Look out for the dimension, scale and proportion

Rudimentary Technical Free-hand Sketching

What is Free-Hand Sketching

"Sketching" in mechanical/electrical engineering means freehand drawing. "Drawing" usually means using drawing instruments, hardware and/or software to bring precision to the diagrams. **NOTE: Absolutely NOT about pretty picture, but to create diagram which is informative in visual manner.**

Why?

One of the best ways to communicate your ideas is through some form of diagrams or images. This is especially true for scientists and engineers.

The ability to communicate any idea requires its translation into words and pictures that others can understand. Technical sketching is a communication method that an engineer or inventor uses to articulate his or her vision.

As engineering projects proceed, you need to produce few sketches about your design. These sketches may eventually become detailed mechanical drawings, which precisely indicate measurements and other critical details.

Do you know all inventors / good engineers do sketching!?

Imagine you are an inventor and wish to register with the government to make sure you OWN your invention, e.g. patent your invention. One of the many documents which you need to provide is your engineering journal. Part of your engineering journal MUST consist of history of your invention. Starting from your sketch of your first idea to the final product of your invention.

From these drawings, the first prototype can be manufactured. The freehand sketch is where ideas become reality.

The purpose of this document is to give you the conceptual level of understanding how to do proper engineering sketching and drawing without additional software and/or hardware tool.

During Sketching, pay attention to:

KEY CONCEPTS TO KEEP IN MIND:

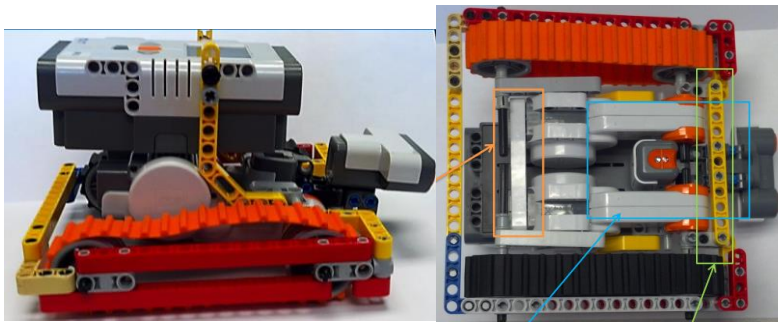
Choose Views which are informative

This is can be Orthographic or Multi-view Drawing

Views include: top, side (left or right), bottom views.

You will need to include only the views that reveal every detail about the object. Do not bother with the views do not provide useful information.

RIGHT **Side V***IEW* *BOTTOM VIEW*



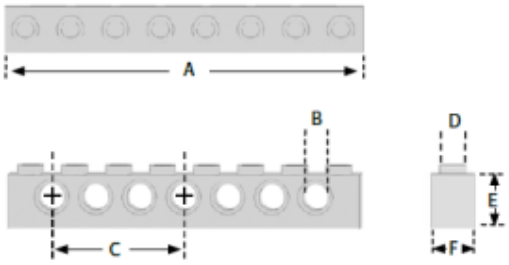
Dimensioning

The purpose of dimensioning is to provide a clear and complete description of an object. A complete set of dimensions will permit only one interpretation needed to construct the part.

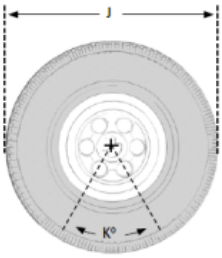
Dimensioning should follow these guidelines.

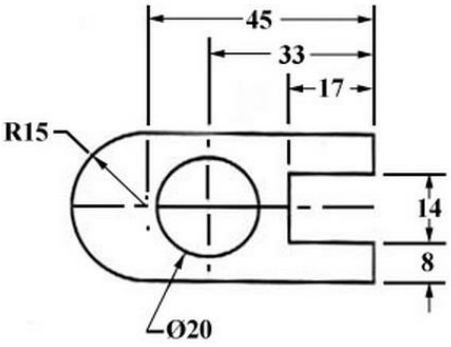
1. Accuracy: correct values must be given.
2. Clarity: dimensions must be placed in appropriate positions.
3. Completeness: Avoid missing information.
4. Simplicity : Do not put in redundant dimensions/
5. Readability: Pay attention to line quality for legibility.
6. Tolerance: May include "tolerances" or accuracy levels have been included

Samples:

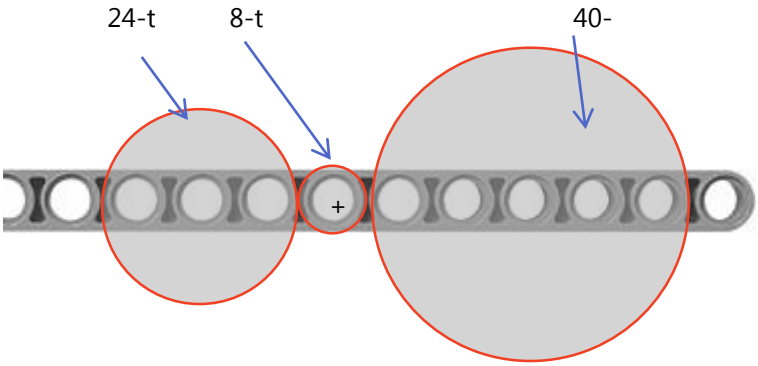


A.	**64MM**	G.	**41MM**
B.	**3MM**	H.	**7.5 degrees**
C.	**24MM**	I.	**14MM**
D.	**5MM**	J.	**51MM**
E.	**8MM**	K.	**60 degrees**
F.	**8MM**	L.	**27MM**





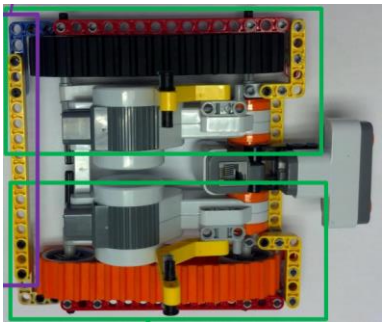
(from me.umn.edu/)



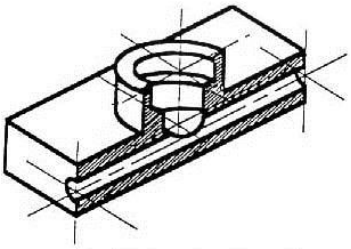
SECTIONING

This is to show the interior details of an object cannot be seen from the outside.

TOP VIEW (WITHOUT CONTROLLER)

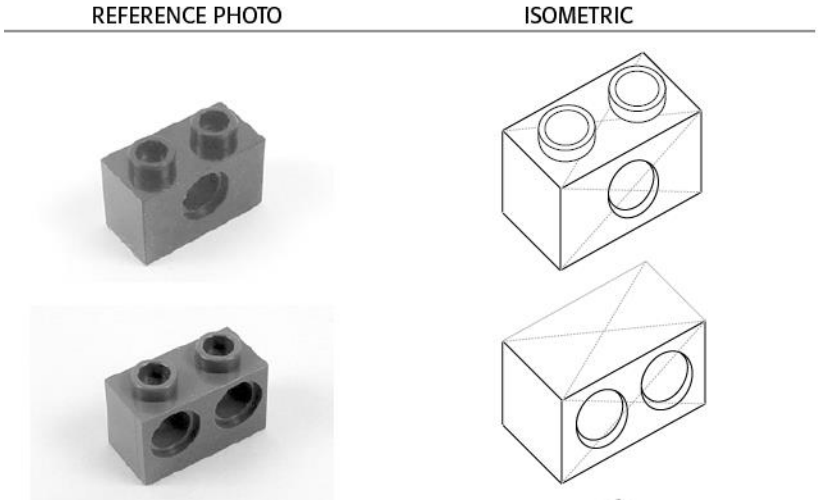


AN OBJECT SHOWS HALF SECTION OF ITS ACTUAL SIZE



ISOMETRIC SKETCHING

An isometric sketch shows 3 sides of an object equally, but may not show an object's true shape. The appearances change depending on which perspective or angle you are viewing the object.



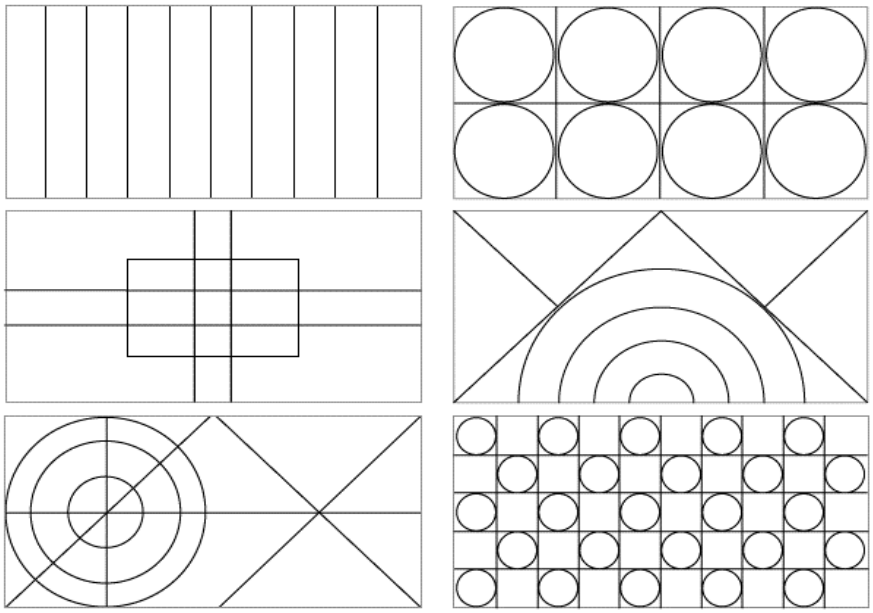
(from cmu.edu – robotics academy)

EXERCISES

1-Draw in the boxes

Use blank sheets of paper to sketch the shapes shown in the boxes below. You will need a sharp pencil. Make sure you put your name and date on each page of your work!

In this exercise, you are drawing "freehand". The exercise is designed to help you develop proper line technique as you learn to keep things in proper proportion. Don't grip the pencil too tightly. Initially pay more attention to keeping your lines light, these lines are known as *developmental lines*. When you begin to sketch things the way you want them then darken your lines. These are called *object lines*. Pay attention to keeping things in proper proportion. Keep your drawings neat.

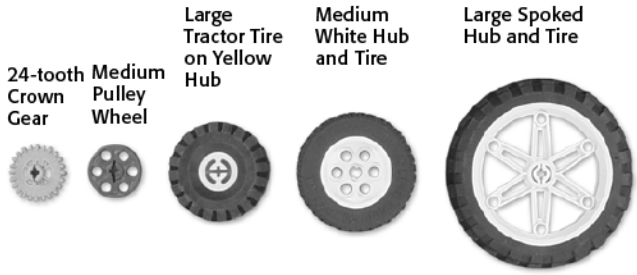


(from cmu.edu – robotics academy)

2-Single View Sketching some LEGO parts

(from cmu.edu – robotics academy)

3- View Sketching some LEGO Wheels & Gears

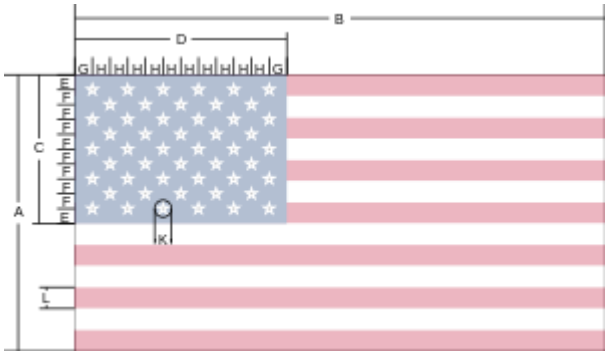


(from cmu.edu – robotics academy)

Reference:

- www.cmu.edu
- http://www.me.umn.edu/

Sample Specification (from www.wikipedia.org)



Flag of the United States specification from www.wikipedia.org

The basic design of the current flag is specified by Title 4 of the United States Code (wikipedia.org). It outlines the proper dimension:

- Hoist (height) of the flag: $A = 1.0$
- Fly (width) of the flag: $B = 1.9$
- Hoist (height) of the canton ("union"): $C = 0.5385$ ($A \times 7/13$, spanning seven stripes)
- Fly (width) of the canton: $D = 0.76$ ($B \times 2/5$, two-fifths of the flag width)
- $E = F = 0.0538$ ($C/10$, One-tenth of the height of the canton)
- $G = H = 0.0633$ ($D/12$, One twelfth of the width of the canton)
- Diameter of star: $K = 0.0616$ ($L \times 4/5$, four-fifths of the stripe width, the calculation only gives 0.0616 if L is first rounded to 0.077)
- Width of stripe: $L = 0.0769$ ($A/13$, One thirteenth of the flag height)