

Construction Assignment II

On The Square

• Staking out a square corner

Assignment Summary

In this assignment, the learner will

- read and follow simple directions
- measure diagrams
- demonstrate and explain the 3-4-5 rule
- plot out a square corner as the basis for the foundation of a house
- use scale measurements to create a diagram.

Prior Knowledge

- **Essential Skills**
- **LBS Levels**
- Basic linear measurement
- Triangles
- How to use a tape measure
- The concept of “square” as 90°
- How to make a 90° angle (protractor) with understanding of 3-4-5 relationship (Pythagorean theorem)

Teaching Planning Notes

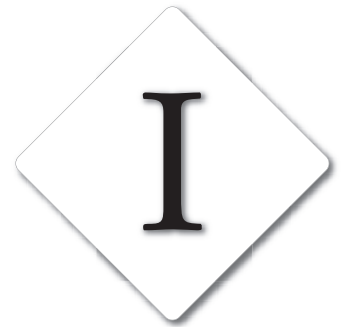
- Provide two pieces of string each tied into a loop, the loops measuring exactly 12" and 12'
- Provide tacks or pins and a flat surface such as cork, corrugated cardboard or styrofoam, into which pins can be pushed
- Provide a Try Square and a Framing Square (a protractor can be used if you cannot find the tools)
- Be prepared to read aloud the instructions for Task # 6

With learner

- Practise use of a measuring tape, marking the starting and finishing points of a specified measurement
- Practise use of a ruler
- Provide string, measuring tape, ruler, stakes (outdoor)
- Review use of graph paper for scale drawings
- Review scale conversions

Achievement Indicators

- Lays out the square corners accurately
- Demonstrates understanding of 3-4-5 rule
- Makes precise measurements
- Checks own accuracy
- Makes scale drawing
- Identifies learning on self-achievement chart



FOCUS ON LEARNING

ESSENTIAL SKILLS

	Complexity Levels				
	1	2	3	4	5
Reading Text	██████████				
Document Use	██████████				
Writing	████				
Numeracy	██████████				
Oral Communication	██████████				
Thinking Skills	██████████				
Working with Others					
Continuous Learning					

LITERACY AND BASIC SKILLS

	LBS Levels				
	1	2	3	4	5
Communication					
Read with Understanding	██████████				
Write Clearly	████				
Speak and Listen Effectively	██████████				
Numeracy					
Number Sense and Computation	██████████				
Measurement	██████████				
Manage Data and Probability	██████████				
Self-Management and Self-Direction					
Concentration and Memory					
Problem Solving					
Self-Assessment					
Thinking Skills					
Time Management and Organization					
Working with Others					

Ontario Curriculum Linkages

Locally Developed Compulsory Credit Course, Mathematics, Grade 9 (MAT1L)

Developing and Consolidating Concepts in Measurement – Overall Expectations

DCMV.02 - estimate and measure length, using the imperial system

Understanding and Using the Imperial System – Specific Expectations

DCM2.01 - investigate, discuss, and describe applications from everyday life and the workplace that would involve the measurement of length in feet and inches

Foundations of Mathematics, Grade 10, Applied (MFM2P)

Measurement and Trigonometry – Overall Expectations

PRV.03P - solve problems involving right triangles, using trigonometry

Solving Problems Involving the Trigonometry of Right Triangles – Specific Expectations

PR3.03P - solve problems involving the measures of sides and angles in right triangles (e.g., in surveying, navigation)

Construction Technology, Grade 10, Open (TCJ20)

Skills and Processes – Overall Expectations

SPV.01C - demonstrate skill in the use of tools, materials, processes, and systems required to build, maintain, and service construction-related projects

Skills and Processes – Specific Expectations

SP1.04C - use correctly tools, equipment, and techniques to measure, cut, lay out, and assemble structural components and systems

On The Square

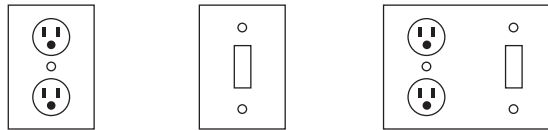
Task # I: Make a Tally Sheet

Susan and Bob are renovating their home. They will change all the switch plates from plastic to brass, and are looking at replacing the lighting fixtures, both ceiling mounted and wall mounted.

Since they live a fair distance from the city and the big supply stores, they will make a complete count of what they are looking for so that they can buy all that they need in one trip.

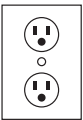
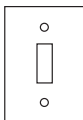
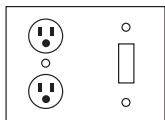
1. Count the switch plates and receptacle covers in your home (or a friend's).
2. Count the light fixtures in your home (or a friend's). Only count the ceiling and wall mounted fixtures that are wired in, not lamps that plug in.
3. Use a tally sheet like the one below to organize and show all the information.
Make a sketch of the different types of switchplates and receptacle covers that you have in the "type" row of the tally sheet.

For example:



(You will need to make your own tally sheet, adding columns to show the different switch plates and receptacle covers that you find.)

Sample Tally Sheet

Switch Plates and Receptacle Covers				Light Fixture	
Type				Ceiling mounted	Wall mounted
How many	12	6	2	4	2

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Task #2: Counting Cabinets

Susan and Bob are also going to update their kitchen cabinetry. They decide to replace all the cupboard and drawer fronts only. First they must measure them all to see how many of each size they must order.

1. Make a rough sketch of the cabinetry in your kitchen (or a friend's). You will label each cupboard door (A,B,C,...) and each drawer front (a,b,c...)
2. Measure the dimensions of the first door in inches. Enter the information on the sketch.
3. Measure the other doors the same way.
4. Are all of the doors the same? Some the same?

5. Repeat steps 2, 3 and 4 for the drawer fronts.
6. Create a simple tally sheet, with one section for doors, and one for drawers. Use subheadings to separate the different sizes of each, if necessary. (See sample tally sheet construction in Task #1 of this assignment)
7. Enter the number of each size door and drawer front that Bob and Sue must order.

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Task #3: Load the Van

You are going to transport some supplies to a job site in the foreman's van. There are pieces of wood and some boxes.

You must measure the boxes to make sure that they will all fit; otherwise, a second vehicle must be used, or extra trips must be made.

1. Measure the available space in a van with the rear seats folded down or removed. Measure the length, width and height in inches. Note if there are any obstructions, such as wheel wells, that will restrict the loading of the boxes.

Sketch the floor of the van, showing the dimensions. Add the height. (The sketch will look like a rectangular solid.) Then draw both the floor and the cross section (height and width) on graph paper.

2. What is the longest piece of 2 x 4 that you can safely put in the van with the back gate closed?
-

3. What is the largest size piece of plywood that can lie inside the van with the gate closed?
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4. Obtain six to eight different sized cartons from grocery stores or LCBO. Measure the dimensions of each in inches. Sketch and label each.

5. a. Assuming that you have one of each box, can you carry them all in one load?
b. If you had three of each to take, how could you best fill the back of the van, so that the fewest trips need to be made? How many trips will you need to make?
Hint: Use the sketches made in step 1. Look at both the floor of the station wagon, and also at the height. How many squares will each box cover in each direction?

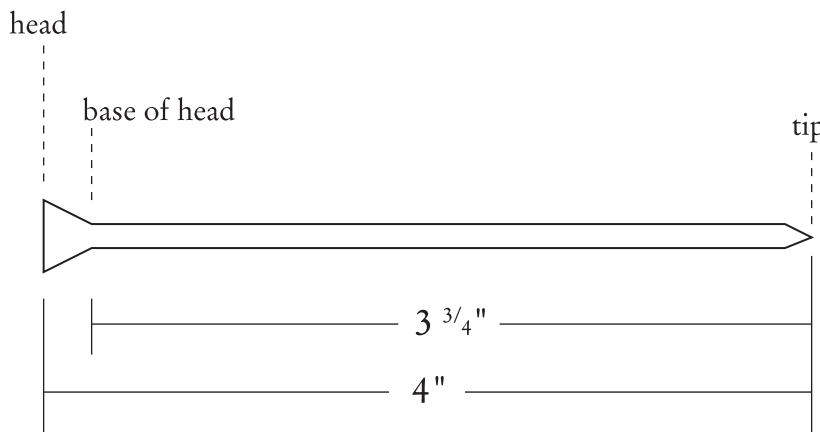
On The Square

Task #4: Measure and Draw

Many carpentry tasks require specific sizes of nails or screws. Use both a metric tape measure and an Imperial (inches/feet) tape measure, or one that shows both.

1. Obtain an assortment of at least ten different length nails, screws and bolts.
2. Measure the length of each one in both inches and centimetres. Measure from the head to the tip. Also measure from the base of the head to the tip.

Example:



3. Draw a line of the exact length to represent each item, marking the head, the base of the head, and the tip.
4. Write the measurement below each line, in both inches and centimetres. (use in. and cm.)

On The Square

Task #5: The 3-4-5 Rule

In this task, you will learn a simple way to make a square corner. This method is called the 3-4-5 Rule.

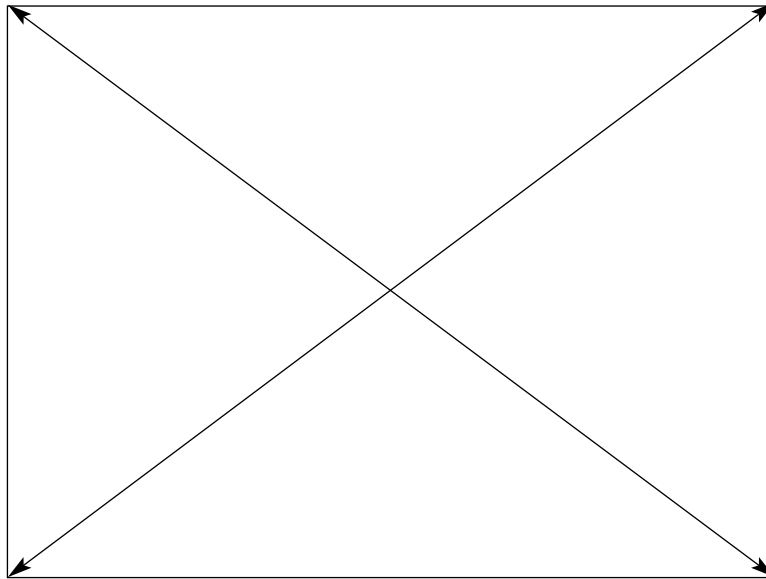
Buildings contain many square corners. The angle of these corners measures 90° . You can see examples in the corners of rooms, windows, doorframes, and kitchen cupboards.

Discovering the 3-4-5 Rule

1. Study the diagram on the next page (the square with the arrows inside).
2. Using a pencil, trace the outline of one of the triangles formed by two sides of the square and one of the arrows.
3. Using a ruler, measure each side of the triangle you marked.
4. Print 3" beside the shortest side of the triangle.
5. Print 4" beside the longer side of the triangle.
6. Print 5" beside the longest side of the triangle.
7. Print 90° in the inside corner between the sides marked 3 and 4. This is your square corner.

Task #5: The 3-4-5 Rule (cont'd.)

This situation is always true. As long as you keep the proportions 3-4-5, your inside angle opposite the longest side will always be square!
This means that 6" - 8" - 10" will also give you a square corner.
This is true even if you measured in feet, or in miles!



On The Square

Task #6: Using Square Tools

In this task, you will

- practise the 3-4-5 Rule in inches
- practise the 3-4-5 Rule in feet
- use a **Try square** and a **Framing square** to verify a 90° angle.

Experiment #1: Try it in inches

1. Work with a partner. Your instructor will read the instructions below aloud.
2. Use a piece of string fastened in a loop. (The perimeter formed by the loop should measure exactly 12".)
3. Lay the string on a flat surface such as cork or Styrofoam.
4. Use tacks or pins to pull the string into a triangle. The tacks or pins will be in the corners.
5. Adjust the tacks until one side is exactly 5" long and another side is exactly 3" long.
6. Measure the remaining side. Write the measurement here: _____".
7. Now take the **Try square** that your teacher has given you. Which of the three inside corners (angles) is square (90°)? The one opposite the side that is _____" long.

Task #6: Using Square Tools (cont'd.)

Experiment #2: Try it in feet

1. Work with three other people. Your instructor will read the directions below aloud.
2. Use a 12' string tied in a loop, a measuring tape, and a framing square.
3. Lay the string on a flat surface, the floor, so that it forms a triangle. Three people hold the string at a corner of the triangle.
4. The fourth person pulls out and locks a measuring tape so that it measures 5'.
5. While the fourth person holds the measuring tape along one side of string, the three people holding the string adjust until one side measures exactly 5' and another side exactly 4'.
6. The fourth person then measures the other side of the string triangle and writes its length here: _____'.
7. The fourth person uses a **Framing square** to test the corner opposite the longest side.
Check here if it is square.

On The Square

Task #7: Staking the Site

Jeff is going to help mark the area for excavation for a basement. The same thing will be done to mark the location of forms for pouring the basement walls. It is important that all measurements be accurate and that corners are square, as the house walls will be built up from there according to the blueprints.

Part I

Working alone or with a partner:

In a large indoor or outdoor area

1. Mark point A (masking tape / stake)
2. Measure 12' 6" in any direction. Mark B. Stretch a string from A to B.
3. From point A, along AB, measure 3'. Mark C.
4. At point A measure 90° . Mark D.

To Mark 90° : On a line beginning at A, mark 3' and mark C.
 Stretch out one measuring tape to 4' and lock in place.
 Stretch out another tape to 5' and lock in place.
 Position the end of the 4' tape at point A, and position the end of
 the 5' tape at point C. Bring the other ends of both tapes together.
 You now have a 3 - 4 - 5 triangle (ACD) with 90° at point A.
 The two ends of the 4' and 5' tapes meet at point D.

This is the standard method of constructing a 90° angle on a construction site. Each time, begin by measuring 3' on the line already marked, then use the 4' and 5' tape to construct the 90° corner.

5. Extend AD to 7'6". Mark E.
6. At point E, measure 90° and mark F.
7. Extend EF to 12'6". Mark G.
8. At point G, measure 90° and mark H.
9. Join GB.

Now measure the diagonals, AG and BE. If the measurements are equal, then all the corners are correctly constructed to 90° .

On The Square

Task #8: Pin a Rectangle

Using corrugated cardboard, pins and thread,

1. Mark point A with a pin.
2. Measure 32 cm in any direction. Mark B with a pin. Stretch a thread from A to B.
3. From A, measure 1.5 cm along AB. Mark C with a pin.
4. At point C, at 90° and using a protractor, measure and mark with thread and pin, 21.8 cm. (CD)
5. Construct a 90° angle at point B and extend BE to 21.8 cm.
6. Join DE.
7. Check the angles at points D and E. Are they both 90° ?
8. Measure the diagonals BD and CE. Are they equal?

