RESIDENTIAL CONSTRUCTION - HOUSE PLANNING
STUDENT INFORMATION

Area of Study: Construction

Objectives: The student will design and construct a single level interior floor plan using a computer.

Related Occupations:

Architects

design buildings and other related structures. The architect must plan and coordinate the project by incorporating good design, engineering, managing skills, supervision, and communicating with clients and builders. Architects have to earn a license to be able to be called architects and begin practice.
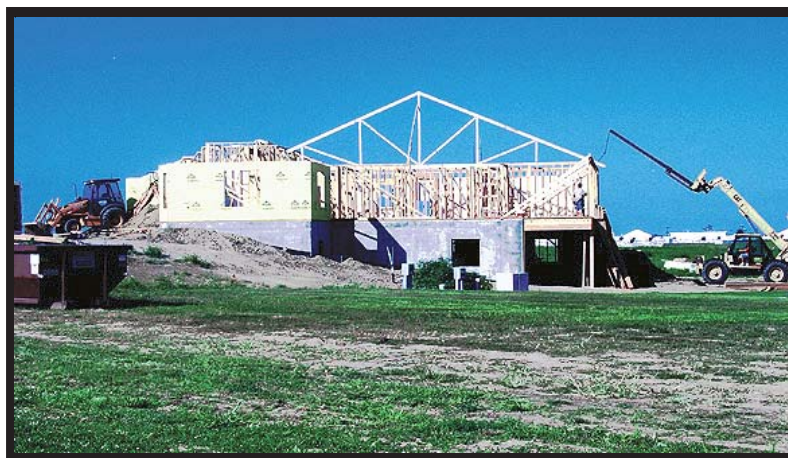
A truss is added to a house in the framing phase of house construction.
Mike Breen Photo

Drafters

draw plans or sketches of structures and machinery. They prepare plans to build everything from houses, toys, spacecraft, and cars. Most drafters work at computers, however they may sit at drafting tables when doing manual drawings. Their drawings provide visual guidelines show the technical details of the products and structures, and specify materials, dimensions, and procedures.

Interior Designers

prepare drawings and specifications for interior construction. This job could involve the planning of furnishings, lighting, floor coverings, window treatments and finishes used in the building while keeping the clients tastes and budget in mind. Most interior designers use computers to plan the layout. Interior designers must design space to conform to Federal, State, and local laws, including building codes.

Key Words and Definitions:

1. **Architect's Scale**: A specialized "ruler" which can be used to measure from scale drawings which have been reduced or enlarged in size.

2. **Construction**: The act of building a structure.

3. **Construction Technology**: All the technology used in designing and building structures.

4. **Dimension**: The size of something in a particular direction which describes thickness, width, or length of an object.

RESIDENTIAL CONSTRUCTION - HOUSE PLANNING

Occupational Choices
Focus: Interior Designer

Classes to take in School:

- Art
- Algebra
- English
- CAD
- FACS
- General Shop
- Mechanical Drawing

After High School:

At a 2 year school or college and earn a associates degree or certificate and become a interior designer's assistant. Enter a 4 year college or University and earn a bachelors degree to become a full fledged interior designer. Following formal training, graduates usually enter a 1-year to 3-year apprenticeship to gain experience before taking a national licensing exam. Twenty four states currently license interior designers.

Earnings:

In May 2006, median earnings of interior designers was $42,260. The lowest 10 percent earned less than $24,270, and the highest 10 percent earned more than $78,760. Salaries very widely with experience and the type of employer. Interior Designers with specialized firms and in architectural design tend to earn higher and more stable salaries.

The Work:

Interior designers are concerned with space, traffic flow, colors, texture, furniture, and lighting. They are involved in the interior spaces of almost all buildings. Interior designers may specialize in either residential or commercial buildings. Interior designers must be able to read blueprints, understand building and fire codes. Designers will meet with clients frequently and travel. Interior designers use computers and may work with other designers internationally. Interior designers work under stress to meet deadlines and to please clients. Self-employed designers have the added pressure to find new clients in order to maintain a steady income.

Employment Opportunities

- Architectural Firms
- Building Material Supply Dealers
- Furniture Stores
- Self Employment
- Residential building construction companies

Personal Characteristics

- Read blueprints & learn building codes.
- Good oral Communications skills
- Good writing Communications skills
- Good reading skills to keep up with trends
- Creative
- Problem solving skills
- Excellent Math Skills
- Computer skills especially in CAD

5. **Residential Construction**: Making of structures for people to live in (i.e. houses, apartments).

6. **Scale drawing**: A plan that has been reduced or enlarged in size.

7. **Specification**: Description of work to be done and materials to be used in making something.

8. **Structure**: Something built or erected that is held or put together in a particular way.

9. **Zone**: A section of a city or town where only certain types of buildings or uses of the land are permitted by law. (i.e. agricultural, commercial, residential)

Materials Needed:

■Floor Plan worksheet   ■Computer   ■Architect's Scale   ■Optional Video/DVD

Construction Technology

Construction Technology is all the technology used in designing and building structures. A structure is something that is built. There are natural structures (i.e. wasp nest, beehive) and there are man-made structures (i.e. dam, road). The design of the structure depends on it's purpose.

Construction System

The technology used to build the structure will also vary with the type of structure being built. For example, a road is going to require a different set of building tools than a house. No matter what type of structure is being built, building the structure is a system. A system is an organized procedure for doing something which will include four parts. These parts are the input (activities and ideas that go into a system), **processes** (actions to make the structure), output (completion of the structure), and feedback (comments on the outputs).

Tools such as heavy machinery are used frequently in construction and are part of the building process.
Mike Breen Photo

Types of Construction

Construction is the process of building a structure. All construction can be divided up into four main types: Civil (i.e. roads or bridges), **Commercial** (i.e. mall), Industrial (i.e. factory), and Residential (i.e. home). As the title suggest, the focus will be on planning a house or residential construction.

Residential Construction

Residential construction means to build a typical single-family home or townhouse. Building a new house is what many people dream of doing. The first step in building a home is to ask yourself questions about what you would want in a home. How much can you spend on a house? How many bedrooms? Are stairs OK.? What size of yard would you be able to take care of?

Once questions like this have been answered, then it is time to look at house plans. Sometimes people will buy the land to build on first, and then pick a plan to fit on it. Make sure the land is not in a flood zone, or that it **zoned** for other types of development before you purchase it. Once a type of house is decided, the architect or draftsman would draw up the plans. It is then up to you as the future homeowner to go to the community planning offices and purchase a building permit and submit the plans so that construction can begin.

Residential construction is a big part of the economy in the United States. Construction data from 2002 indicate that residential construction represents approximately 49% of the value of building construction in America, or over $336 billion.[1] This money is spent employing all kinds of construction workers.

In residential construction the structures are large. The architect can't draw the plans for houses life size, but will reduce the ideas of a large structure down to a size that will fit on paper. This reducing of plans is called reducing to scale.
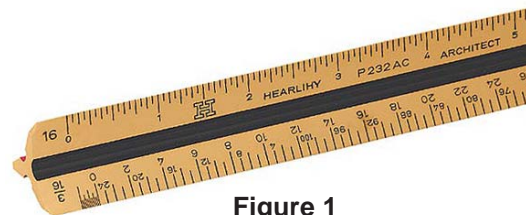

Figure 1
An Architect's Scale.

Scale

To put it simply, every dimension of the structure is divided by the same number to create plans that are in exact in proportion only smaller than the real thing. These plans show you exactly how the structure will lay out. This is done so the builder doesn't have to carry around a huge roll of paper the size of a house!

Architect's Scale

A scale is also a tool used to measure or lay out dimensions (sizes) on a drawing or a plan. The architect's **scale** is a tool that is used to speed up the process of reducing the floor plan. The architect's scale in **figure 1** is based on the foot (12"). There are several different units of measure that could be used to reduce or enlarge an object on this tool. A common reduction when drawing a house plan is the 1/4" scale. The 1/4" scale means that 1/4 inch on the scale represents one foot on the drawing.
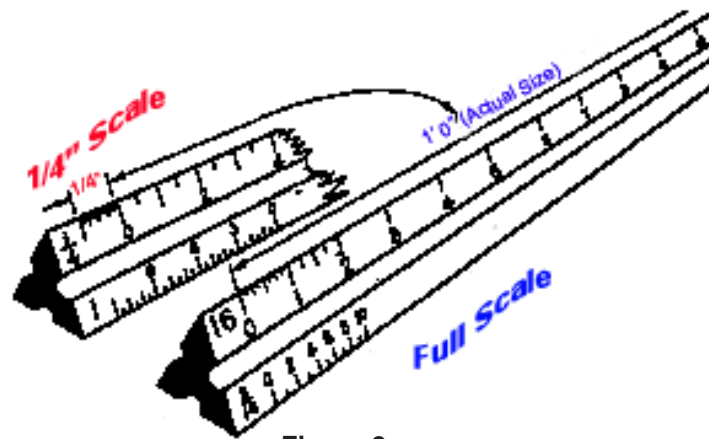

Figure 2
Two Architect"s Scales comparing the 1/4" scale & 1 foot.

Look at the illustration on the architect's scale reading in **figure 2**. The illustration is explaining that one-quarter inch equals one foot. Another way to think of this concept is **1/4" on paper will equal a foot in real life.** This can also be written as 1/4" = 1' where this symbol (") means inches, and this symbol (') means feet.

[1]Guettermann, S., Clum, J. L

In this activity, you may use an architect's scale to help you draw out your floor plan. A sketch on 1/4" graph paper will be required before you use the computer. You may count squares on the graph paper or use the architect's scale. Lets say we want a bathroom **5 feet wide** to fit the length of a bathtub. This can be done by counting **5 squares** on the graph paper or by using the architect's scale putting the 0 mark on the first square and marking at the 5 mark as shown in **figure 3.**
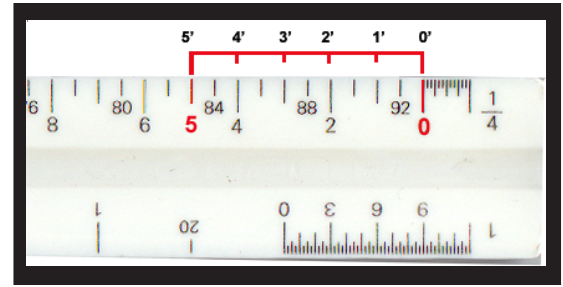

Figure 3
Five feet on the 1/4" scale.

If you wanted even more precise measurements, the architect can lay out inches and add them to the feet markings. Two feet-four inches (2' 4") is shown out in **figure 4**.

A house or dwelling is designed to meet the desires of the owner. Architects will custom design each house for the people who will use it. When planning the rooms for the home, the designer must make decisions concerning the furniture and fixtures to be used in each room. Furniture size and style will greatly influence each room design. The room dimensions will be determined by the purpose of the room and the size and amount of furniture planned. For instance, a dining room must be big enough that the chairs can be pulled out around the dining room table to sit down and allow for some traffic to flow around the table.
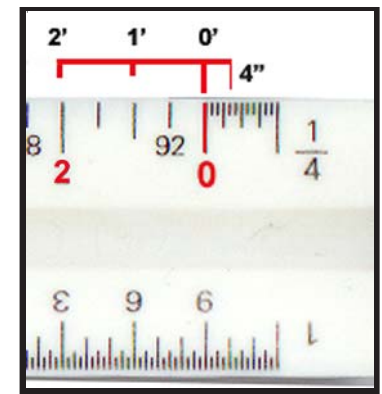

Figure 4
2 feet4 inches on the 1/4" scale.

When designing a home, the draftsman or architect must also be concerned with room placement. Quiet rooms such as bedrooms should be grouped together away from noisier rooms like the kitchen. Architects must also consider traffic flow. Hallways are in the interior of the house and mainly used to get to all the bedrooms. The dining room and kitchen should be grouped together so that serving food to a table will not be difficult. It is helpful when laying out the plumbing to have bathrooms back to back or in close proximity to one another to save on plumbing costs.

There are many other things an architect must consider and one of these is the style of the house. Houses must fit in with other houses in the neighborhood and community. There are two-story, split level, and ranch style houses. There are many variations of these contemporary designs that are suited for a particular area of the country. For instance, a southwestern style house would work better in the western United States than a cape cod style house.

Impacts on Society & the Environment:

Homes have benefited people in many ways. Houses provide shelter from the elements. By having humans out of the elements and adding the modern conveniences and technology (indoor plumbing, electricity) in today's modern home, has contributed to our increased life span. New technologies in homes have made more comfortable homes that provide savings in utility bills and maintenance costs. The creation of homes also provides employment for many different people. Today, construction workers are the largest group of skilled workers in the United States.[2]

[2]Harms, H. R., & Swernosky, N. R.

Construction of homes can also have negative impacts. The sizes of the homes being built today has **doubled** in size since the 1940's and this has put a greater demand on our resources as modern homes are bigger so they require more material to build. Demolition and/or remodeling to make way for these new or updated homes account for large amounts of waste which fill up landfills. If the houses are built in new subdivisions, encroachment into wildlife areas or the loss of open space in many communities becomes a concern. Plans to make sure that there is recreational as well as wildlife areas in a community must be weighed against development of the areas. Such concerns are often why cities develop plans for building within the city. The city planners will "zone" areas of construction to hopefully meet the needs of the population.

Procedure Day 1:

Your job is to design a **ranch** style house. This ranch style house has all of the rooms on one floor.

Study the floor plan illustrations in **figure 5, 6, 7** and in **appendix A** on page 15.

Notice the room placements for each of the one story homes. Acquire the *floor plan worksheet* and put your name and your partner's name on the worksheet.


In most ranch style houses, the rooms are all on one floor.
Mike Breen Photo

Draw the house using the architect's scale and the floor plan worksheet as shown in **figure 6 or in Apendix A**. Furniture **should not be added** to the floor plan worksheet in this drawing. Refer to the specifications to make sure that you have completed each task.

The house plan will be taken home tonight and drawn so that you may draw the plan on the computer tomorrow.
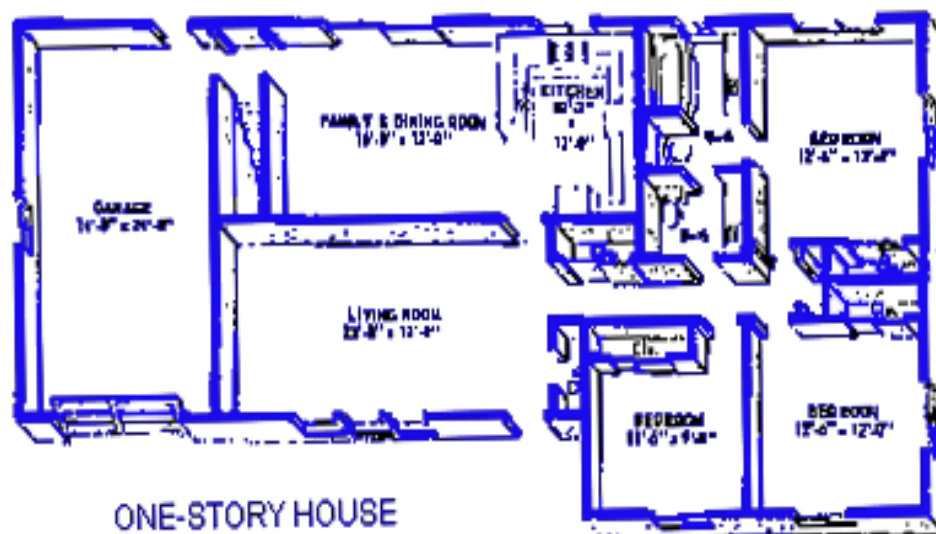
ONE-STORY HOUSE

Figure 5
A ranch style house plan similar to the house in the photo above.

Specifications:

- The house size will be 30'-0" x 45'0" without a garage. A garage may be added to the house plan when doing the final plan on the computer. If you add a garage, make sure to include a door to access the garage from the house.

- **The house will include these rooms:**
  - 2 -Bathrooms
  - 1- Kitchen
  - 1- Eating Area (Formal Dining room and or Breakfast nook or bar in the kitchen)
  - 3- Bedrooms
  - 1- Living Room
  - 1- Utility Room (place for the hot water heater and furnace)
  - 1- Laundry Area (in a utility room/or separate room/or closet w washer & dryer)

- **Optional rooms:**

  - Family Room
  - Den or Office
  - Exercise Room
  - Kids Play Room
  - Storage
  - 2 car garage 26'-0" wide x 26' to 30' long

- Each room must be labeled and the room size given as in **figure 6 & 7**.

Figure 6
A 1/4" = 1'-0" sketch of a 30' x 45' house.

- Two to six foot "jogs" of the outer walls are permitted, but the roof design must be considered when jogging the outside walls of the house.

- Check your work by using the live view mode to take a virtual walk-through of your home design.

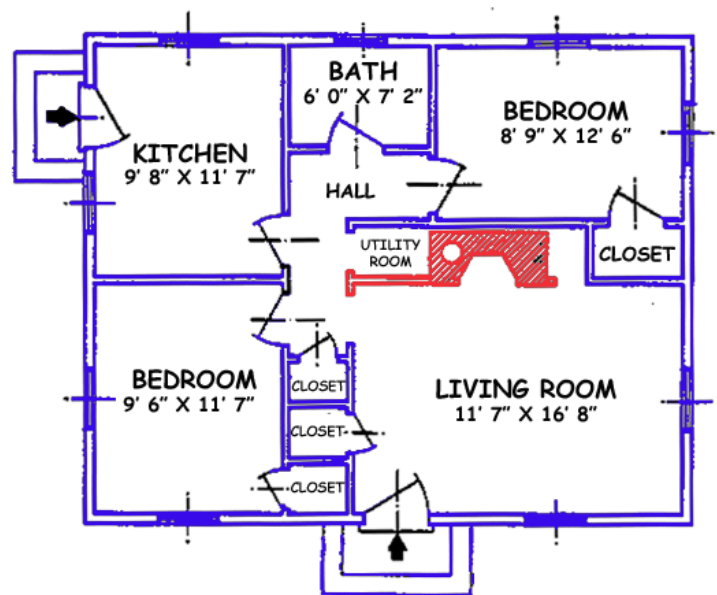- Print off your floor plan to fit the page and hand a copy to your instructor.

Figure 7
Each room is labeled and the room size given

Procedure Day 2:

Show your teacher the completed house plan before you use the computer.

Draw the house plan on the computer and print out the floor plan to fit on a single sheet of paper. Use each section of the directions for drawing your house as needed.
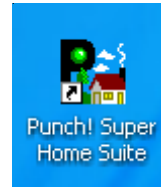
Figure 8

Your job is to draw your sketch of your **ranch style house** on the computer. This set of directions will give you the bare minimums on how to operate the program. There are some basic steps to getting started that will be highlighted here.

Set up

1. The first step will be to open the program. Look for the shortcut labeled as shown in **figure 8** and **double click** on the **icon** to open the program.

2. Next, use the mouse and **open** the **design menu** as shown in **figure 9**. Click on **Lot size** and **enter 150 feet** for the width and **150 feet** for the depth.

3. The third step is to **set the scale** to **1/4" =1'-0"** by **opening** the design menu. Click on Plan scale and set the scale.

4. The next step is make the grid visible. Again **open** the **design menu** and click on **grid visible.**

Figure 9

5. The fifth step is to set the type of grid that you wish. Make the lines look like your graph paper by selecting the **design menu** again. Click on **grid properties**. Click on the **Grid Style** tab. Click on the **Grid Lines** button and click **OK** as shown in **figure 10.**
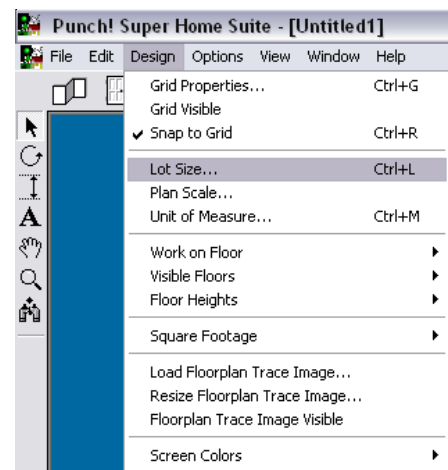
The Drawing

You are now ready to start drawing.

1. Click the wall tool which is circled in red in **figure 11.** On the right side of the screen, a menu will show up.

Figure 10

2. Click on the toggle menu "walls" on the right hand-side of the screen. A 4" wall should be selected.

Figure 11
Wall tool circled in red

3. A list of pre-drawn shapes should have appeared on the right side in the wall menu. Scroll down through the list of rectangle shapes until the 45' x 30' rectangles are
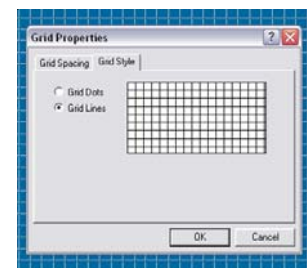
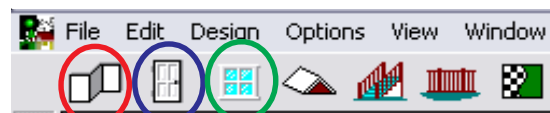visible. Select one that closely matches your plan or at least has the outside walls and drag it into the center of the grid. The rectangles are shown in **figure 12.** After dragging, the outside of the house has been drawn as shown in **figure 13.**

4.   **Click** on the outer walls and drag them until they line up with the cross-hairs on grid. This will make drawing interior walls easier.
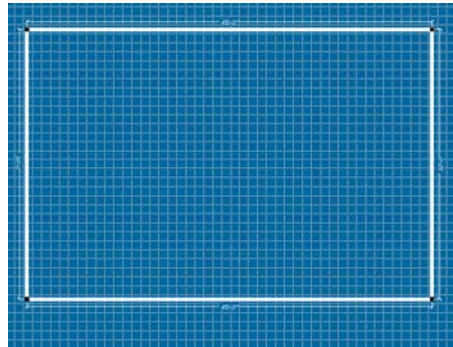
Jogging exterior walls

Before drawing interior walls, jog in any exterior walls if they need to be. If you do not need to jog in any walls continue on to the next section: *Drawing walls.*

1.   To change a wall while drawing select the pointer tool in the left menu and click on the line you wish to change. The pointer tool is shown in **figure 14.**

2.   Once one outer wall is selected push the delete key on the keyboard. Redraw the walls to fit your plan as described in the next section.
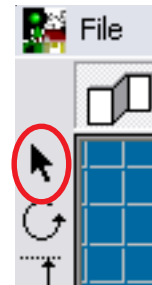
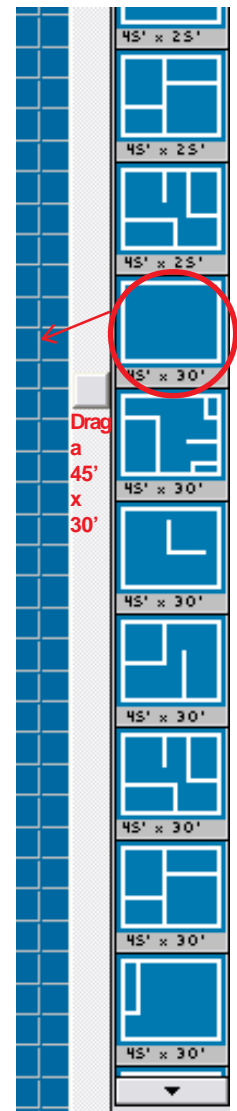## Determining Distance when Drawing

To draw interior walls, there are a couple of ways measuring. One way is to count squares to locate distances from walls and/or a virtual ruler is available as shown in **Figure 15**.

1.   To use the virtual ruler open the **options menu** and drag down to **virtual ruler** as shown in **figure 16.** Drag the ruler in to place and re-size it by simply dragging it.
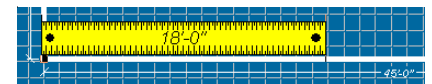
Drawing walls

1.   Make sure the wall tool is still selected as was described in **figure11.** Move inside the outside walls and **click** and **hold** the **left mouse button. Drag the mouse.** A wall should appear when you let go of the left mouse button. The size of the wall being drawn will be displayed as you draw it.

2.   Continue drawing all your inside walls in this manner if you need to change where a wall is located click and drag the wall into place. It may also be nessaccary to stretch and change a wall length by dragging on it.   An interior room is shown in **figure 17.**
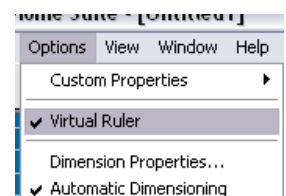

Figure 13

Figure 14

Figure 12

Figure 15
Virtual Ruler

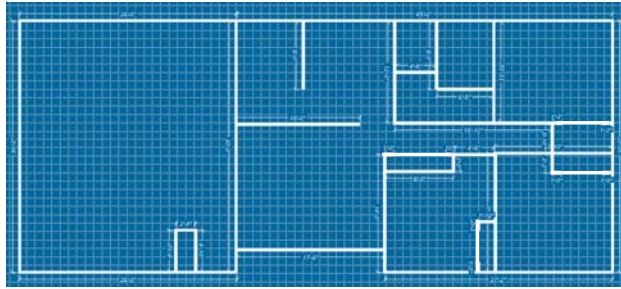**Figure 16**

Finish drawing your interior walls as shown in **figure 18**.

Figure 17

Adding Doors

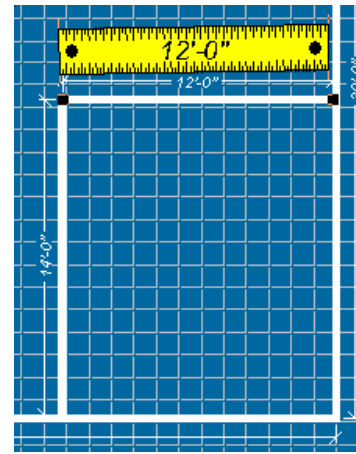1. To add a door select the door tool by clicking on it. The door tool is circled in blue in **figure 19**. A door menu will appear on the <u>**upper right side**</u> of the screen. **Click** on the toggle arrow by the word *doors* as shown in **figure 20**. Select and put in your exterior doors. A normal exterior door is 3'-0".
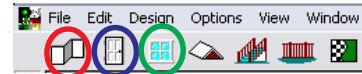

Figure 18
All Walls Drawn

Figure 19
Door tool circled in blue

2. Drag the selected door to where you want it and click to drop it into place. You will need to click again to determine the direction and *swing of the door* (which way the door opens left or right). This is shown in **figure 21.**

Note: On homes all doors open into the room.

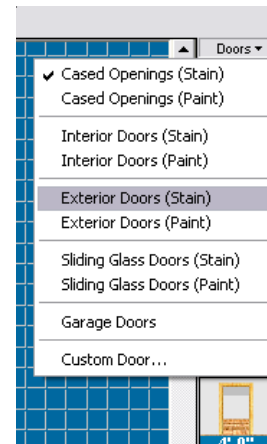3. Finish adding interior and exterior doors and openings to rooms as shown in **figure 22.**
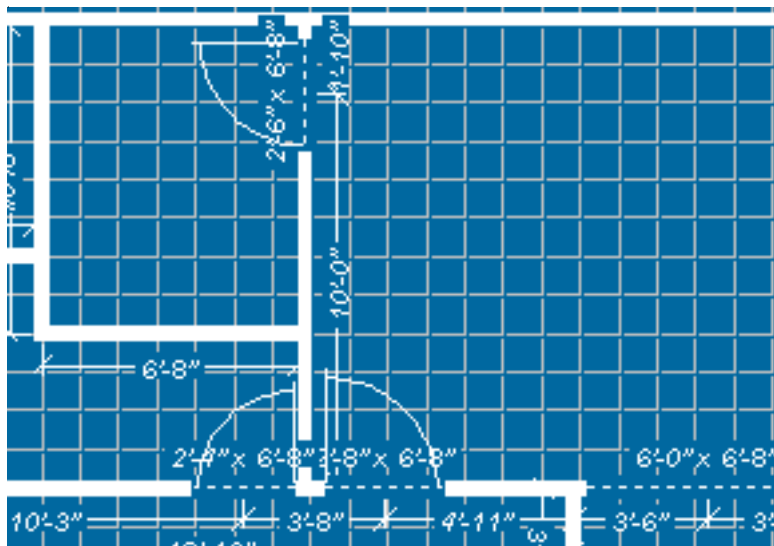

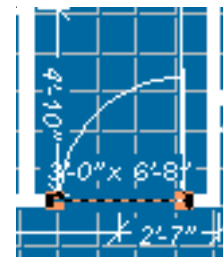**Figure 20**

Figure 22
interior doors

Figure 21
Exterior door with right hand swing

Adding Windows

1. To add a window select the window tool which is circled in green in **figure 23**. A window menu will appear on the **upper right side** of the screen. **Click** on the toggle arrow by the word *window* as shown in **figure 24**.

Figure 23
Window tool circled in green

2. Drag the selected window to where you want it and click to drop it into place. Consider the window height as you place it into room (tall windows don't work too well in bedrooms etc.) Note: Casement windows have a crank and hinge out. Double Hung windows slide up and down.
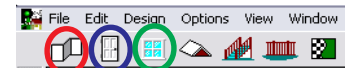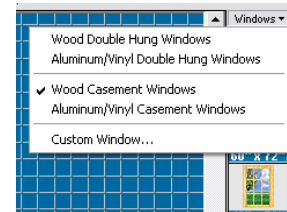

Figure 24
The window menu

Labeling Rooms

1. **Click** on the text tool on the left side of the screen. It is circled in **figure 25.**

2. **Click** in the center of a room and use a keyboard to enter in the information. Label each room and put the dimensions of the room as shown in **figure 26.**

3. In the upper right-hand corner add a label with your name and period on it.

Figure 25
The text tool

Adding the roof

1. **Click** on the roof menu on the top-left side of the screen. It is shown next the window menu in **figure 23.**

2. **Click** on the toggle arrow next to the word roof to open up the roof menu as shown in **figure 27.**
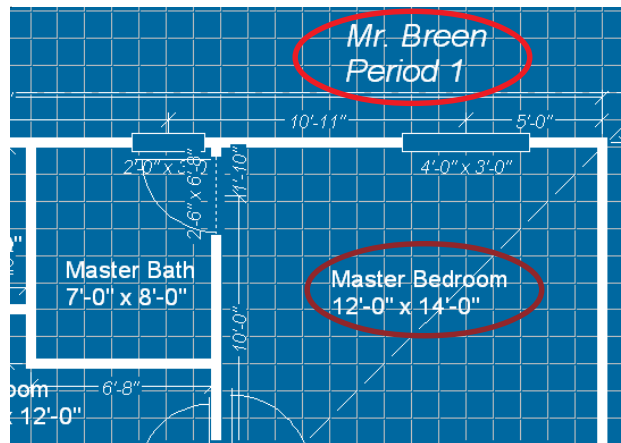

Figure 26
Labeled rooms with dimensions and designers name

Decide on your ceiling and roof pitch. In determining roof pitch, the higher the number the steeper the roof will be. **Figure 27** shows a standard 4:12 pitch which is a common roof pitch.

3. **Click** on a gable (2 sided roof design) or a hip (4 sided roof design) and **drag** it into place over your house. **Each corner of the roof will need to be dragged from a 1'-0" to 2'-0" outside of the walls of the house.** The roof is bigger than the exterior walls of the house and the part that sticks out past the walls of the house is called the eave or overhang of the roof.

Figure 28
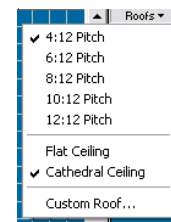*Gable (left) Hip (right) roof styles*

Figure 27
roof menu

Adding furniture

At least one piece of furniture should be placed in each room. If you are running out of time, leave the furniture out of the kitchen as it is the hardest to do.

Figure 29

You may wish to use the zoom tool before putting in fixtures. This tool is found on the left side tool menu and looks like a magnifying glass as shown in **figure 36**. To use the zoom tool, select the tool and click and hold the left mouse button over the area you wish to zoom in. **Move the mouse forward or backward to zoom.**

1.	To add furniture select the furniture tool by clicking on it. The furniture tool is shown in **figure 29**. A furniture menu will appear on the **upper right side** of the screen. **Click** on the toggle arrow by the word *objects* as shown in **figure 30**.

2.	Select and put in your bathroom fixtures. Drag the selected object to where you want it and click to drop it into place. The object may not be facing the correct direction as in **figure 31 and** this can easily be corrected. Select the rotate tool as shown in **figure 32** and click directly on the object that has been placed. Move the mouse with the left button held down until the object is facing the correct direction. Right clicking on the object will also bring up a rotate menu.

Figure 30

3.	Use the pointer tool to drag the object into place.
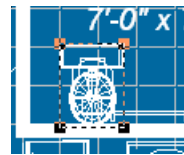
4.	Finish adding interior furniture.

Figure 32

Printing your work

Figure 31

A printed copy of your labeled floor-plan will need to be handed in to your teacher to receive credit. At least one copy would need to be handed in at this time. Make sure you have added your name to the floor-plan before you hand it in.

1.	Open the file menu and select **"print to fit page"** as shown in **figure 33**.

2.	Select the proper printer and select 2 copies to print.

3.	Hand in one of the copies and take the other home.

You have completed this activity by handing in the paper. There are extension that you may complete if you feel that you have time. It will allow you to view your work in a virtual world.

To Save

Different instructors may want the student to save in different places. You may save to a network drive, the hard drive, or a floppy disk. Wherever you save, you will need to find the correct "path" to where you are saving the information.

1.   The first step is to open the **File** menu and choose **Save As.** This will bring up the dialog box in **figure 34**. Using the toggle button select the place that you have been directed to save your work (i.e.: floppy drive, hard drive, or network drive, under your name on the network drive).

2.   Enter in the name that you are going to use to recall the file.

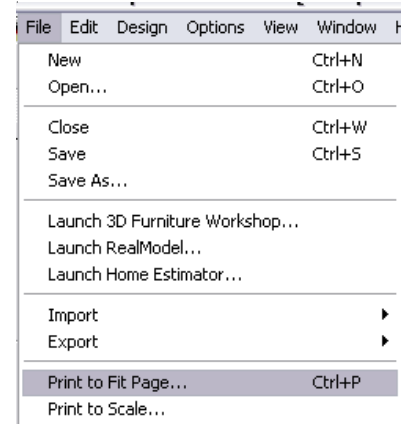3.   Once you have entered in the data click the **Save** button to save the file.

Figure 33

Extension 1 -Adding other objects

The program allows the creator to add many objects to their creation. Trees, shrubs, flowers, decks, and fences may be added to the same way as has previously been done with adding walls, doors windows, roofs, and furniture. The tools are across the top of the screen as before. Holding the cursor of the mouse over the tool will display a description of the object or tool in the lower left-hand corner of the screen.

Figure 34

Resetting the view

There will be times in this next section that the view will need to be reset. It can easily be done by opening the **view menu** and scrolling down to **reset plan view** as shown in **figure 35**.

The view may also be manipulated by using the pan tool to move the view around the screen or the zoom tool as shown in f**igure 36**. These tools are found on the left side tool menu. To use the zoom tool, select the tool and click and hold the left mouse button over the area you wish to zoom in . **Move the mouse forward or backward to zoom.**
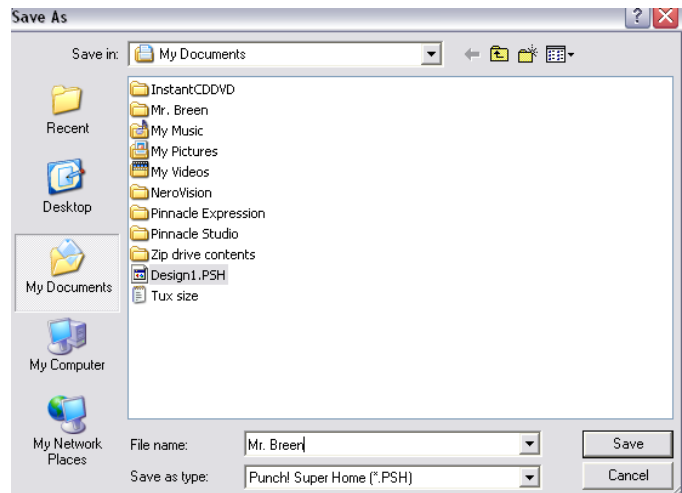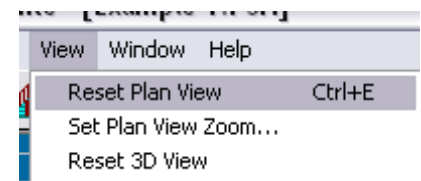

Figure 35

Extension 2 - Live View

Figure 36
Pan tool (left) and zoom tool (right)

In the virtual tour, more detail can be added. Flooring, paint, siding, brick can all be added to the drawn walls besides walking through the house or flying overhead. When in the virtual tour, a little mouse movement will go a long way. Once you have mastered the live view, it is a good way to check your work. In **figure 37** the icon on the far left is the two dimensional view that we are currently in. The others in **figure 37** use a combination of 2D and 3D views. You may click on the left one and it will take you back to the 2D view.

1.	Click on the far **right** icon circled in blue in **figure 37** to open up live view.

Figure 37
Various on screen views

2.	Click on the textured patterns shown in **figure 38** once the view loads.

3.	Select the exterior that you would like to see your house in such as siding shown in **figure 39.**

4.	Scroll through the siding types until you see one you wish and drag it to the part of the house you wish to have that pattern as shown in **figure 40**. If you are disoriented as to where you are at, read the next section : *Taking a virtual tour.*

Figure 38
Texture tool circled in blue

5.	Add carpet and paint to the interior of your house.

Taking a Virtual Tour

You may find that you can not determine where you are in the house while trying to do extension 2 or in walk through in a live view. Check these steps to orient yourself to where you are in the house:

a.	Click the live view to include a 2D and 3D view as shown circled in green in **figure 37.**

b.	Click the walk through icon as shown in circled in green in **figure 38.**

c.	Watch in the 2D view as you move the mouse around in the 3D view as shown in **figure 41.** The arrow in the 2D view is the direction you are headed as you walk through the house.

Figure 39
Texture menu
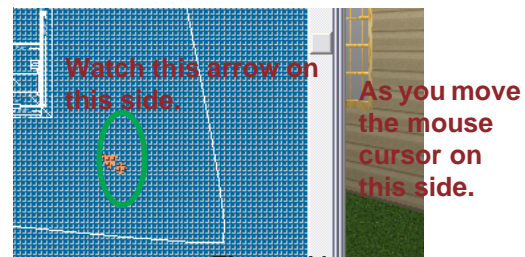

Figure 40
Drag and drop textures

Figure 41
Split screen with 2D and 3D views

RESIDENTIAL CONSTRUCTION - HOUSE PLANNING
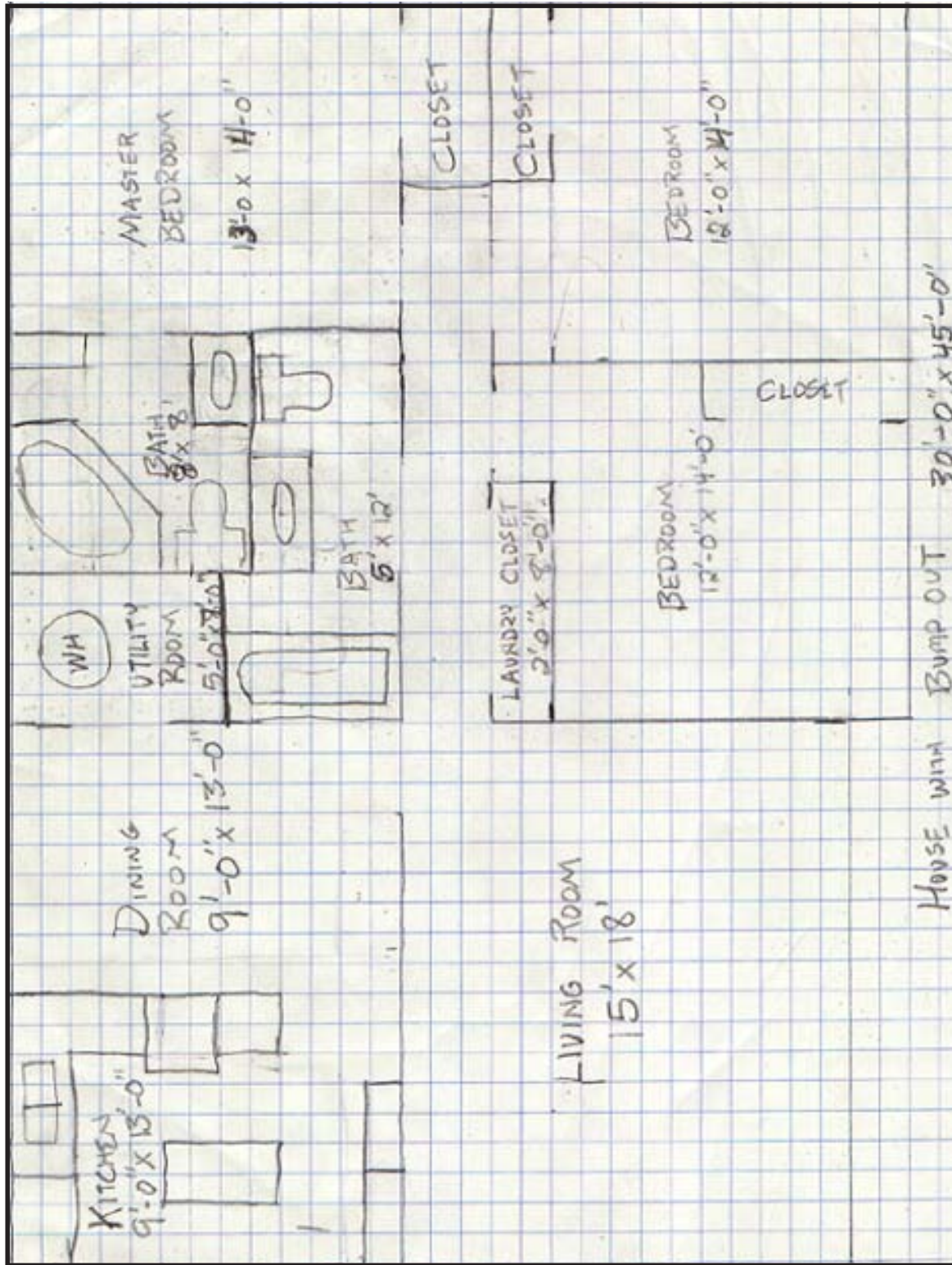## Student Work Sheet

Name:_____ Period: _____ Date: _____

Directions: In the blank on the left, write the correct answer to the statement or question.

1. _____   ____ technology is all the technology used in building structures.

2. _____   Construction systems include input, _____, output, & feedback.

3. _____   Types of construction are: civil, ____, industrial & residential.

4. _____   Carpenters working on a home are involved in __ construction.

5. _____   Make sure the land is not _____ for other types of development.

6. _____   An architect's _____ is a tool used to speed up the process of reducing the floor plan.

7. _____   1/4" = 1'-0" means that 1/4" on _____ equals 1 foot in real life.

8. _____   Five squares on the floor plan worksheet is equal to _____ feet.

9. _____   The sizes of the homes being built today has _____ in size since the 1940's.

10. _____   The type of house that was drawn for this activity was a _____ style house

Apendix A:

An example of a plan that has been created for this assignment using the floor plan worksheet.

Apendix B:

Average size rooms labeled with furniture placement.

Bathroom
6'-0"x9'-6"

Bathroom
5'-0" x 9'-6"

WH CL F W D

Utility Room
6'-0"-10'-0"

STORAGE SHELVES

BOOKS

STEREO

END TABLE
LAMP

CHAIR

PIANO

Living Room
16'-0" x 20'-0"

TABLE

SOFA

EASY CHAIRS

TV

DVD STORAGE

BOOKS

LAMP

TV

BOOK SHELVES

PIANO

TV

Living Room
16'-0" x 20'-0"

COFF TBL

SECTIONAL SOFA

CH

LIVING ROOM

CHAIR

Dining Room
12'-0"x16'-0"

SERVER

BUFFET

TABLE AND CHAIRS

KITCHEN

CORNER CAB

CHINA CABINET

Ref

Kitchen
10'-6"x 16'-0"

Pantry Desk Pantry

Closet

Bedroom
12'-0"x12'-0"

Bed

Dresser Dresser