

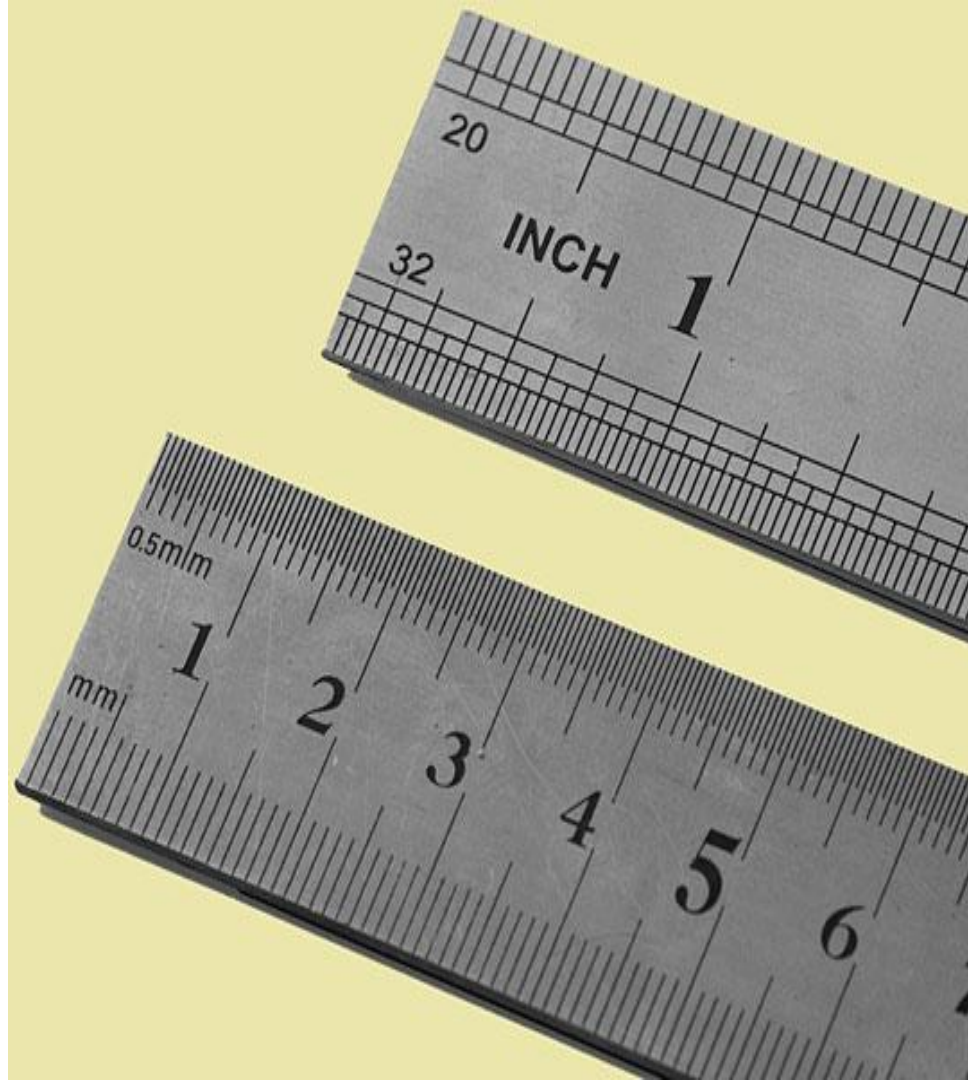
2890 The Hawk Collective

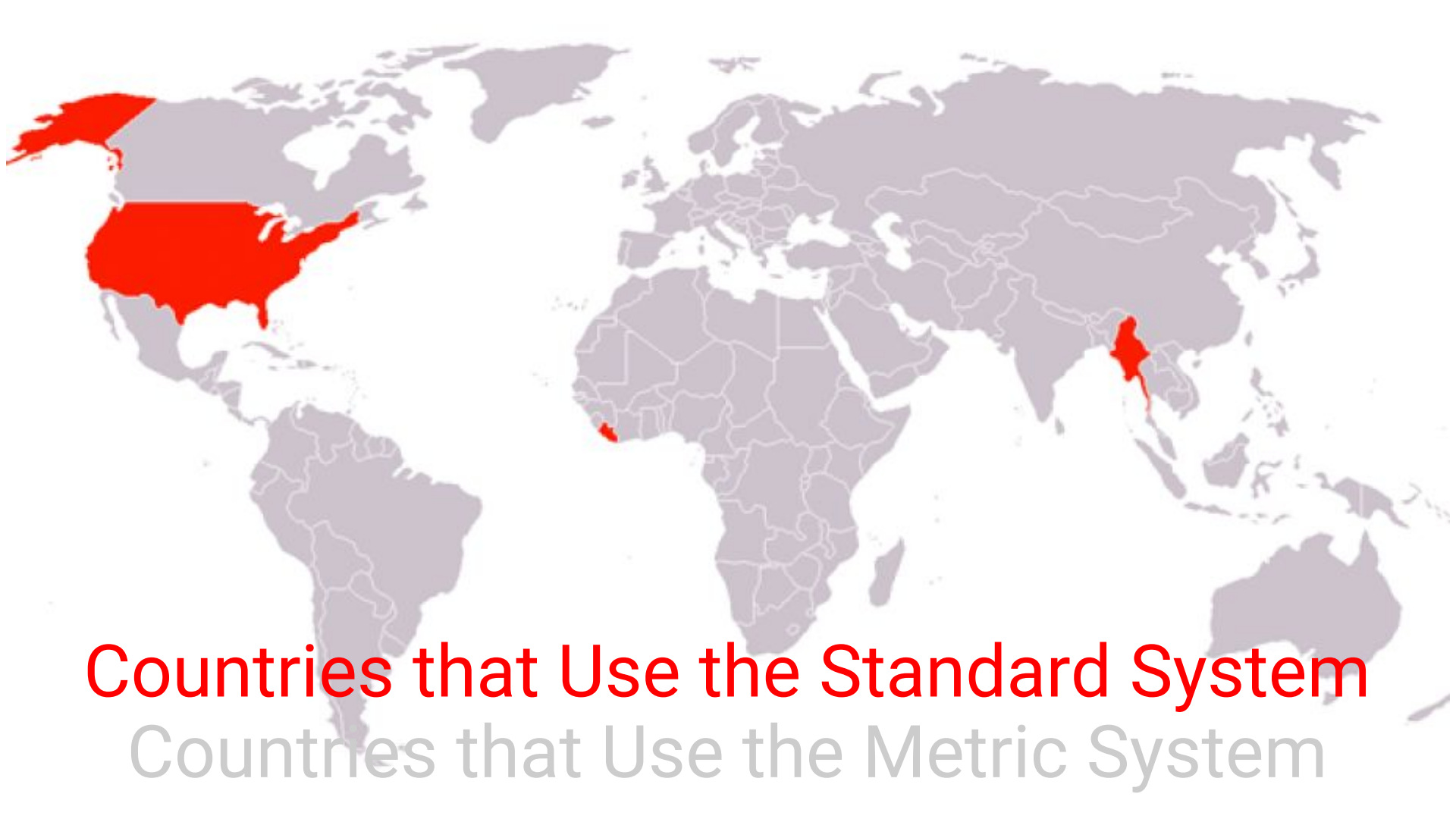
Mechanical Level 1 - Measurement and Sketching

Measurement and Marking

There are 2 units of measure Standard and Metric

The majority of the work we do
is in the standard format

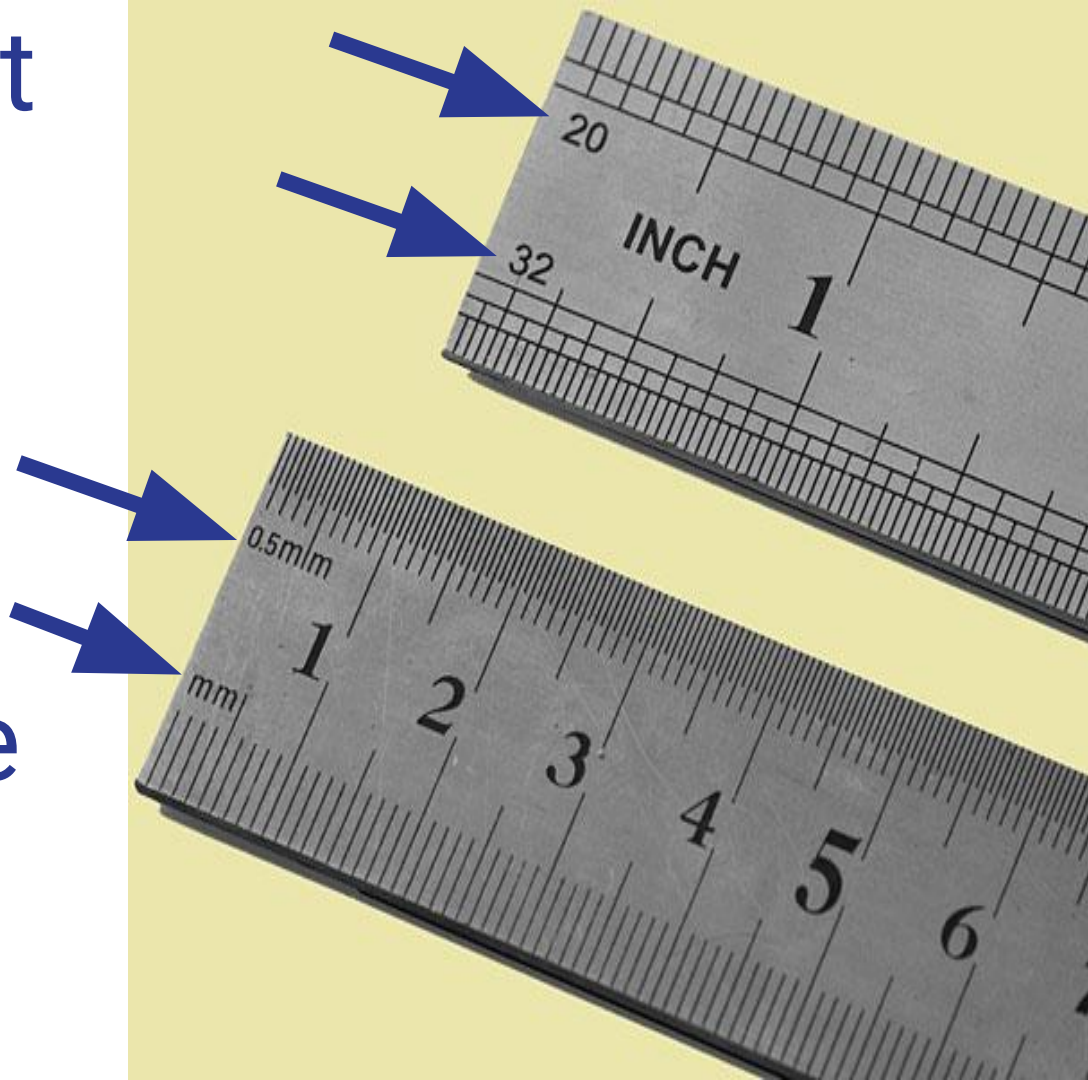




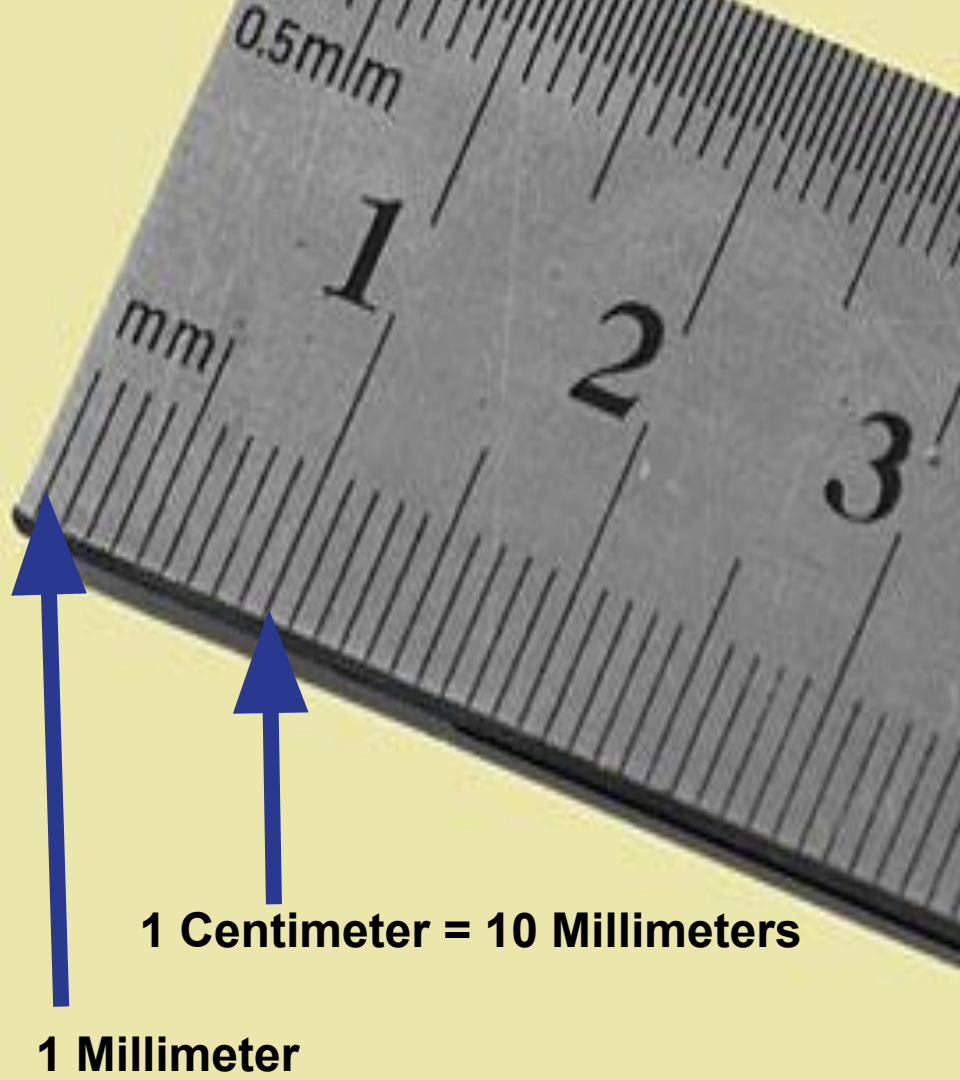
Countries that Use the Standard System

Countries that Use the Metric System

The indicator at
the end of the
ruler tells you
what the
smallest unit
that side of the
ruler can
indicate



Metric units use the decimal system where each larger unit is broken up into 10 smaller units.

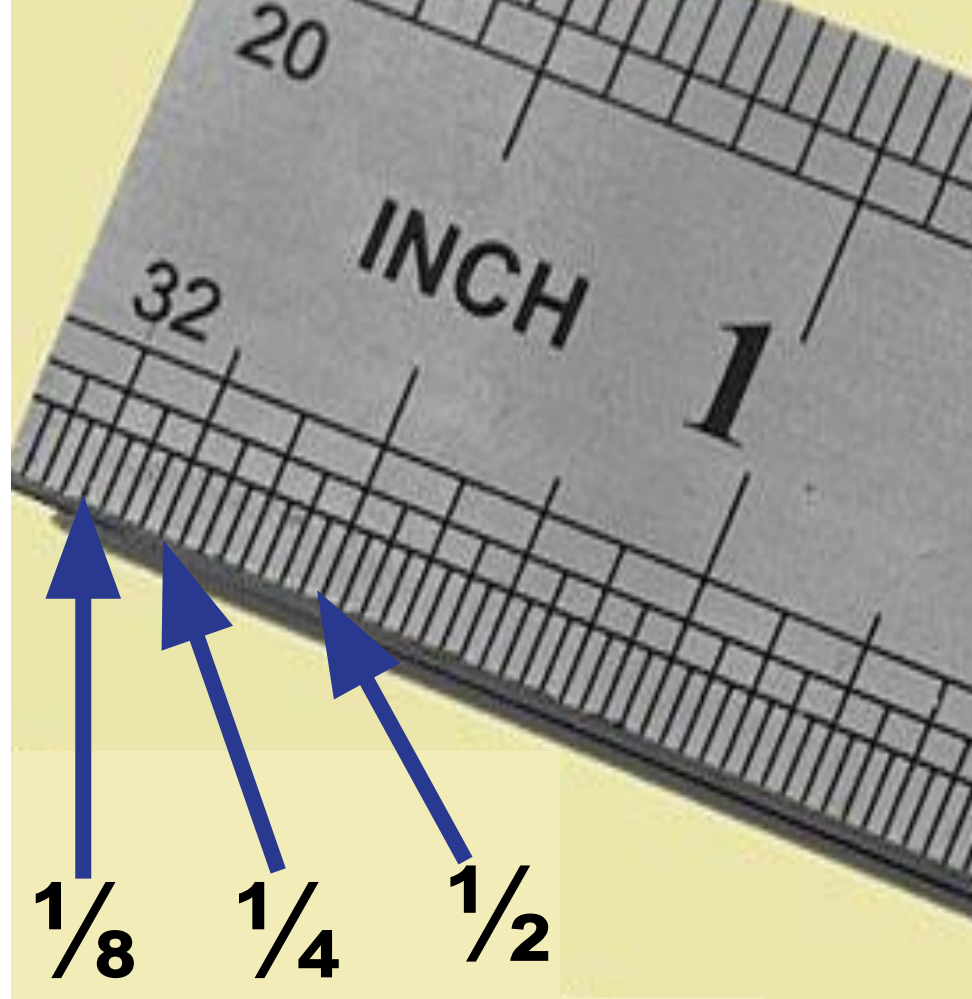


Meters

Commonly used prefixes for Metric units

Prefix	In words	Multiply by	Factor
nano (n)	Billionth	1/1000000000	$1 \cdot 10^{-9}$
micro (μ)	Millionth	1/1000000	$1 \cdot 10^{-6}$
milli (m)	Thousandth	1/1000	$1 \cdot 10^{-3}$
centi (c)	Hundredth	1/100	$1 \cdot 10^{-2}$
deci (d)	Tenth	1/10	$1 \cdot 10^{-1}$
		1	
deca (da)	Ten	10	$1 \cdot 10^1$
hecto (h)	Hundred	100	$1 \cdot 10^2$
kilo (k)	Thousand	1000	$1 \cdot 10^3$
mega (M)	Million	1000000	$1 \cdot 10^6$
giga (G)	billion	1000000000	$1 \cdot 10^9$

Standard
System breaks
up decimal
units into
fractional units.
 $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}$, etc

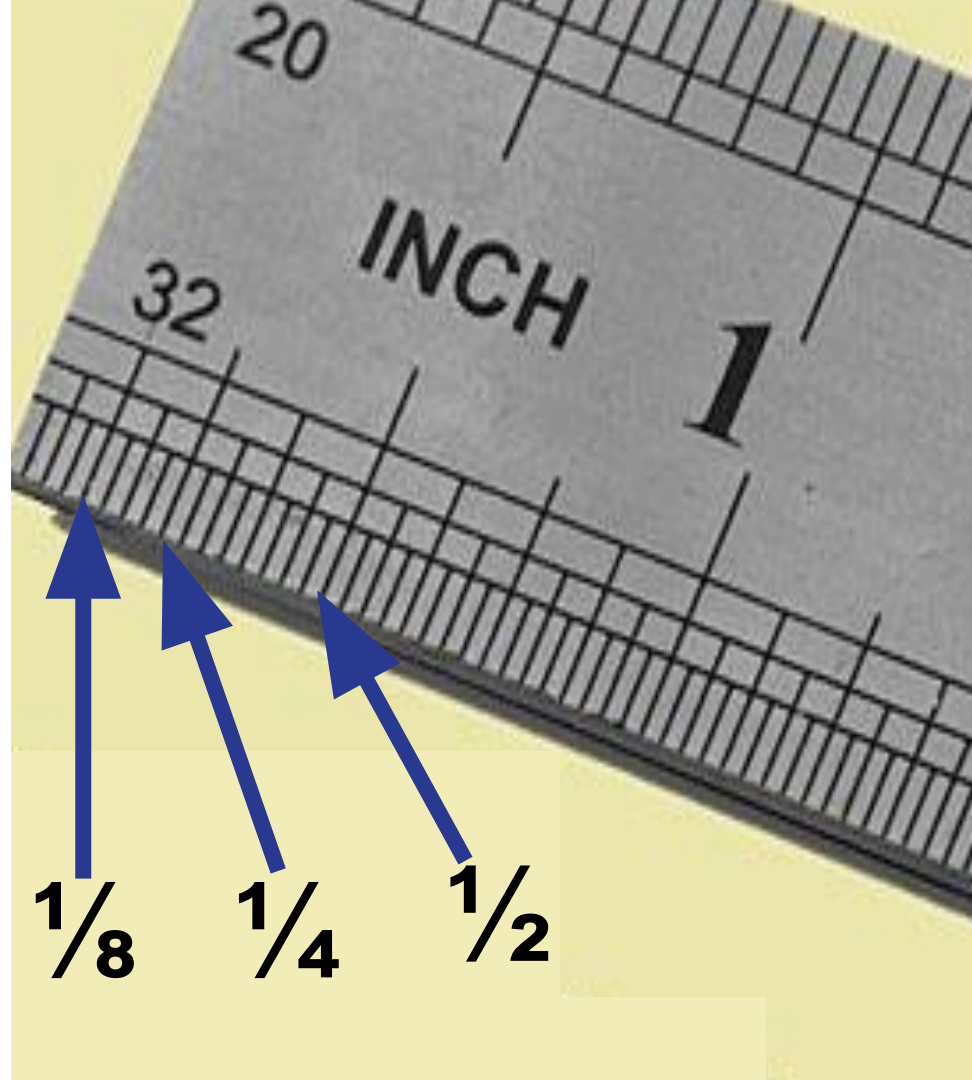


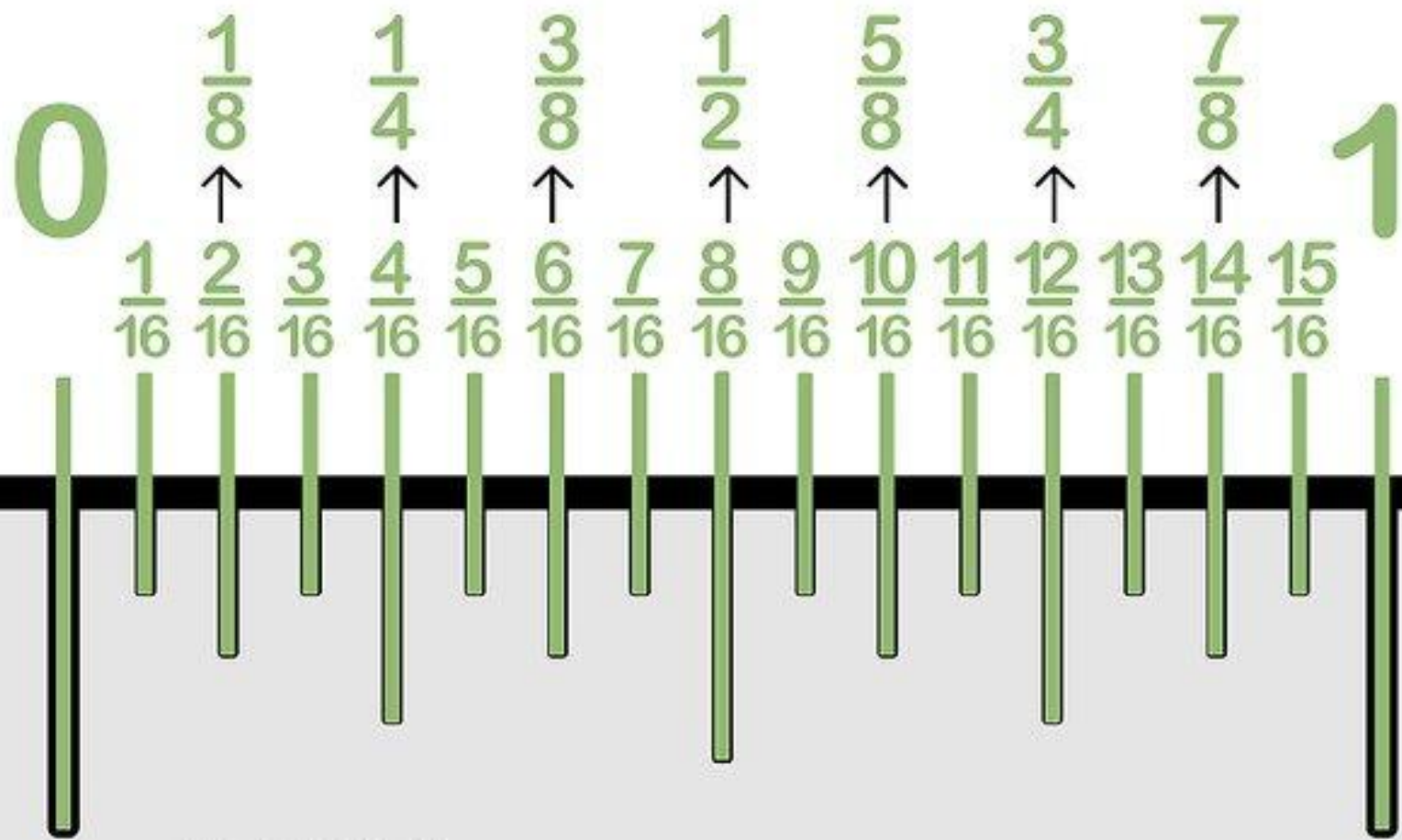
All Fractional
rules apply with
the standard
system.

-reducing

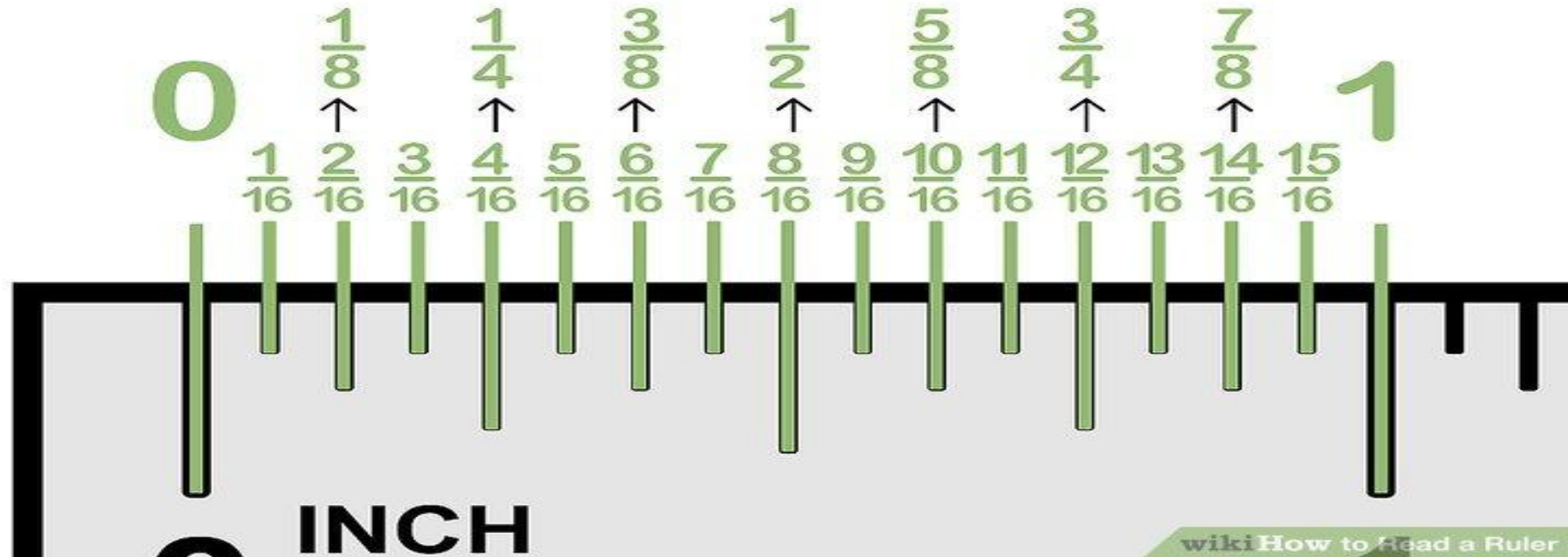
-adding

-subtracting

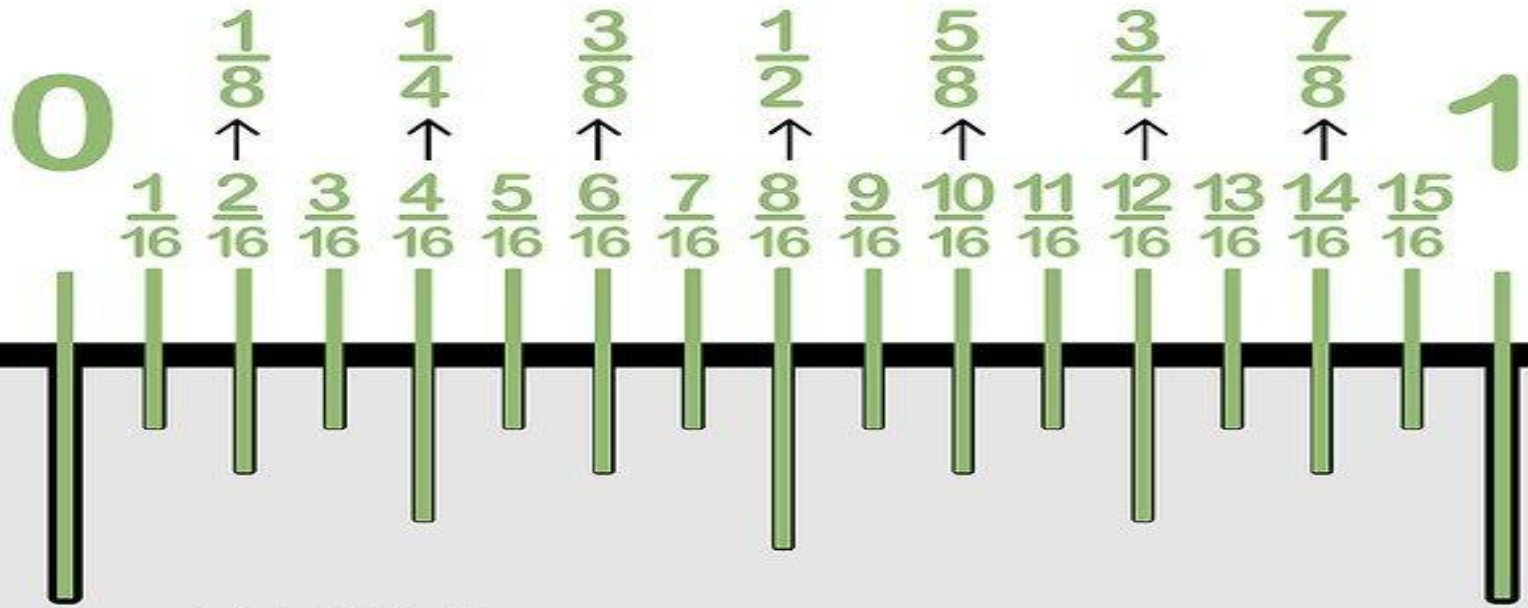




Use the smallest denominator (bottom number) option when writing down/conveying measurements.



Use whole numbers
1 and 3/16ths not 19/16ths



INCH

To make the math simpler fractions can be converted to a decimal number. That requires a bit of mental gymnastics.

$$1\text{mm} = .03937" \quad .001" = .0254\text{mm}$$

Fractions	Decimals	Millimeters	Fractions	Decimals	Millimeters	MM
1/64"	.015625"	0.397	33/64"	.515625"	13.097	.1
1/32"	.03125"	0.794	17/32"	.53125"	13.494	.2
3/64"	.046875"	1.191	35/64"	.546875"	13.891	.3
1/16"	.0625"	1.588	9/16"	.5625"	14.288	.4
5/64"	.078125"	1.984	37/64"	.578125"	14.684	.5
3/32"	.09375"	2.381	19/32"	.59375"	15.081	.6
7/64"	.109375"	2.778	39/64"	.609375"	15.478	.7
1/8"	.1250"	3.175	5/8"	.6250"	15.875	.8
9/64"	.140625"	3.572	41/64"	.640625"	16.272	.9
5/32"	.15625"	3.969	21/32"	.65625"	16.669	1
11/64"	.171875"	4.366	43/64"	.671875"	17.066	2
3/16"	.1875"	4.763	11/16"	.6875"	17.463	3
13/64"	.203125"	5.159	45/64"	.703125"	17.859	4
7/32"	.21875"	5.556	23/32"	.71875"	18.256	5
15/64"	.234375"	5.953	47/64"	.734375"	18.653	6
1/4"	.2500"	6.350	3/4"	.7500"	19.050	7
17/64"	.265625"	6.747	49/64"	.765625"	19.447	8
9/32"	.28125"	7.144	25/32"	.78125"	19.844	9
19/64"	.296875"	7.541	51/64"	.796875"	20.241	10
5/16"	.3125"	7.938	13/16"	.8125"	20.638	11
21/64"	.328125"	8.334	53/64"	.828125"	21.034	12
11/32"	.34375"	8.731	27/32"	.84375"	21.431	13
23/64"	.359375"	9.128	55/64"	.859375"	21.828	14
3/8"	.3750"	9.525	7/8"	.8750"	22.225	15

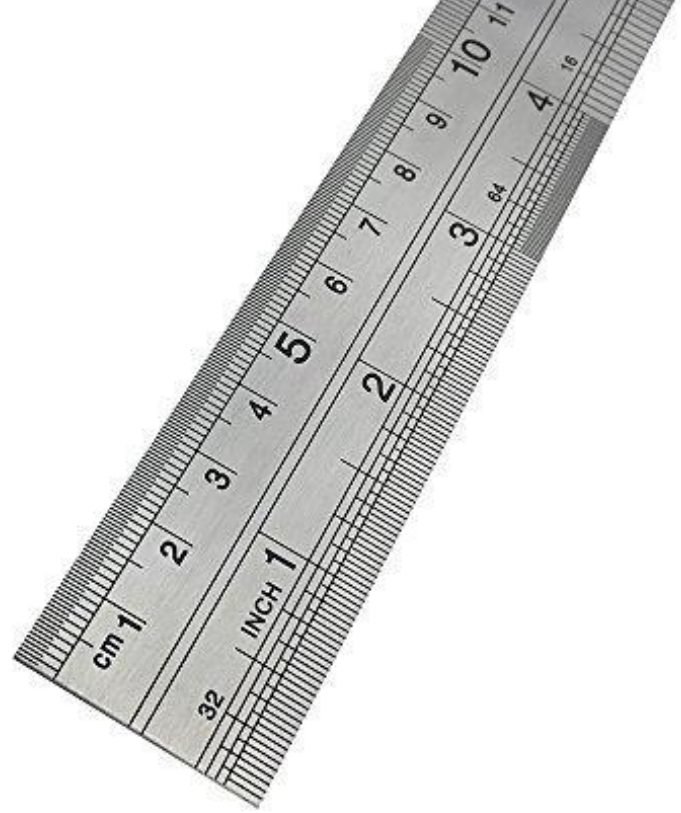
Measuring Devices - Tape Measure

Not good for accurate measurements due to the moving part at the end. It is a feature not a bug, but if you do not understand it it can skew your measurement. Tape measures are fine for rough or overall measurements do not use it for part fabrication. If you have nothing else. Do not use the tab at the end as your starting position. Instead, skip to a number on the tape, like 3, measure from there out. Subtract 3 from your final number.



Measuring Devices - Ruler

Best choice for larger measurements. Here again try to make your measurements between two numbers and not from the corner/end. Use the subtraction method mentioned in the last slide for more accurate measurements.



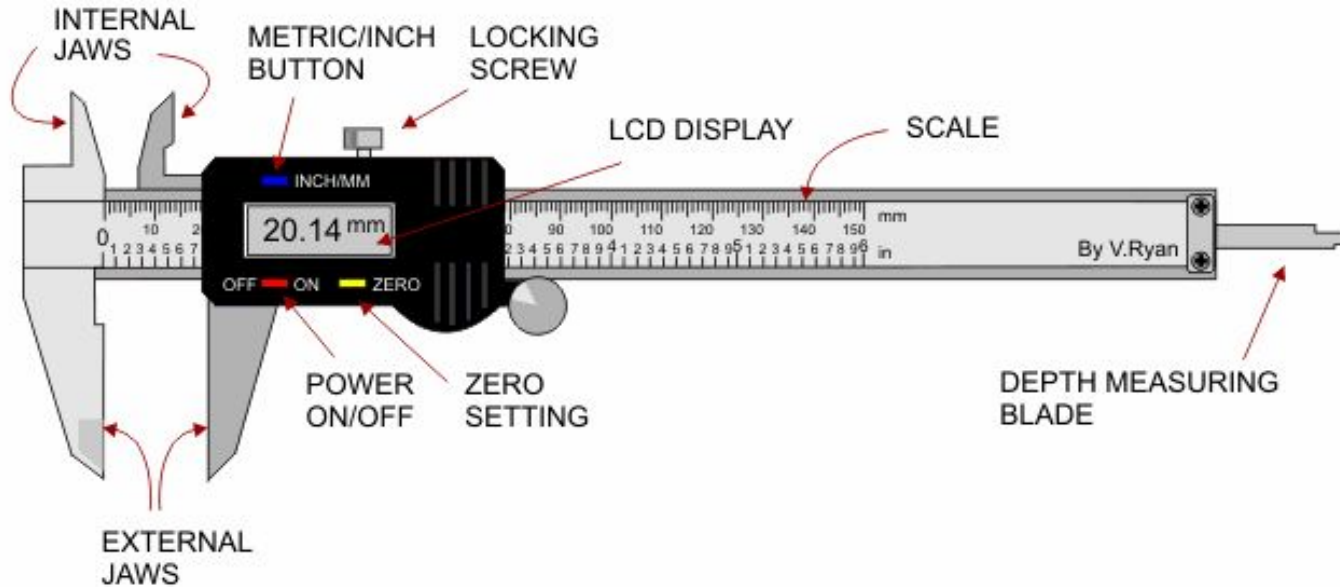
Measuring Devices - Caliper

Best choice for small measurements. Calipers allow you to measure

- inside holes (with the ears on the back)
- outside objects (with the large fangs below display)
- Depth of holes with the spike
(extends from the back of the bar)



Measuring Devices - Caliper



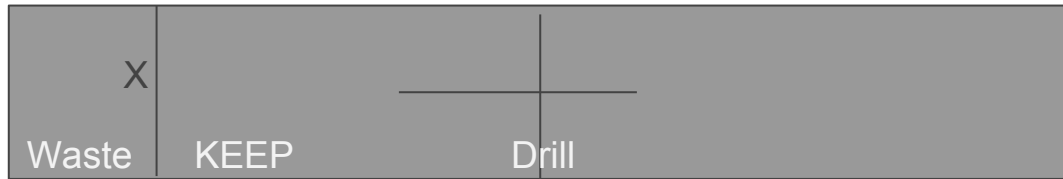
Be sure to zero the caliper before using it and check its zero often.
To zero it close it all the way and press the ZERO button.

Making your mark!

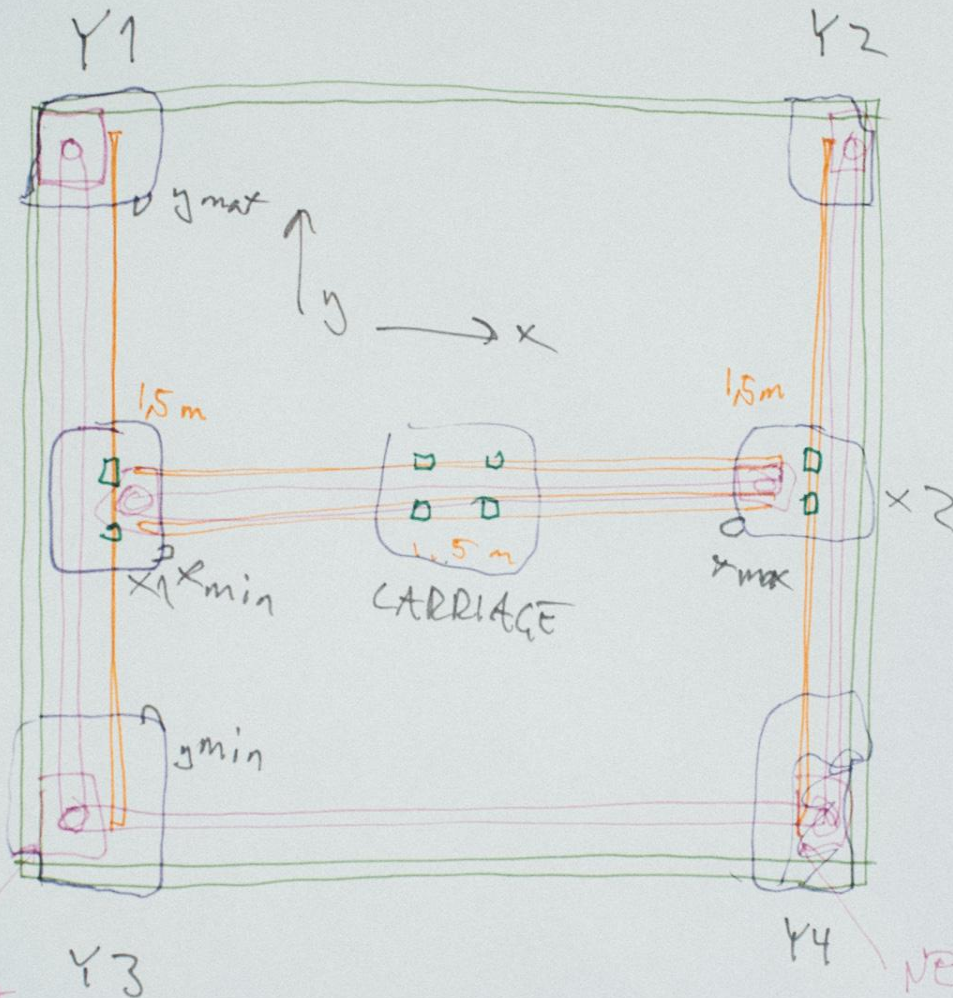
When making a mark on an object to be modified in some way we need to do it in a way that will remove any confusion.

Here are some general rules.

- Use a very sharp point when marking (Sharpies are never OK), scribe, blade, pencil.
 - A good cut will leave half the line behind.
- When cutting, put an x on the side of the material that is considered waste material.
- Use a cross-hair mark for drill holes. Use a center punch to start the hole.



Sketching and Markup



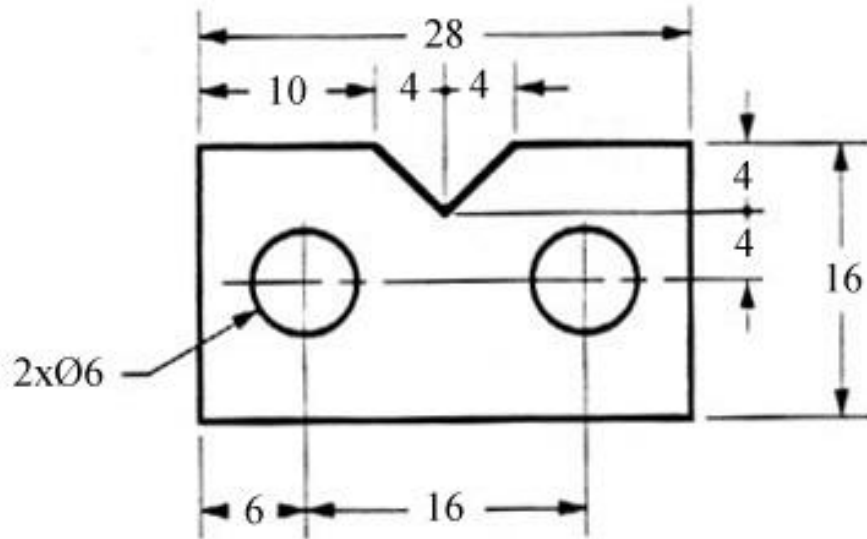
Sketch

A sketch is a hand drawn representation of a part or assembly that has enough information on it to make it. It could also show how different parts interact with each other. It should include at least one view (side of) an object and might have measurements of the desired feature.

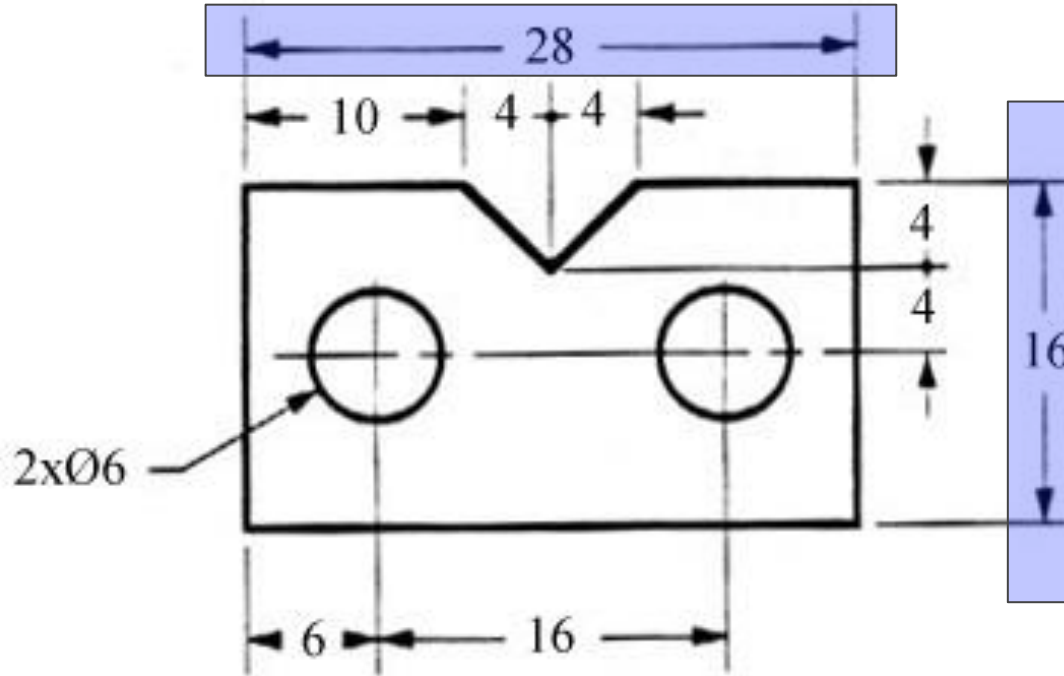
It does not have to be to scale or artistically accurate.

Sketching Markup

We are going to look at how this part was marked up so we can understand how mechanical draftspeople do it. We are not expecting this level but it does show good practices.

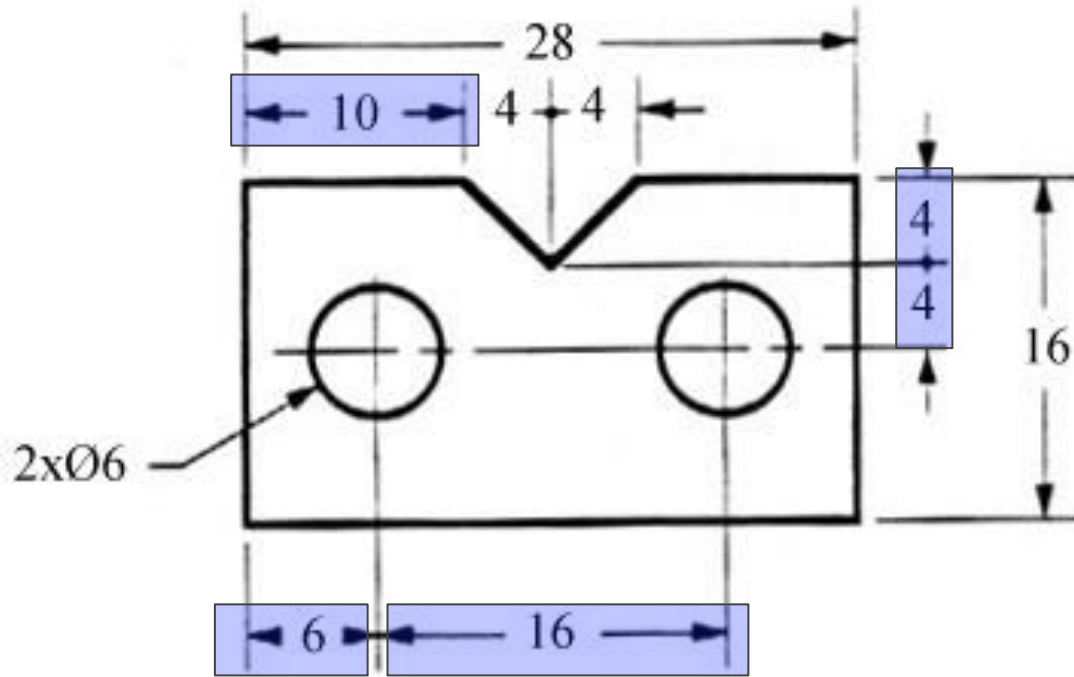


Sketching Markup



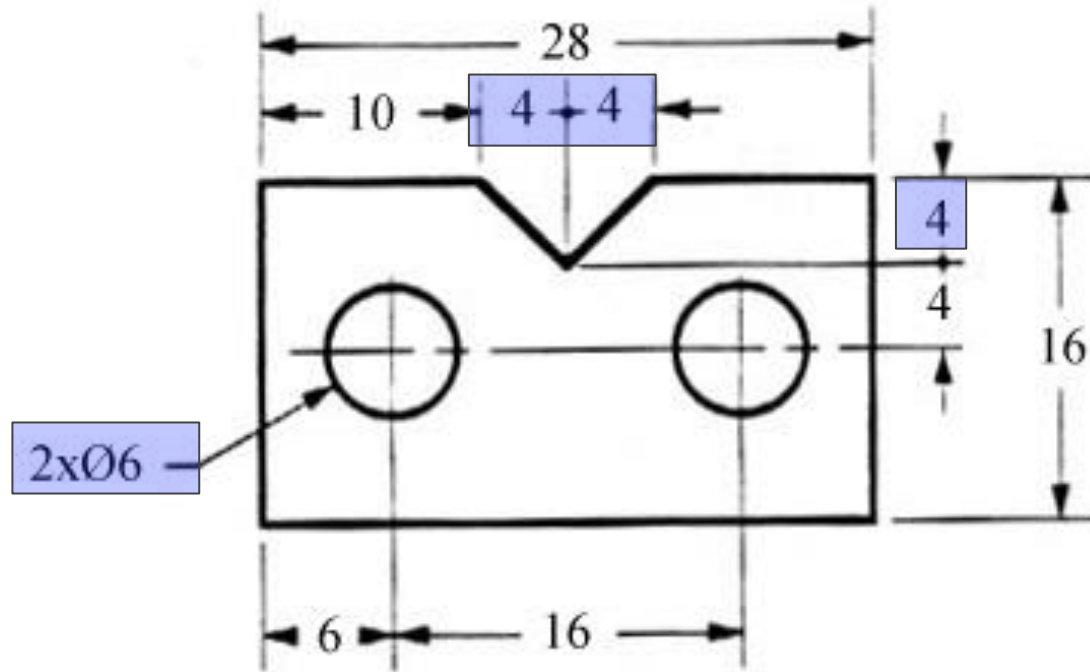
Overall dimensions

Sketching Markup



Distance from known points to add features

Sketching Markup



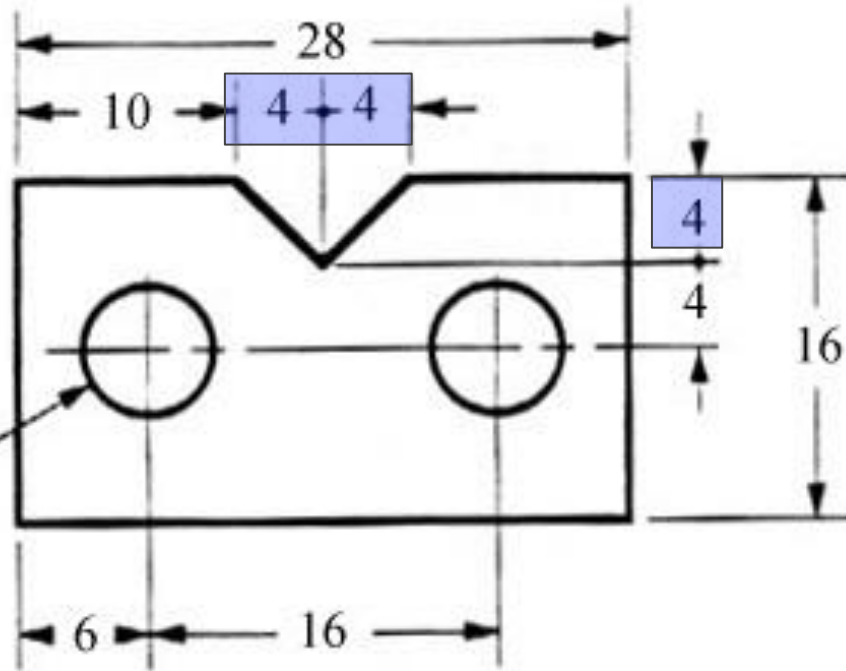
Size and shape of features

Sketching Markup

Circle with a line through it indicates diameter of the Circles

2xØ6

2x indicates 2 of the same size



Size and shape of features



To Achieve Mechanical Technician Level 1

1. Read this presentation understand the tools and generally how they are used.
2. Take the Pretest for Mech Technician Level 1
3. Schendle an in person test with a Mechanical Trainer
 - a. Identify each tool and its purpose
 - b. Pass written ruler test with 90% or better
 - c. Hand sketch an object given to you the trainer. Include as much info to recreate the item.
 - i. 1 sided view minimum
 - ii. Include measurements

Next-Mech Tech Level 2

1. Review safety guidelines for each tool.
2. Get supervised “hands on time” with each tool.
3. Schendle an in person test with a Mechanical Trainer
 - a. Cut and dress a piece of square tube to size. Be no more than 1/16 out of stock
 - b. Drill two ¼” holes a specific distance apart.