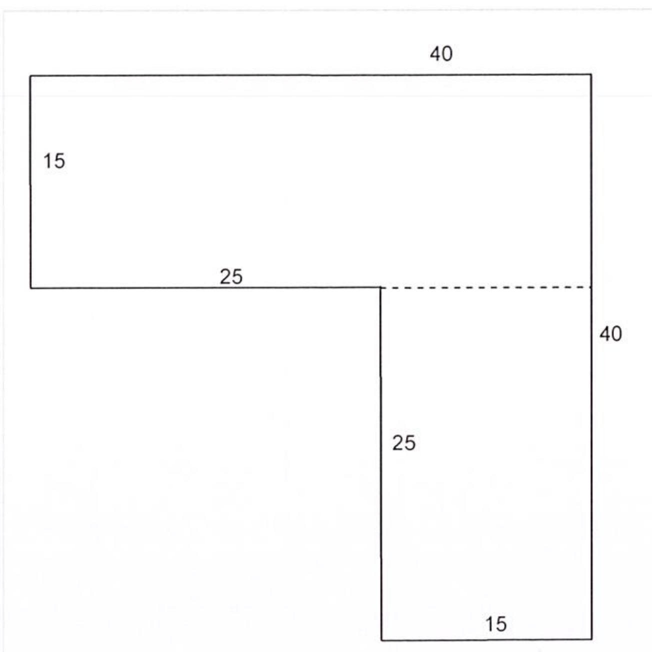
Before we use the sketches that follow, there probably needs to be some discussion on how to read the diagram. If the number is on the outside of the sketch then the measurement goes all the way across the line. If the measurement is on the inside then the measurement goes from corner to corner.



The dashed line represents one method of breaking the sketch into two rectangles to allow for calculation of the total square foot.

15 x 25 = 375
15 x 40 = 600
Total 975 square feet

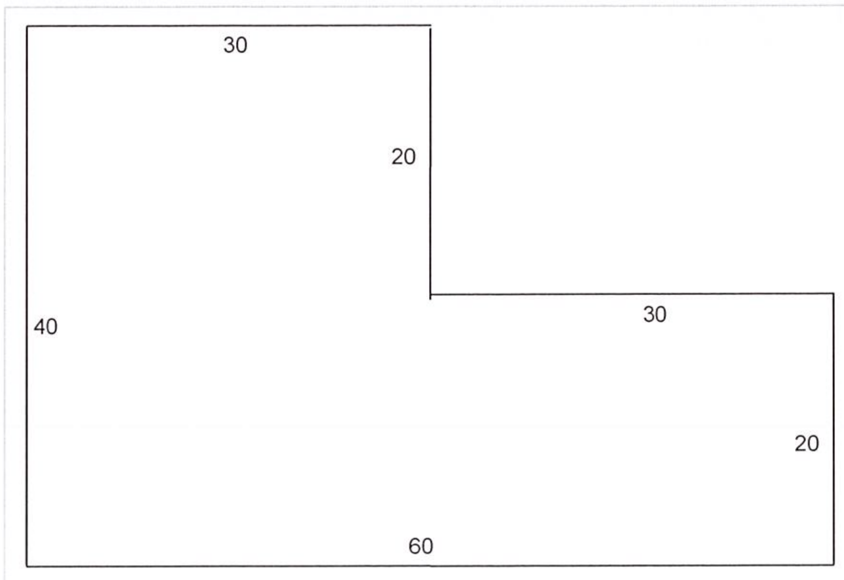
You could have also broken the sketch up as shown below and the results would be the same.



Houses are valued giving consideration to the number of square feet. Most homes are not a nice easy square or rectangle in shape and multiple dimensions must be used to calculate the total square foot. Then appendages to the house such as a garage, deck, porch, etc also have to have the square footage calculated to determine a value

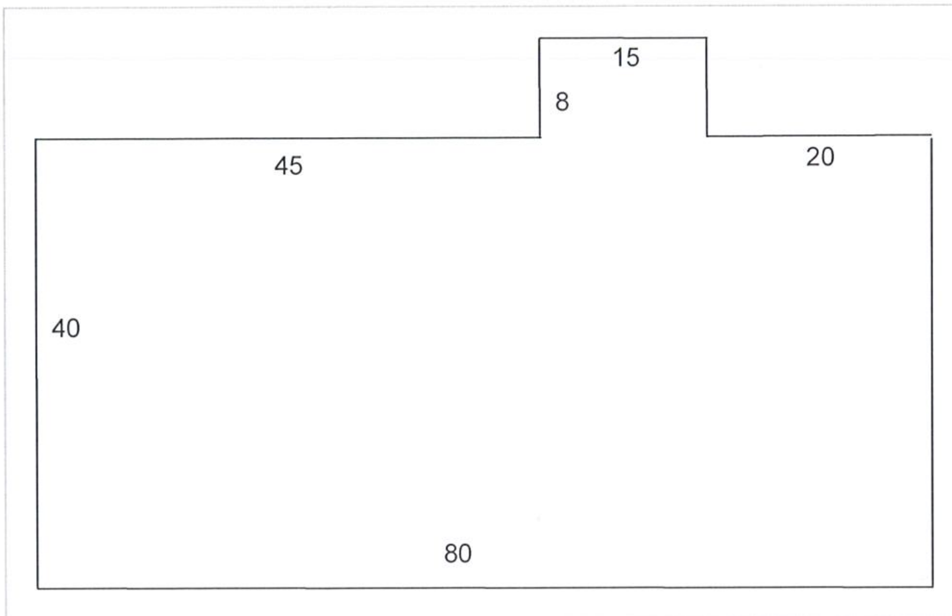
Problem 7-1

Using the house sketch below, calculate the total square footage.



Problem 7-2

Using the house sketch below, calculate the total square footage.



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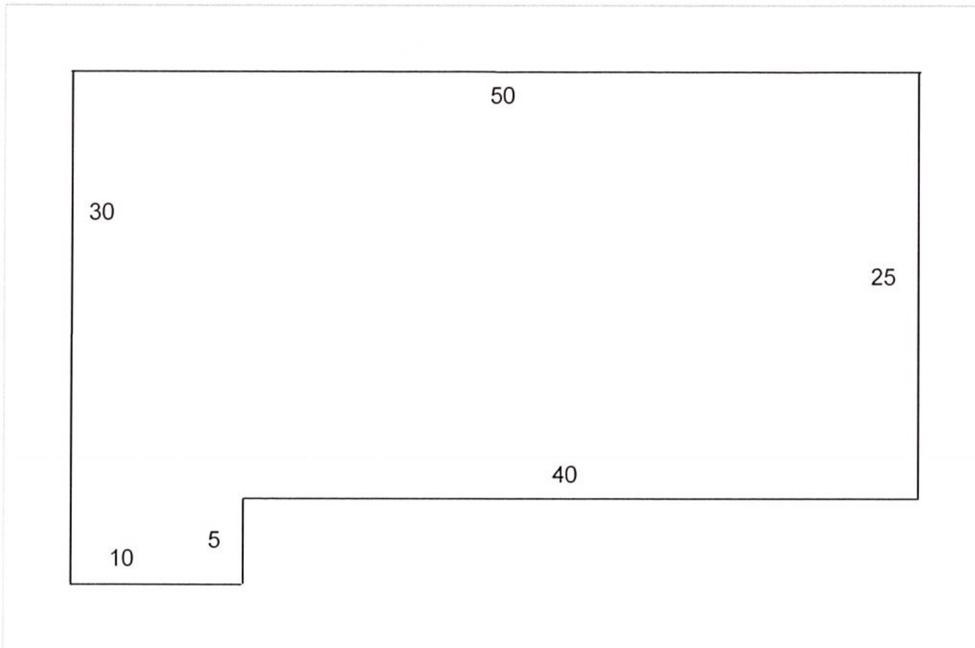
Problem 7-3

Using the house sketch below, calculate the total square footage.



Section 8

I. Making Things Fit (Adjustment Process)

All things are not created equal. Sometimes we make allowances for differences between products. If you go to buy a new refrigerator you will be faced with multiple choices and options. When comparing different brand names of refrigerators you have to review all the characteristics and determine which one to buy. Choice #1 is for $1,090 and includes an automatic ice maker. Choice #2 is the same but has no ice maker and sells for $870. Based upon this data, the ice maker would contribute $220 ($1,090 - $870).

As you continue to shop for that refrigerator you find a store that deals with damaged appliances and has a refrigerator similar to choice #1 but the ice maker does not work and they are asking for bids. Using the information above, if the original cost was $1,000, what would be a good estimate for a bid? If the contributory value of the ice maker was $220, then a bid of $780 ($1,000 - $220) may be reasonable.

The method above of making adjustments is a lump-sum dollar adjustment. We could also do it on a percentage basis. For example: If you buy an annual service contract on your furnace/air conditioner you can save 10%. If the annual maintenance is $200, then the savings would be $20 ($200 x 0.10). That reduction is a percentage adjustment.

In the valuation of real property we also make adjustments for differences between the comparable sales and the subject property we are valuing. The first adjustment if present is for financing. Financing can be given as a dollar amount or as a percentage. The adjustment must be added or subtracted from the actual sale price. Example: A property sold for $149,000 but it was determined that an adjustment of -$3,550 must be made to reflect more typical financing terms. Thus the finance adjusted sale price would be $145,450 ($149,000 - $3,550). If instead it was stated that a -4% adjustment was necessary then the finance adjusted sale price would be $143,040 [$149,000 – ($149,000 x 0.04)].

Problem 8-1

A sale price of $290,000 was determined to need adjusting for financing in the amount of +$4,900. What is the finance adjusted sale price?

Problem 8-2

If a property sold for $67,600 and a finance adjustment of +5% was needed, what is the finance adjusted sale price?

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Within the comparable sales approach to value it is typical that there are several adjustments to each sale to make it have the same characteristics as the subject of the appraisal. As mentioned the adjustments can be done on a lump-sum dollar or percentage basis. An example of each is shown below using the same sold property that sold for $80,000. The adjusted sale price will come out the same by use of either method with the exception of some possible small differences due to rounding.

Characteristics	**Lump-sum dollar adjustment**	**Percentage adjustment**
Condition	+ $4,000	+ 5%
Quality	- $5,600	- 7%
Extra bath	+ $800	+ 1%
Net adjustment	- $800	- 1%
Adjusted sale price	$79,200	$79,200

The sale price is adjusted by a - $800 to a value of $79,200 on the lump-sum dollar method. In the percentage method it is also a - $800 adjustment that is calculated by [$80,000 – ($80,000 x 0.01)].

The adjustment process used in the sales comparison approach has a sequence that must be followed. The sequence is:

	Sale price
+/-	<u>Finance adjustment</u>
=	Finance adjusted sale price (FASP)
+/-	<u>Time adjustment</u>
=	Time adjusted sale price (TASP)
+/-	<u>Net adjustments</u>
=	Adjusted sale price

Some further explanations of the terms are needed before an understanding of the application is complete. As shown at the start of this section, some property sale prices may need to be adjusted to reflect typical financing. Sometimes personal property is included in the sale and it must also be removed at this point. The FASP would indicate that the adjusted sale price now reflects typical financing or the removal of any larger personal property items such as boats, tractors, etc.

Time adjustment is the recognition that the market is constantly changing. Hardly ever does the market stay flat for an extended period of time. After adjusting for time as shown in Section 3, the TASP is stating that this is what the property would now sell for as of the appraisal date. Any other adjustments are made against the TASP. Example: A property sold for 4 months ago for $154,000 and because of creative financing an adjustment of + $5,200 must be made. Market analysis also has indicated the values are increasing at a rate of 0.005 per month. What would be the FASP and TASP?

Sale Price		$154,000	
Finance adjustment	+	5,200	
FASP		$159,200	
			4 months x 0.005 = 0.02
Time adjustment	+	3,184	$159,200 x 0.02 = $3,184
TASP		$162,384	

Problem 8-3

Find the FASP and TASP if a property sold for $210,000 six months ago with a time trend of 0.004 per month and a finance adjustment of - $3,500.

Problem 8-4

Using the TASP from Problem 8-3 and the information below, determine the net adjusted sale price.

Location adjustment	- $ 5,000
Quality adjustment	+ $12,500
Fireplace	+ $ 2,600

Problem 8-5

Again using the TASP from Problem 8-3 and the information below, determine the net adjusted sale price.

Quality adjustment	- 15%
Extra bathroom	+ 6%
Extra garage	+ 4%

Sometimes you can also see comparable sale adjustments in a multiplicative method. If you have all of something you have 100% or 1.00. Then if there is more than a 100%, say 10% more than you would have 110% or 1.10. The inverse would be true for less than a hundred. If you have 20% less it would be shown as 80% or 0.80. Using the information in Problem 8-5 the multiplicative adjustments would be as follows.

Quality adjustment	- 15% = 0.85
Extra bathroom	+ 6% = 1.06
Extra garage	+ 4% = 1.04

Multiplicative means to multiply by each other and thus the net adjustment factor would be 0.937 (0.85 x 1.06 x 1.04). Using the same TASP we can compare the answer to the additive method used in Problem 8-5. Under the multiplicative method the adjusted sale price would be $198,134 ($211,456 x 0.937). The answer is slightly different but no materially. Emphasis in Course 101 will be on the lump-sum and percentage adjustment methods.

Section 9

I. Looking for Mis-Matches (Paired Sales)

Ever have trouble matching up those socks that are close to the same color? You obviously want to find the perfect match for it but sometimes you simply say "close enough, no one will notice." The valuation of real property works very similar in that when you try to value a property you would love to have a perfect match to the subject you are appraising that just sold. A perfect match would be a good indication of value. Finding that perfect match is almost impossible. What normally happens is we find sales that are similar in characteristics to the subject and then have to make adjustments just as we did in Section 8. The first two paragraphs of Section 8 are repeated below.

All things are not created equal. Sometimes we make allowances for differences between products. If you go to buy a new refrigerator you will be faced with multiple choices and options. When comparing different brand names of refrigerators you have to review all the characteristics and determine which one to buy. Choice #1 is for $1,090 and includes an automatic ice maker. Choice #2 is the same but has no ice maker and sells for $870. Based upon this data, the ice maker would contribute $220 ($1,090 - $870).

As you continue to shop for that refrigerator you find a store that deals with damaged appliances and has a refrigerator similar to choice #1 but the ice maker does not work and they are asking for bids. Using the information above, if the original cost was $1,000, what would be a good estimate for a bid? If the contributory value of the ice maker was $220, then a bid of $780 ($1,000 - $220) may be reasonable.

This process of measuring the value difference is called paired sales analysis. You again want to find a perfect match but know that is not reasonable, instead you look for two sales exactly alike except for one difference. That one difference would then be the contributory value of that item.

Before we get into real property, lets' go car shopping. On the lot are two cars that are exactly alike except one has a sunroof. The one without the sunroof is priced at $7,500 and the one with the sunroof is priced at $8,000. The contributory value, the difference, of the sunroof would be $500 ($8,000 - $7,500). Additionally you see another car without the sunroof but with electric and heated seats priced at $7,800, the electric seats would add $300 ($7,800 - $7,500).

The determination of items that contribute value and what value they add or deduct from a property is also determined by paired sales. If you think of buying a home there are certain items or characteristics you look for. Maybe items such as quality, condition, number of bedrooms and bathrooms, finished basement, etc. Given sufficient sales, the contributory value for each of those can be determined. Example: A home just sold with three bathrooms for $168,000 and a home exactly like it but with only two bathrooms just sold for $162,000. The contributory value of the extra bathroom would be $6,000 ($168,000 - $162,000).

Problem 9-1

A recent sale in your neighborhood was for $123,000 and the home had only one attached garage stall. A recent sale down the street was for $129,600 but has two attached garage stalls. What is the contributory value of the extra garage stall?

It would be unusual that the sales occur at the same time. Remembering the adjusting process in the sales comparison approach, we would have to adjust the sale first for any financing or personal property and then for time. At that point we would look for two sales exactly alike except for the one characteristic.

Problem 9-2

You have found a recent sale that has a completed finished basement that can be used for living area. It sold for $235,600. Another sale like the subject sold for $212,500 without a basement but the sale was five months ago. If the time adjustment is 0.004 per month, what is the contributory value of the finished basement?

Problem 9-3

Your supervisor has stated you need to determine the value of fireplaces within one of your assigned neighborhoods. You have found a recent sale that has a fireplace and it sold for $127,300. There are two other sales available and neither of them have fireplaces. Comparable #1 sold eight months ago for $115,000 and comparable #2 sold two months ago for $117,500. If the time trend is 0.002 per month, what are the indicated contributory values for the fireplace?

Section 10

I. How Much Does It Cost (Calculating Cost New)

Everyone likes new things. We will all pay more for something new than for a used item. If we go car shopping a new car we really like might cost $25,000. But if we look at the same model of car but a few years old, the value will be less because of the depreciation due to use and wear and tear. Cost new will typically recognize the upper end of value. Normally people will not pay more than what they can buy a new item for.

Sometimes you can see ads for items for sale and they indicate they are brand new. How would we know if the price they are asking really is reasonable or not? The best way would to compare the price to what you can buy the item for from the store.

Improvement value works in the same fashion. The starting point for using the cost approach to value is the calculation of what it would cost new to construct. This cost is termed replacement cost new and will be abbreviated as RCN.

Cost new is best extracted from the market by contacting builders and finding what the actual construction cost of a home was. In Section 7 we calculated the square footage of homes. If we know what those homes cost to construct, we can divide the cost by the number of square feet to get a cost per square foot. Example: A home cost $267,900 to construct and has 2,500 square feet of living area. The cost per square foot would be $107.16 ($267,900 ÷ 2,500). This is a unit of comparison.

Problem 10-1

A house was recently constructed for $367,000 and has 3,020 square feet. What is the cost per square foot?

Often the construction cost cannot be individually obtained but there are sales of new homes in an area. If we know the sale price and the land value we can calculate the improvement value. The sale price has two components: land and improvement. If we subtract the land value from the sale price the remaining value must be the improvement value. Then we can calculate the cost per square foot to build.

Example: A property sold for $256,000 with a new home on it. If land sales in the area are indicated to be $45,000 and the house has 1,800 square feet, what would be the cost per square foot for the house?

$256,000 - $45,000 = $211,000 house cost new
$211,000 ÷ 1,800 = $117.22 house cost new per square foot

Problem 10-2

A sale crossed your desk for $267,000 consisting of 1,730 square feet and a lot value of $40,000. What is the cost new per square foot for the house?

Once we have determined the square foot cost new for a house, we can use it to check our cost manual or to apply to other homes. In the example above the cost new was calculated to be $117.22. If we had a similar home recently constructed that has 1,810 square feet, what would be an estimated cost new?

1,810 x $117.22 = $212,168

Problem 10-3

A recent sale with a new house constructed on it was shown to have sold for $412,000 and has a land value of $65,000 and contains 3,060 square feet. An owner is questioning the cost you have on his new home that is similar and contains 2,840 square foot. Using the sale, what would be an indicated cost on owner's home?

Sometimes we can use older, historical costs and trend them to the current date of appraisal for an estimate of value. Trending was discussed in Section 4 but can be applied here also. Trending is the application of change or factors for time. Trending is the recognition that costs or values will change and that an older value can be adjusted to reflect the current value. In the applications below and in IAAO Course 101 the trends applied are straight-line and not compounded.

The following is a repeat from Section 4 but applies in this section also. Indexing can be used to trend up an original cost to a current cost estimate. If someone built an unusual home or recently constructed a home, maybe looking at the original cost may be beneficial to check if your cost estimates are reasonable. Example: A property owner shows documentation that the cost to construct his home three years ago was $256,400. At the time of construction, a nationally recognized costing manual stated the cost index to be 210 and the current index is 222. Two processes to make the calculations are shown below.

222 – 210 = 12 amount of change
12 ÷ 210 = 0.0571 percent of change
$256,400 x 0.0571 = $14,640 dollar amount of change
$256,400 + $14,640 = $271,040 trended cost

Or

222 ÷ 210 = 1.0571 or otherwise stated, a 5.71% increase
$256,400 x 1.0571 = $271,040 trended cost

The terms of cost manual and cost index had previously been introduced. A cost manual allows for an estimate of the replacement cost new. Whenever a manual is first created or totally updated, the cost index is 1.00 which means the manual is accurately reflecting the current cost to build new. Developing a cost manual is extremely difficult, time-consuming and costly. What occurs are periodic updates to measure the increase in costs and apply them by the use of a cost index.

Problem 10-4

An owner has provided information that the actual cost of his unusual home three years ago was $198,400. At the time of construction the index was 1.68 and the current index is 1.80. What would be the indicated trended cost?

Section 11

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I. Not Worth as Much Now (Depreciation)

Depreciation is the loss of value due to wear and tear. All items suffer from depreciation. It is always discussed that the minute you drive a new car off the lot, it automatically has lost value. It has lost value because it is no longer new. No one would willingly pay more for a used car than for the same car if it were new. If a car cost $22,000 three years ago and will now sell for $12,500, then the amount of depreciation is $9,500 ($22,000 - $12,599). The dollar amount of depreciation is also expressed as a percentage. The car would have loss 43% ($9,500 ÷ $22,000) of the cost new.

Real property improvements also suffer from depreciation. The difference between the car example above and real property improvements is that the cost new for the improvements is not when it was built but what it would cost to replace the improvement as of the date of the appraisal. How to calculate the cost new was shown in Section 10. Example: A home is 20 years old and has been determined to have 14% depreciation. If the current RCN is $235,600, what is the depreciated value?

$235,600 x 0.14 = $32,984	dollar amount of depreciation
$235,600 - $32,984 = $202,616	depreciated value of the house

Depreciation is a loss of value from 100% of the value as new. In the above problem the percent of depreciation was shown as 14%. The inverse of depreciation is the percent good. If there was 14% used then the percent remaining or the percent good would be 86% (100% - 14%). Calculation by using the percent good would be:

$235,600 x 0.86 = $202,616	depreciated value of the house

Problem 11-1

The house you are appraising has an RCN of $186,300 with 27% depreciation. What is the dollar amount of depreciation and the depreciated house value?

Problem 11-2

A house is estimated to have 72% good and an RCN of $347,200. What is the depreciated value using the percent good?

Problem 11-3

Calculate the depreciated improvement value given:

2,180 square foot of house costing $90 per square foot

400 square foot of garage costing $30 per square foot
Depreciation for the house and garage is 20%

Depreciation can be applied in a straight-line method. Straight-line depreciation states that the percentage of depreciation is the same as long as the improvement has value. Again, if you have all of something, you have 100% of it. Under straight-line depreciation you would determine how long the improvement will have value and then spread the 100% equally over the life of the improvement. Example: It is anticipated the roof on the house will last 20 years. The annual amount of depreciation would be 5% (100% ÷ 20).

Problem 11-4

If the driveway pavement is one year old, will last 10 years and just cost $12,000 to replace, what is the annual percent, annual dollar amount of depreciation and the depreciated value?

Depreciation can be applied to the various components of a house just as the roof and driveway example. For each component you would need the age, how many years it is projected to have value (economic life) and the RCN. A formula to calculate the component depreciation would be:

Age ÷ Economic life = % of Depreciation x RCN = $ of Depreciation

Example: A roof has an estimated economic life of 20 years and is 5 years old and would cost $12,000 to replace. The heat and air conditioning system has an RCN of $2,400 and is 4 years old with an estimated life of 20 years. What is the amount of depreciation for each item?

Items	Age	Econ Life	% Dep.	RCN	$ Dep.
Roof	5	20	0.25	$12,000	$3,000
H&AC	4	20	0.20	$2,400	$480

Problem 11-5

Calculate the depreciation for each of the following items.

Item	Age	Economic Life	RCN
Carpet	5	10	$7,000
Heat & Air Conditioning	12	15	$3,600
Roof	8	20	$9,000

Depreciation can be in the forms of physical deterioration, functional obsolescence and external obsolescence. Physical deterioration is the loss of value due to wear and tear and the forces of nature. Functional obsolescence is the loss of value due to the change in use or desirability of an item in the market. External obsolescence is the loss of value due to factors outside of the property boundaries such as a bad location.

Functional and external are often calculated by measuring the rent loss and converting that income loss into a value loss. Rent loss is the difference between what a property is renting for that has the obsolescence and one that does not. Example: A property that has a functional problem is renting for $750 per month. If a similar property without the problem rents for $800 per month, the rent loss per month is $50 ($800 - $750). Then we have to convert that monthly rent loss into the amount of depreciation. The conversion process is by use of a term called Gross Rent Multiplier (GRM). GRM is calculated by dividing the sale price of a residential property by what the monthly rent was at the time of sale. The GRM is typically rounded to the nearest whole number. Example: A property sold for $63,000 and was renting for $700 per month. The GRM would be 90 ($63,000 ÷ $700).

Problem 11-6

A property is currently renting for $800 per month but has a functional problem. Another property that does not have the problem is renting for $875 per month. What is the monthly rent loss?

Problem 11-7

What would be the GRM if the rent is $900 and the sale price is $85,000?

If we have the rent loss and the GRM we can calculate the amount of functional obsolescence. The formula is: Rent loss x GRM. Example: If the rent loss is $50 per month and the GRM is 90, the amount of functional obsolescence is $4,500 ($50 x 90).

Problem 11-8

Using the answers from Problems 11-6 and 11-7, calculate the amount of functional obsolescence.

External obsolescence uses the same formula with one addition. Because this is a locational adjustment you would have already recognized the loss of value to the land when you set the land value. That means we must determine what percent of the overall property value is for the improvement only. We can do that by use of a land-to-building ratio (L:B) or by use of a percentage. Example: A property sold for $127,000 and the land value was determined to be $30,000.

The L:B ratio would be calculated as follows:

$127,000 ÷ $30,000 = 4.2 normally rounded to one place to the right of the decimal

In the L:B ratio, land is always one part so the L:B ratio would be 1:3.2.

Problem 11-9

A property recently sold for $96,000 with a land value of $20,000. What is the L:B ratio?

Problem 11-10

If land value is $40,000 and the property sold for $200,000, what would be the L:B ratio?

The L:B ratio is also expressed as a percentage. In the last problem the L:B ratio was 1:4 or there were 5 total parts. From that information we can calculate what percent of the property value is for the improvement. If there are 5 total parts and 4 of them are improvement then 80% (4 ÷ 5) is the percentage that the improvement value is of the entire property value.

Problem 11-11

If the L:B ratio is 1:3, what percent of the value is the improvement?

Now that we have determined how to calculate the percent of value that the improvement contributes we can finish the calculation for external obsolescence. The formula is: Rent loss x GRM x % of building value.

Example: A property is suffering a rent loss of $75 per month because of location. The GRM is 80 and the percent of building value is 75%. The external obsolescence would be:

$75 x 80 x 0.75 = $4,500

Problem 11-12

If rent loss is $50 per month, the GRM is 90 and the percent of building value is 80%, what is the external obsolescence?

Problem 11-13

Calculate the external obsolescence given the following information:
The subject property is close to a noisy freeway and rents for $900 per month. A similar property not close to the freeway rents for $1,000 per month. You have found a recent sale that was also renting for $1,000 per month and sold for $90,000. The L:B ratio in the neighborhood is 1:4.

A GRM can also help us to find other residential values. The formula would be Monthly rent x GRM = Property value. This formula is referred to as VIF. Where Value = Income x Factor. Income is the monthly rent and factor is the GRM. Example: A GRM has been determined to be 85 and the subject's monthly rent is $600. The indicated value would be:

$600 x 85 = $51,000

Problem 11-14

Your subject property is renting for $825 per month. If the GRM is 90, what would be the indicated property value?

If the property is a commercial property then the rent is annualized (monthly rent x 12 months). Then the GRM is changed to a GIM (Gross Income Multiplier). A GIM would be calculated by dividing the sale price by the gross annual rent.

Section 12

I. How Much for Part of It (Abstraction)

Often we only want to buy part of something. Then the question becomes what would that cost? On a trip to the florist you look at a dozen red roses and a nice vase and see the price of $50 and you ask the florist how much for just the roses and he says $35. It is easy to see that there is a $15 difference. We have extracted or abstracted out the cost of the vase. This could have also been done on a percentage basis if the florist said the roses are 70% of the cost, therefore it would have been $50 x 0.70 = $35 for the roses.

Depreciation for improvements can be done in a very similar manner. If an improved property sells it has two components: land and improvement. In order to determine the improvement value we would have to subtract out the land value, just like we subtracted out the roses value from the total cost.
Example: A property sold for $164,900 and the land value is $42,000. What is the indicated improvement value?

$164,900 - $42,000 = $122,900

If we know what the RCN is for the improvement we can also by use of abstraction determine the dollar amount and percentage of depreciation for the improvement. Example: If the RCN in the above example was $157,300, then the depreciation, or loss value from cost new, would be:

$157,300 - $122,900 = $34,400

Problem 12-1

A property sold for $96,400 with a land value of $22,000 and an RCN of $135,800. What are the indicated improvement value and the dollar amount of depreciation?

Once we know the dollar amount of depreciation we can determine what the depreciation is as a percentage. In Problem 12-1 it was determined that the depreciation was $61,400 with an RCN of $135,800. The dollar amount of depreciation can be converted into a percentage by dividing the dollar amount of depreciation by the RCN. Thus the percentage would be:

$61,400 ÷ $135,800 = 0.45 = 45%

Problem 12-2

A property sold for $218,000 with a land value of $40,000 and an RCN of $192,800. What is the percentage of depreciation?

The amount of depreciation determined from the market can then be applied to similar improvements. Example: Based upon sales data the typical depreciation for a 15 year old home is 12%. If a similar home has an RCN of $163,600, what would be the amount of depreciation?

$163,600 x 0.12 = $19,632

Problem 12-3

Using the depreciation calculated in Problem 12-2, what would be the amount of depreciation and the depreciated value of a home with an RCN of $347,300?

GOOD LUCK!

Formulas

Whole number = Decimal x 100

Decimal = Whole number ÷ 100

Rate = Smallest number ÷ largest number

Taxes = MV x AR = AV x TR = Taxes

- MV = Market Value and also referred to as appraised value and 100% value.
- AR = Assessment Rate, assessment ratio or assessment level. This is a fraction of market value.
- AV = Assessed Value is the product of multiplying and is the base value used to determine the amount of property tax.
- TR = Tax Rate that is multiplied against the assessed value to determine the taxes.

Change (dollar) = (Newest sale – oldest sale) ÷ oldest sale

Change (percent) = (Dollar change ÷ oldest sale) x 100

Change (monthly) = (Dollar change ÷ oldest sale) ÷ # months between sales

Trending = Sale price + (Sale price x percentage change)

Trending = Old cost x trend

Tax rate = (Budget – non-property tax revenue) ÷ Assessed value

Effective tax rate = Tax dollars ÷ market value

Effective tax rate = Assessment rate x tax rate (E = A x T)

Unit of comparison = Price ÷ unit

Acres = Square feet ÷ 43,560

Price per unit = Price ÷ unit of comparison
Area = Length x width or side x side

Percent of depreciation = House value ÷ RCN

Dollars of depreciation = RCN x percent of depreciation

Dollars of depreciation = (Age ÷ economic life) x RCN

GRM = Sale price ÷ monthly rent

Land to building ratio = Total value ÷ land value

Section 2 - Answers

Problem 2-1
1 ÷ 60 = 0.017 x 100 = 1.7%

Problem 2-2
10% ÷ 100 = 0.10   0.10 x $2,000,000 = $200,000 winnings per year
15% ÷ 100 = 0.15   0.15 x $200,000 = $30,000 taxes per year

Problem 2-3
MV x AR = AV x TR = TAXES
40% ÷ 100 = 0.40   38.35 mills ÷ 1000 = 0.03835 Now use the formula.
$248,300 x 0.40 = $99,320 x 0.03835 = $3,808.92

Section 3 - Answers

Problem 3-1
7.5 ÷ 100 = 0.075
$237,400 x 0.075 = $17,805 increase
$237,400 + $17,805 = $255,205

Problem 3-2
2.3 ÷ 100 = 0.023
$10.35 x 0.023 = $0.24
$10.35 + $0.24 = $10.59

Problem 3-3
$340,000 - $325,000 = $15,000
$15,000 ÷ $325,000 = 0.0462 as a decimal
0.0462 x 100 = 4.62%

Problem 3-4
$210,000 - $206,000 = $4,000
$4,000 ÷ $206,000 = 0.0194 as a decimal
0.0194 x 100 = 1.94%

Problem 3-5
$154,000 - $150,000 = $4,000
$4,000 ÷ $150,000 = 0.0267
0.0267 x 100 = 2.67%

Problem 3-6

3-3 0.0462 ÷ 18 months = 0.0026 per month x 100 = 0.26%

3-4 0.0194 ÷ 8 months = 0.0024 per month x 100 = 0.24%

3-5 0.0267 ÷ 12 months = 0.0022 per month x 100 = 0.22%
Oldest sale was 20 months ago and newest sale was 8 months ago so difference between sales in Problem 3-5 is 12 months.

Section 4 - Answers

Problem 4-1
0.0035 x 12 months = 0.0420 total percent increase
$375,000 x 0.0420 = $15,750 total dollar increase
$375,000 + $15,750 = $390,750 trended sale price

Problem 4-2
0.0062 x 6 months = 0.0372 total percent increase
$148,500 x 0.0372 = $5,524 total dollar increase
$148,500 + $5,524 = $154,024 trended sale price

Problem 4-3
$177,600 - $172,500 = $5,100 dollar change
$5,100 ÷ $172,500 = 0.0296 percent change
0.0296 ÷ 7 months = 0.0042 monthly percent change

0.0042 x 4 months = 0.0169 percent change for the subject
$192,000 x 0.0169 = $3,245 dollar change for the subject
$192,000 + $3,245 = $195,245 time adjusted sale price

Problem 4-4

182 – 167 = 15	amount of change
15 ÷ 167 = 0.0898	percent of change
$210,300 x 0.0898 = $18,885	dollar amount of change
$210,300 + $18,885 = $229,185	trended cost

OR

182 ÷ 167 = 1.0898	or otherwise stated, a 8.98% increase
$210,300 x 1.0898 = $229,185	trended cost

Section 5 - Answers

Problem 5-1
1,000,000 ÷ 20,000,000 = 0.05
0.05 x 100 = $5.00 per hundred
0.05 x 1000 = $50.00 per thousand
0.05 x 1000 = 50 mills

Problem 5-2
6,500,000 ÷ 600,000,000 = 0.0108
0.0108 x 100 = $1.08 per hundred
0.0108 x 1000 = $10.80 per thousand
0.0108 x 1000 = 10.80 mills

Problem 5-3
1,000,000 – 2,000,000 = 800,000 ÷ 20,000,000 = 0.04
0.04 x 100 = $4.00 per hundred
0.04 x 1000 = $40.00 per thousand
0.04 x 1000 = 40 mills

Problem 5-4
6,500,000 – 1,000,000 = 5,500,000 ÷ 600,000,000 = 0.0092
0.0092 x 100 = $0.92 per hundred
0.0092 x 1000 = $9.20 per thousand
0.0092 x 1000 = 9.20 mills

Problem 5-5
78.23 ÷ 1000 = 0.07823

Problem 5-6
$4.40 ÷ 100 = 0.0440   T in the EAT formula
50 ÷ 100 = 0.50   A in the EAT formula
A x T = E   0.50 x 0.0440 = 0.0220 x 100 = 2.20%

Problem 5-7
125 mills ÷ 1000 = 0.1250 T in the EAT formula
20 ÷ 100 = 0.20   A in the EAT formula
A x T = E   0.20 x 0.1250 = 0.0250 x 100 = 2.50%

Section 6 – Answers

Problem 6-1
$5,000 ÷ 10,000 miles = $0.50 per mile
$4,500 ÷ 8,500 miles = $0.53 per mile

Problem 6-2
$50,000 ÷ 1.20 acres = $41,667 per acre
$46,000 ÷ 1.10 acres = $41,818 per acre

Problem 6-3
You will have to multiply the number of acres by 43,560 to get the square footage of each lot.

Lot 1 — 1.20 acres x 43,560 = 52,272 square feet
$50,000 ÷ 52,272 square feet = $0.96 per square foot

Lot 2 — 1.10 acres x 43,560 = 47,916 square feet
$46,000 ÷ 47,916 square foot = $0.96 per square foot

Problem 6-4
$6,500,000 ÷ 30 units = $216,667 per unit
$6,500,000 ÷ 60 bedrooms = $108,333 per bedroom
$6,500,000 ÷ 75,000 square feet = $86.67 per square foot

Problem 6-5
$140.00 - $119.45 = $20.55 dollars of spread
$20.55 ÷ $119.45 = 0.1720 spread as a decimal
0.1720 x 100 = 17.20% of spread

Problem 6-6

Comparable #	Price Per Unit	Price Per Square Foot	Price Per Bedroom
1	$266,667	$80.00	$88,889
2	$225,000	$81.82	$75,000
3	$200,000	$62.50	$66,667

Spread of Price Per Unit — $266,667 - $200,000 = $66,667
$66,667 ÷ $200,000 = 0.3333 x 100 = 33.33%

Spread of Price Per Square Foot — $81.82 - $62.50 = $19.32
$19.32 ÷ $62.50 = 0.3091 x 100 = 30.91%

Spread of Price Per Bedroom — $88,889 - $66,667 = $22,222
$22,222 ÷ $75,000 = 0.33 x 100 = 33.00%

÷ **Problem 6-7**
$266,667 x 8 units = $2,133,336
$80.00 x 26,000 square feet = $2,080,000
\+ $88,889 x 16 bedrooms = $1,422,224

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Section 7 – Answers

x **Problem 7-1**
(30 x 40) + (30 x 20)
1,200 + 600 = 1,800
÷ **Or**
(30 x 20) + (20 x 60)
\+ 600 + 1,200 = 1,800

Problem 7-2
\- (80 x 40) + (8 x 15)
3,200 + 120 = 3,320

x **Problem 7-3**
(50 x 25) + (10 x 5)
÷ 1,250 + 50 = 1,300

\+

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Section 8 – Answers

Problem 8-1
x $290,000 + $4,900 = $294,900

Problem 8-2
÷ [$67,600 + ($67,600 x 0.05)]
$67,600 + $3,380 = $70,980

\+ **Problem 8-3**

Sale Price		$210,000	
Finance adjustment	-	3,500	
FASP		$206,500	
			6 months x 0.004 = 0.024
Time adjustment	+	4,956	$206,500 x 0.024 = $4,956
TASP		$211,456	

Problem 8-4

TASP		$211,456
Location adjustment	-	5,000
Quality adjustment	+	12,500
Fireplace	+	2,600
Net adjustments	+	$ 10,100
Adjusted sale price		$221,556

Problem 8-4

TASP		$211,456	
Quality adjustment	-	0.15	
Extra bathroom adjustment	+	0.06	
Extra garage adjustment	+	0.04	
Net adjustments	-	0.05	
Net dollar adjustment	-	$ 10,573	$211,456 x 0.05 = $10,573
Adjusted sale price		$200,883	

Section 9 – Answers

Problem 9-1

$129,600 - $123,000 = $6,600

Problem 9-2

5 months x 0.004 = 0.02	percent of increase
$212,500 x 0.02 = $4,250	dollar amount of increase
$212,500 + $4,250 = $216,750	time adjusted sale price
$235,600 - $216,750 = $18,850	contributory value of the finished basement

Problem 9-3

Comparable #1

8 months x 0.002 = 0.016	percent of increase
$115,000 x 0.016 = $1,840	dollar amount of increase
$115,000 + $1,840 = $116,840	time adjusted sale price
$127,300 - $116,840 = $10,460	contributory value of the fireplace

Comparable #2

2 months x 0.002 = 0.004 percent of increase

$117,500 x 0.004 = $470 dollar amount of increase

$117,500 + $470 = $117,970 time adjusted sale price

$127,500 - $117,970 = $9,530 contributory value of the fireplace

If this were the only two available sales, a reasonable estimate would be around $10,000.

Section 10 – Answers

Problem 10-1

$367,000 ÷ 3,020 = $121.52

Problem 10-2

$267,000 - $40,000 = $227,000 house cost new

$227,000 ÷ 1,730 = $131.21 house cost new per square foot

Problem 10-3

$412,000 - $65,000 = $347,000 house cost new

$347,000 ÷ 3,060 = $113.40 house cost new per square foot

2,840 x $113.40 = $322,056 indicated cost new for owner's home

Problem 10-4

1.80 – 1.68 = 0.12 amount of change

0.12 ÷ 1.68 = 0.0714 percent of change

$198,400 x 0.0714 = $14,166 dollar amount of change

$198,400 + $14,166 = $212,566 trended cost

Or

1.80 ÷ 1.68 = 1.0714 or otherwise stated, a 7.14% increase

$198,400 x 1.0571 = $212,566 trended cost

Section 11 – Answers

Problem 11-1

$186,300 x 0.27 = $50,301 dollar amount of depreciation

$186,300 - $50,301 = $135,999 depreciated house value

Problem 11-2

$347,200 x 0.72 = $249,984 depreciated house value

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Problem 11-3

2,180 x $90 = $196,200	house RCN
400 x $30 = $12,000	garage RCN
$196,200 + $12,000 = $208,200	total RCN
$208,200 x 0.20 = $41,640	dollar amount of depreciation
$208,200 - $41,640 = $166,560	depreciated improvement value

Problem 11-4

100% ÷ 10 = 10% ÷ 100 = 0.10	annual percent of depreciation
$12,000 x 0.10 = $1,200	annual dollar amount of depreciation
$12,000 - $1,200 = $10,800	depreciated improvement value

Problem 11-5

Items	Age	Econ Life	% Dep.	RCN	$ Dep.
Carpet	5	10	0.50	$7,000	$3,500
H&AC	12	15	0.80	$3,600	$2,880
Roof	8	20	0.40	$9,000	$3,600

Problem 11-6

$875 - $800 = $75

Problem 11-7

$85,000 ÷ $900 = 94

Problem 11-8

$75 x 94 = $7,050

Problem 11-9

$96,000 ÷ $20,000 = 4.8 L:B ratio = 1:3.8

Problem 11-10

$200,000 ÷ $40,000 = 5 L:B ratio = 1:4

Problem 11-11

1 + 3 = 4	total parts
3 ÷ 4 = 0.75 x 100 = 75%	percent of value for improvements

Problem 11-12

$50 x 90 x 0.80 = $3,600

Problem 11-13

$1,000 - $900 = $100	rent loss
$90,000 ÷ $1,000 = 90	GRM
1 + 4 = 5 parts 4 ÷ 5 = 0.80	percent of value for improvements
$100 x 90 x 0.80 = $7,200	external obsolescence

Problem 11-14

$825 x 90 = $74,250

Section 12 – Answers

Problem 12-1

$96,400 - $22,000 = $74,400	depreciated improvement value
$135,800 - $74,400 = $61,400	dollar amount of depreciation

Problem 12-2

$218,000 - $40,000 = $178,000	depreciated improvement value
$192,800 - $178,000 = $14,800	dollar amount of depreciation
$14,800 ÷ $192,800 = 0.08 x 100 = 8%	percent of depreciation

Problem 12-3

$347,300 x 0.08 = $27,784	dollar amount of depreciation
$347,300 - $27,784 = $319,516	depreciated improvement value