Engineering Drawing and Computer Graphics
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Lecture – 55
Solidworks

Hello, everyone. Welcome to our online NPTEL certification courses on Engineering Drawing and Computer Graphics. In the earlier classes, we have learned about Solidworks software. In today's class, we will practice a couple of examples of how to use Solidworks. After double-clicking these Solidworks icon either here or from the applications we will have this terminal.

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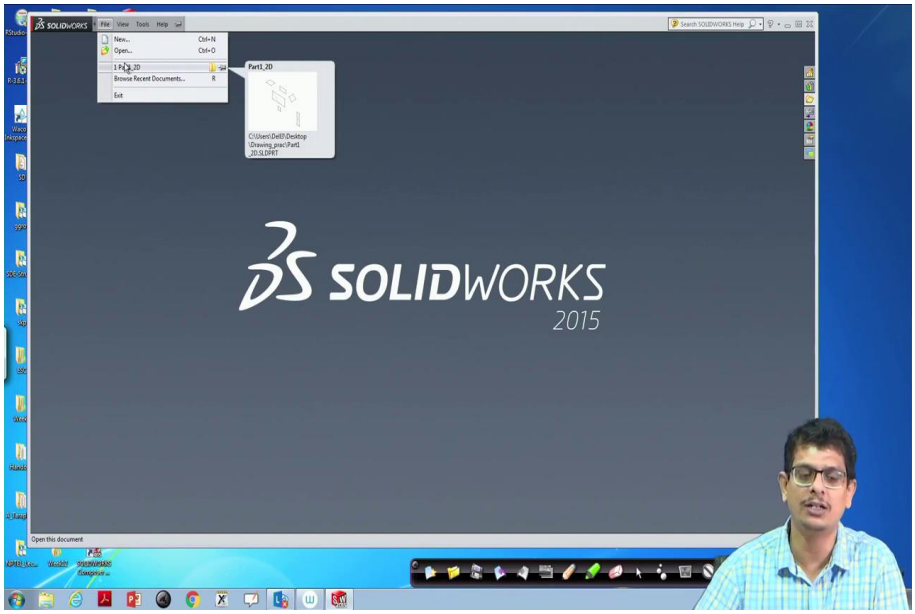

So, on this, we will be in a position to draw any object and it is up to you which version you would like to use. We have Solidworks 2015 version and we are using that. So, when you are going for new versions, new updates will be there for the software still the older versions work for practising the simple engineering drawing problems. The first step as Solidworks what we have to do is using mouse try to go through this object name New. Here we can see this New control.

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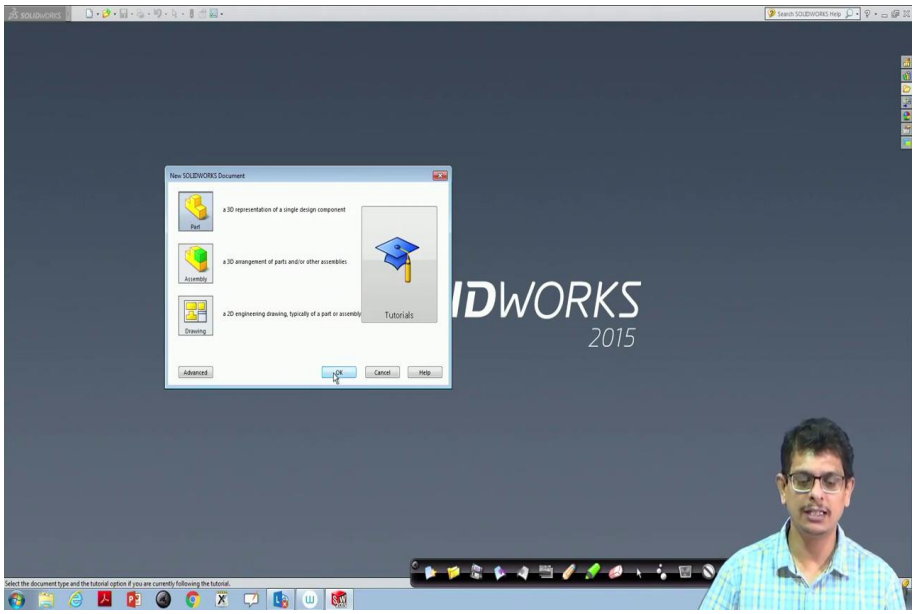

There click New. So, the first example what we are practising is 2D sketches or part drawing we would like to go with. So, in the earlier class, we have learned about Solidworks identifies 3 kinds of objects - one is part drawing, another one is assembly drawing, the other one is drawings. So, first 2D sketches may be simple 3D objects which are unique if we are interested to construct, we have to click part drawing. Click Part, then click Ok.

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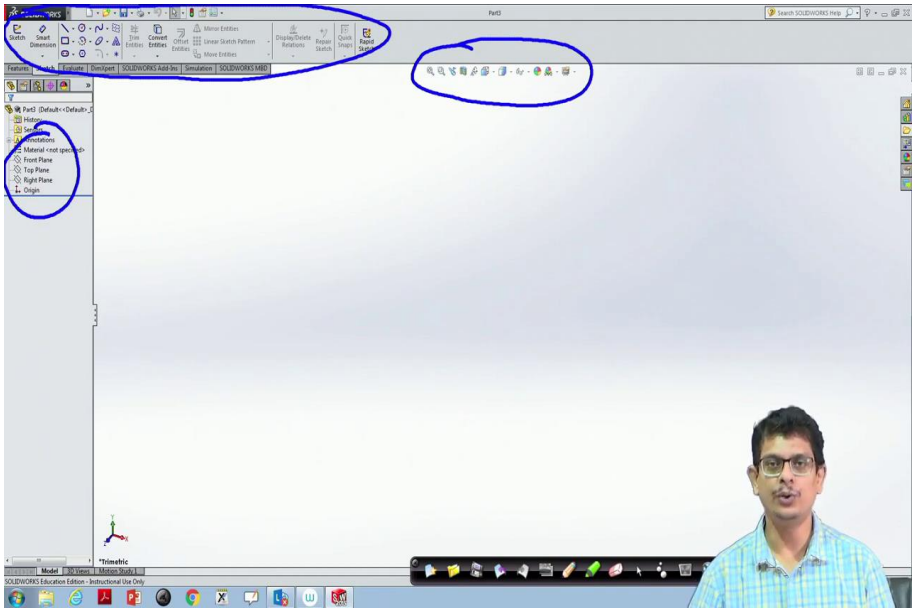

Then it opens a blank screen. Again first we go to this object New, then it opens something like a Part drawing, click then Ok. It opens a blank space. In this blank space, we have a feature manager where the front plane, top plane and right plane is located.

Similarly, we have something like a Sketch toolbar - something like Sketch, Line and different kind of thing. There is another object here Zoom, Views and other things are located, and bottom we have units something named MMGS and this MMGS represents our units.

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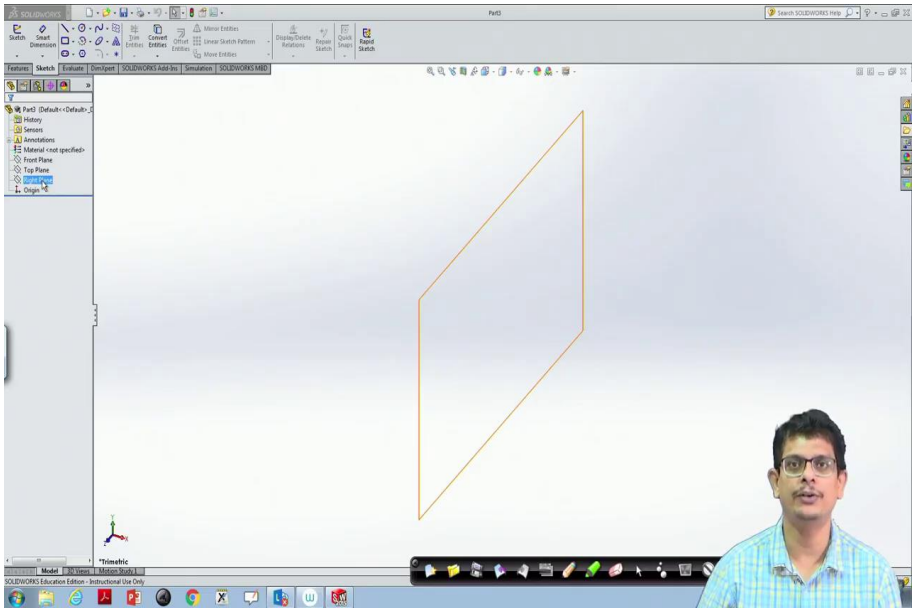

So, now let us begin with one simple example. After opening this part drawing, if we want to draw anything if it is a 2D sheet what manually we draw, we have a sheet normal to that we will draw anything, but for Solidwork you have to specify on which plane you would like to draw the things. And, the recommended plane to begin any drawing is picked the front plane.

So, for that what we have to do you, move your mouse onto Front Plane, then it detects something like an Isometric view of a plane. You should not click anything just move your mouse. Similarly, if you are moving your mouse on to Top Plane, it shows the flat section of that surface.

So, if you are assuming something like a cuboid one of the midplane is the front plane, the cut sectional kind of thing is stop the plane and there is a right plane also we can see the right plane of that cuboid. This is the way we have seen for isometric drawings this one.

If we are looking at this, the front plane represents one of the principal axes, the top plane gives you another principal axis and the right plane gives you another axis. So, the first thing what we are going to do is pick the front plane; pick means just move your mouse, then give a right click of that button.

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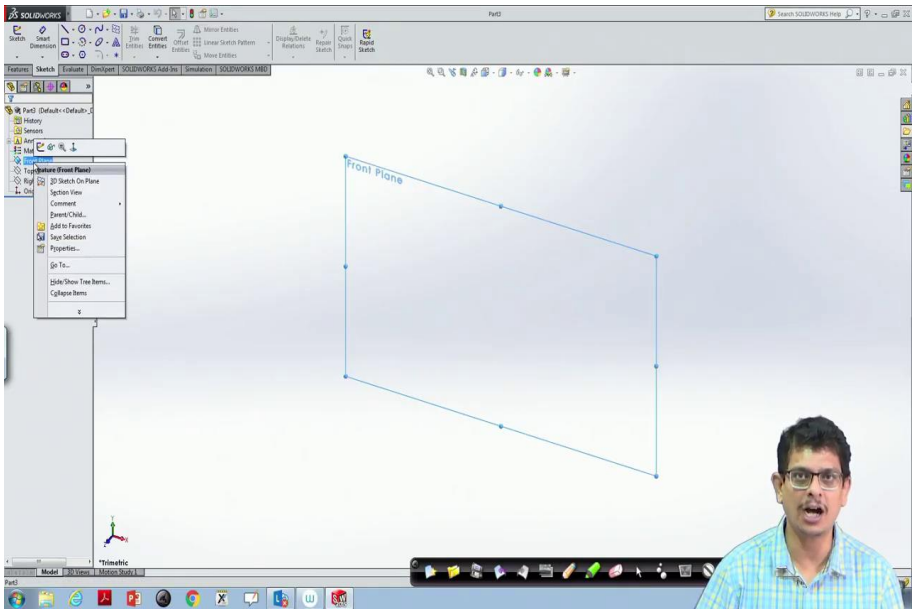

So, for mouse right side, left side 2 buttons are there and pick right-side button. Once you click that a single click, it opens a dialogue box showing something would you like to draw normal to that plane? So, this is the symbol what we have something like a square with a normal vector pointing in that direction if you click that it will align to that front plane.

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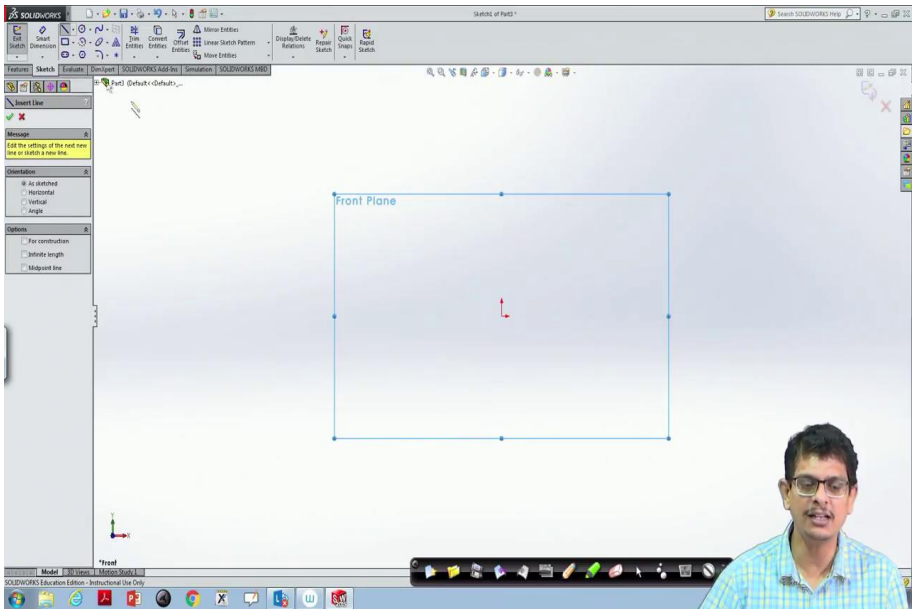

So, the first step is to move your mouse onto Front Plane, then give a right click then click this normal thing.

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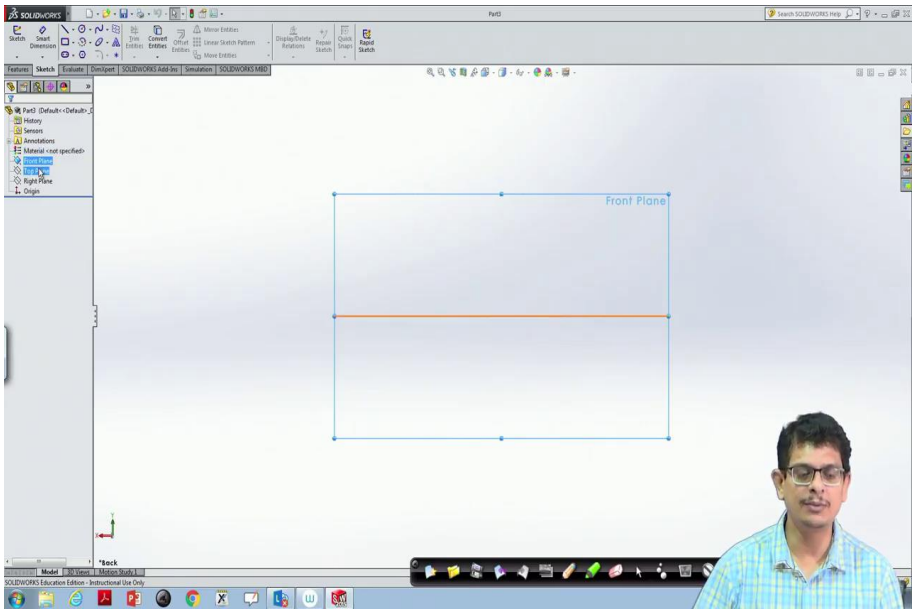

We will have that front plane.

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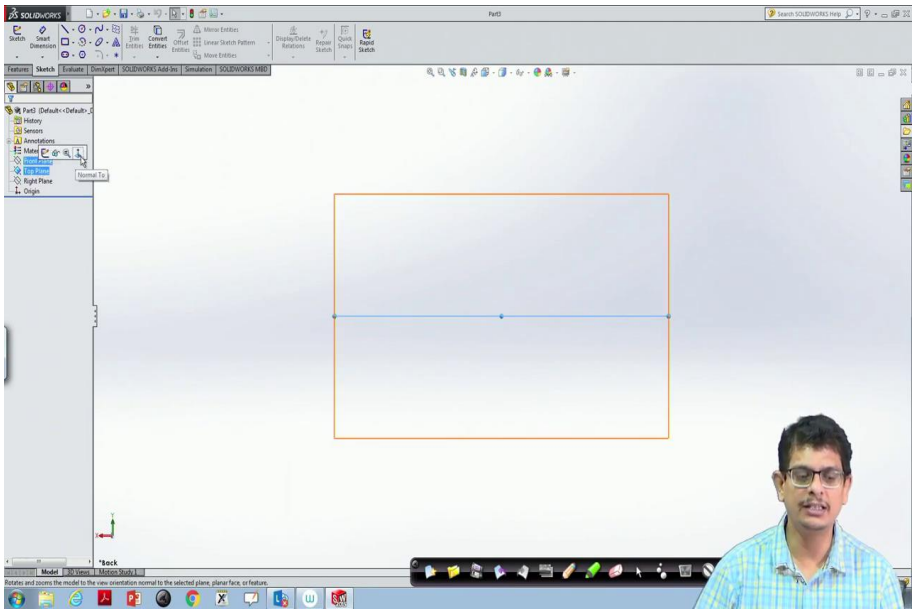

Similarly, if we are going to draw it on a top plane what we have to do is give a click that is to right-click on that Top Plane, then give a left click on that gives you top plane.

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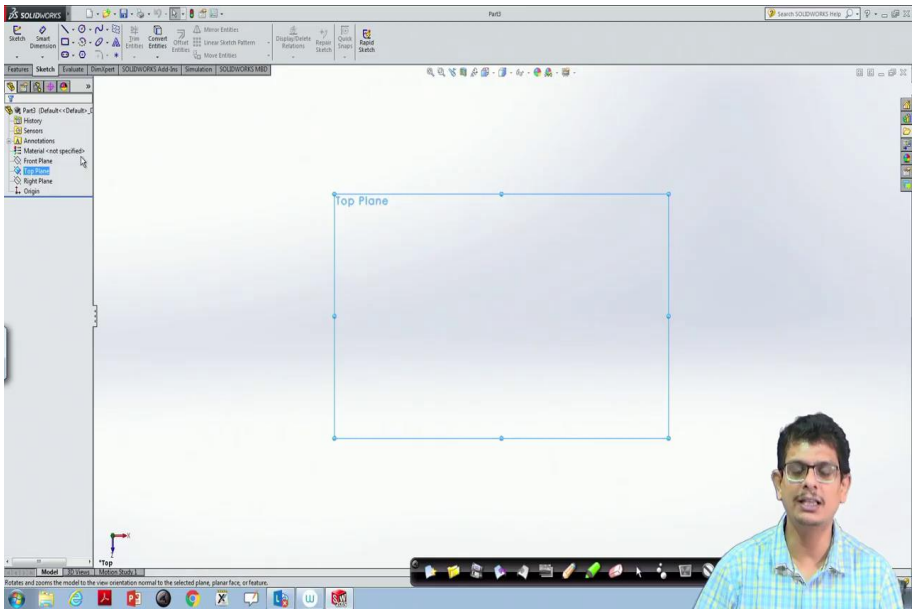

Recommended plane to begin is for us a front plane. Click, left click, then again one more left-click gives me a front plane. So, whatever the 2-dimensional drawings we go we are going to do we will do it on this front plane. So, let us do that. There are a variety of options like Line, Circle, Curve and many more.

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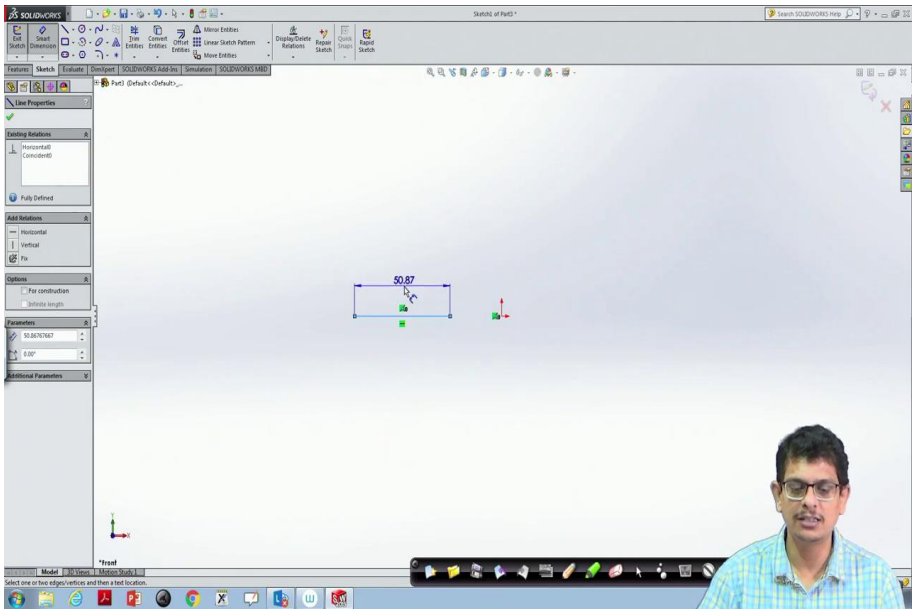

So, the first one what we are going to do is move your mouse give a left-click. Then there is a Line, pick that Line, then from one point to other point draw a line then press Enter, then press Escape. It draws a line. Now, this line we would like to specify certain units. For that purpose what we do is just

next to Line, there is a button Smart Dimension. Using the Smart Dimensions we can adjust the length of that line.

So, click that Smart Dimension click that, just move your mouse without any click then click that.

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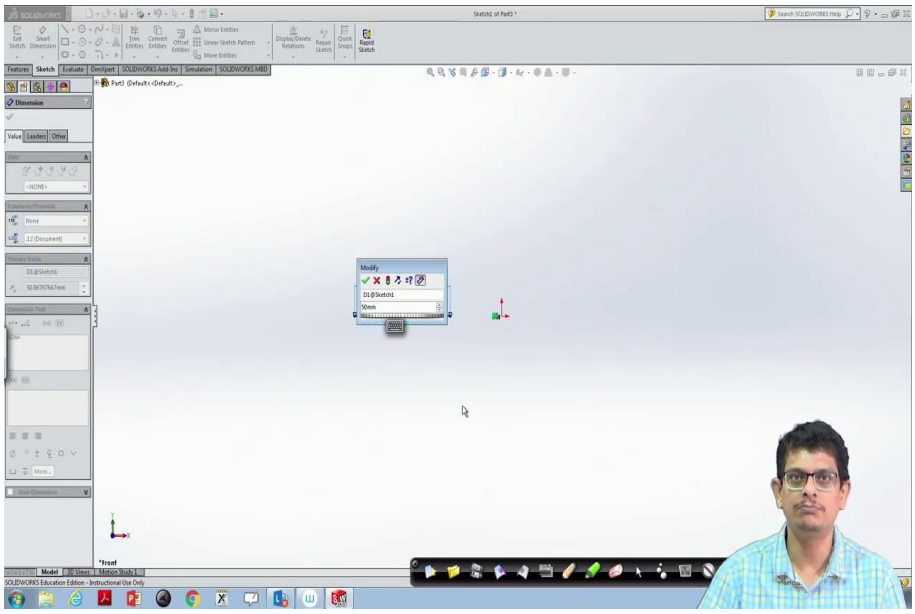

If you are happy with those dimensions, it is ok if you are not happy with that dimension just put 50. Now, the units you can always pick it. So, if you are coming down below that 50, there is something like units in that unit we can pick mm. Once it is done click the tick mark.

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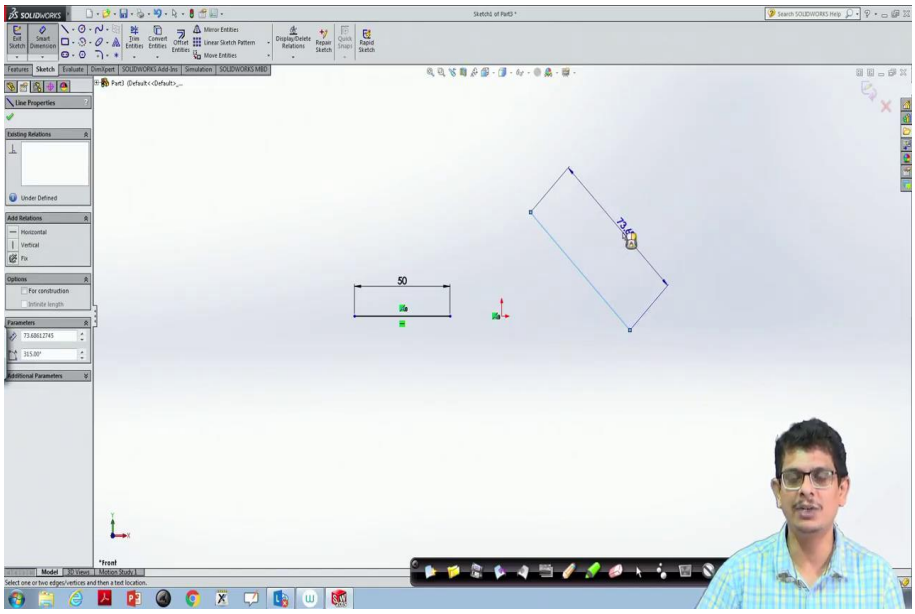

Then it shows you 50 mm dimension. Again, the first step is after opening the front plane normal to it, we pick a Line drawn from one point to other points at your convenience whatever the points because it is a practice session. Then press Enter, then press Escape. It draws a line if you are moving the mouse you would not see any more information. Now, this line we would like to adjust. For that purpose what we do is, click Smart Dimension, click this line.

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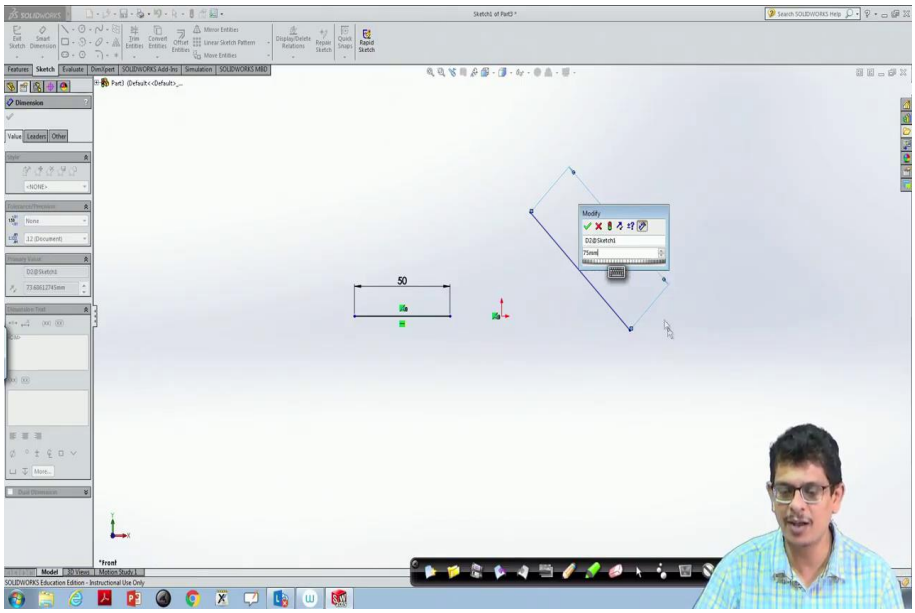

Along that dimension, we can just move our mouse, then again give a left-click. Now, whatever the dimensions we are interested in 75 units mm, then click Ok.

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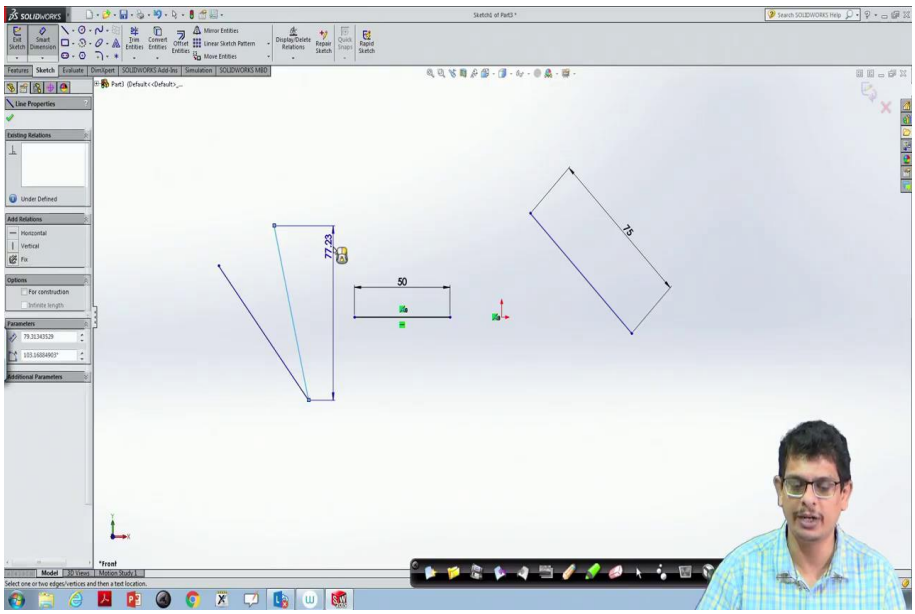

It draws a line with 75 mm my suggestion is all the time for the drawing use same dimension; same in the sense the same units of dimensions.

If you begin with mm everything go with mm throughout that sketch what you are going to do use only mm ah. Why I am suggesting this is because we are at part drawing level we construct an object with so and so units may be mm for this.

The next part when we are constructing it in centimetres, if we are not careful enough these objects we may not be in a position to make and there will be a problem. So, all the time go with one uh one system of units like mm. Now, I would like to have an inclined line from one to other and I would like to draw one more line with a certain angle.

So, what I have to do is I do not have to pick again line because I did not press any Enter or Escape button. So, I can just freely move my line and click that Enter. Now, I can just put Enter and Escape. So, I will come out of that draw mode.

Now, I can use my smart dimension, this one if you are careful enough you can just pull this mouse normal to that adjust the length or we can give the vertical height of that line also with respect to ground level. For that, you just move to rotate your mouse. Then it turns out to be in that way you see. One of the lines is is going to show it in normal to that direction you have to be careful in using the mouse.

In another way, if you are slightly rotating twisting it, then it shows that vertical height of that.

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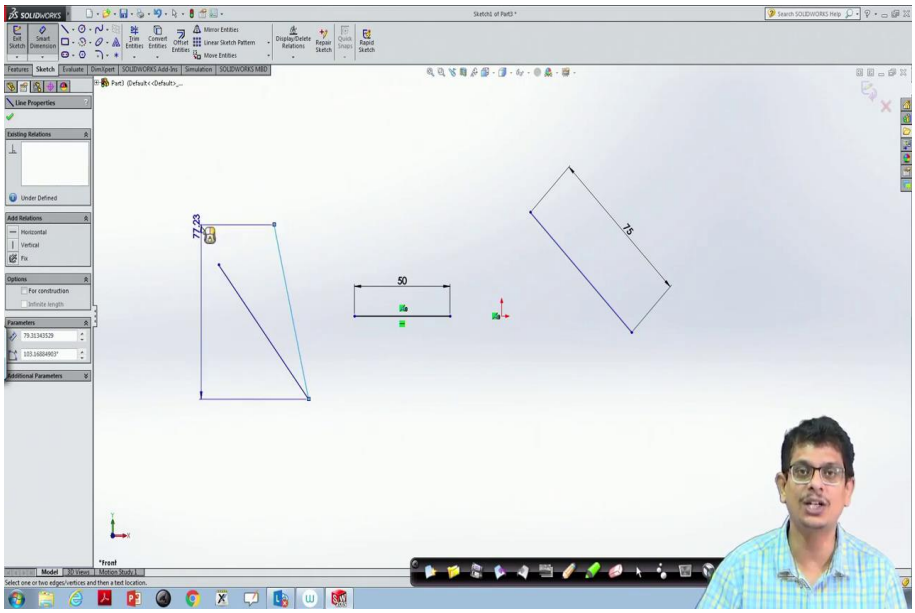

Similarly, we can use in this direction also. So, whatever the dimension we would like to specify that we can do that. For example, I would like to have a height of 50 millimetres.

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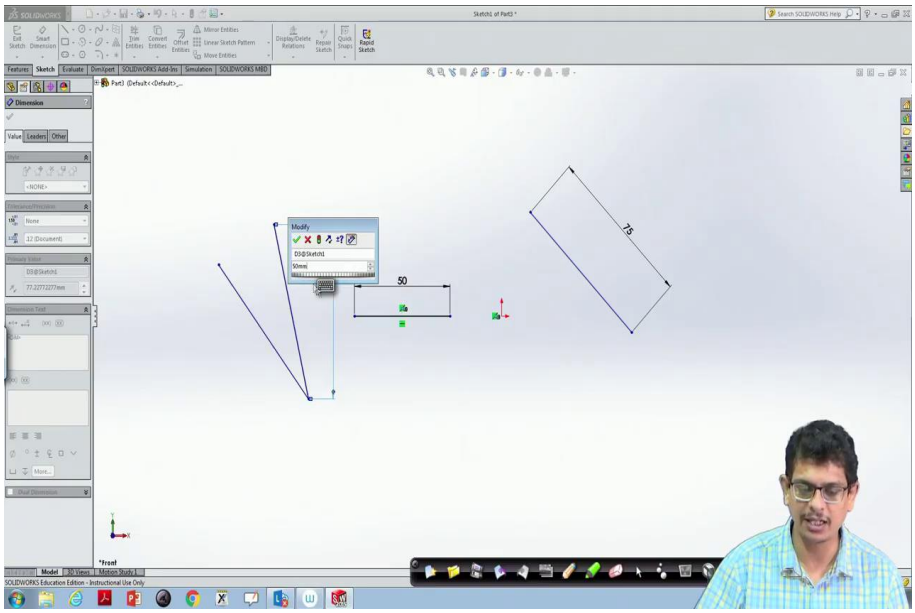

For that what I do, 50 units or millimeters and click OK.

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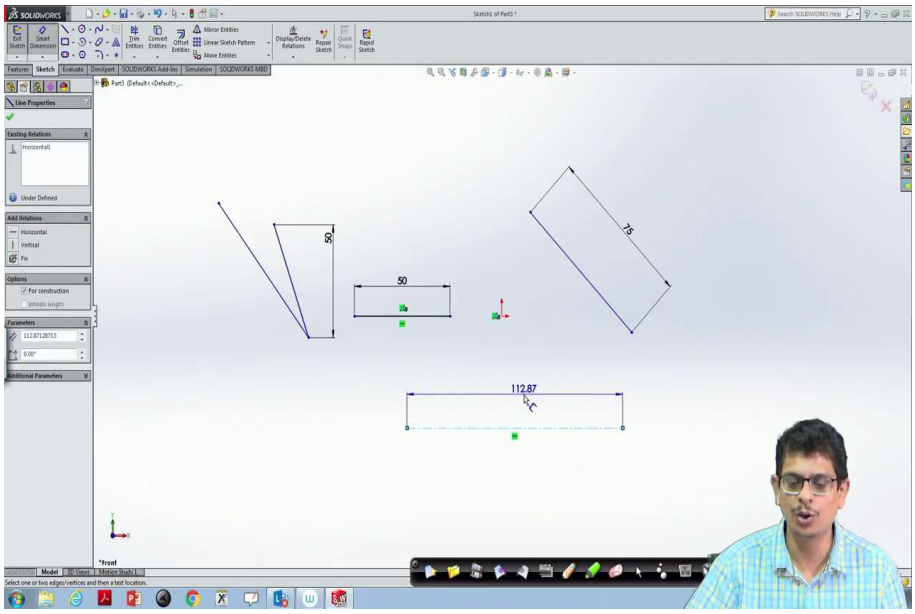

So, now you see the line is shortened because the vertical height with respect to the ground level is 50 millimetres.

Now, you would like to draw some other object. For example, like a centre line instead of a continuous line we would like to draw a Centerline. For that what we have to do is click this one there is a drag down kind of button the triangular one click that, go there. There is something like a Centerline, pick that Centerline draws from one point to another point. Then Enter, then press Escape. So, you will be in a position to draw a centre line.

In the earlier classes, we have seen when you have axis axisymmetric kind of objects, we use this centre line. So, that centre line always is having a standard format like big dashes followed by small dashes.

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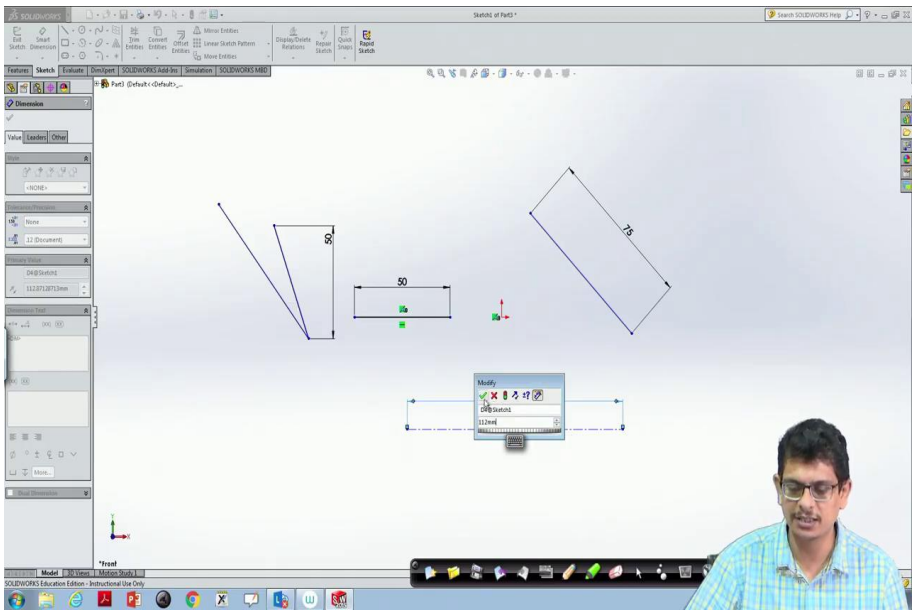

Now, I would like to adjust this centre line distance or perhaps length, then Smart Dimensions I can use it. Click go there, adjust it to 112 whatever the units like millimetres, then click Ok. It automatically adjusts that centre line length.

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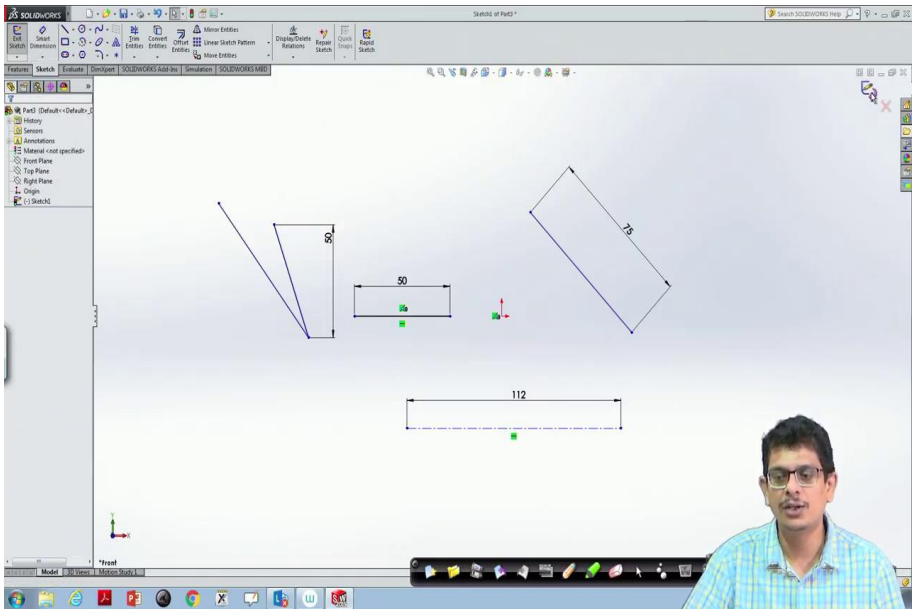

If you as long as you are in sketch mode, here you can see that there is something like an icon with pencil kind of thing and writ10 kind of thing. That indicates that you are in Sketch mode; that means, you are on that plane. You pick some object; you will be in a position to draw. You want to come out of Sketch mode because you want to delete the things, you want to erase the things you cannot straight away do it on the sketch mode. I cannot straight away delete the lines and so on.

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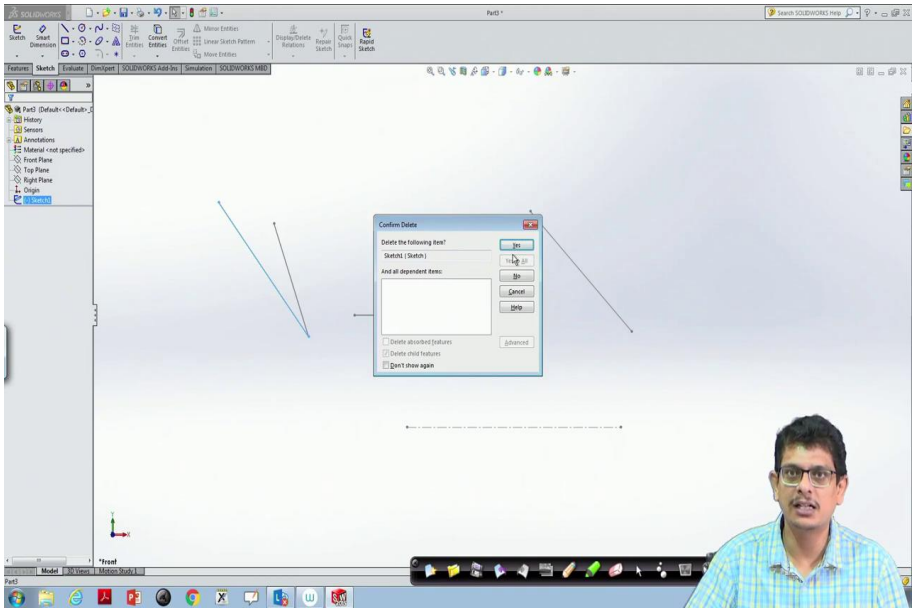

First of all for that either press escape or go there click that object, then I came out of that Sketch mode. Now, anything if I want to draw again I have to pick the Front Plane and so on things I have

to do. Now, I would like to delete this line. What I have to do? Click that, do that. Does it say that Delete the following item? Yes, if that is the case you delete it.

So, whenever you are coming out of sketch mode if you are deleting usually if you are not saving the drawing it deletes everything. So, let us do it once again. In this, if I would like to because I have deleted everything. Now, if I would like to construct it, go to Front Plane - just move your mouse then give a right-click, then it shows Normal To plane, click that Normal To plane. So, the normal plane opens up.

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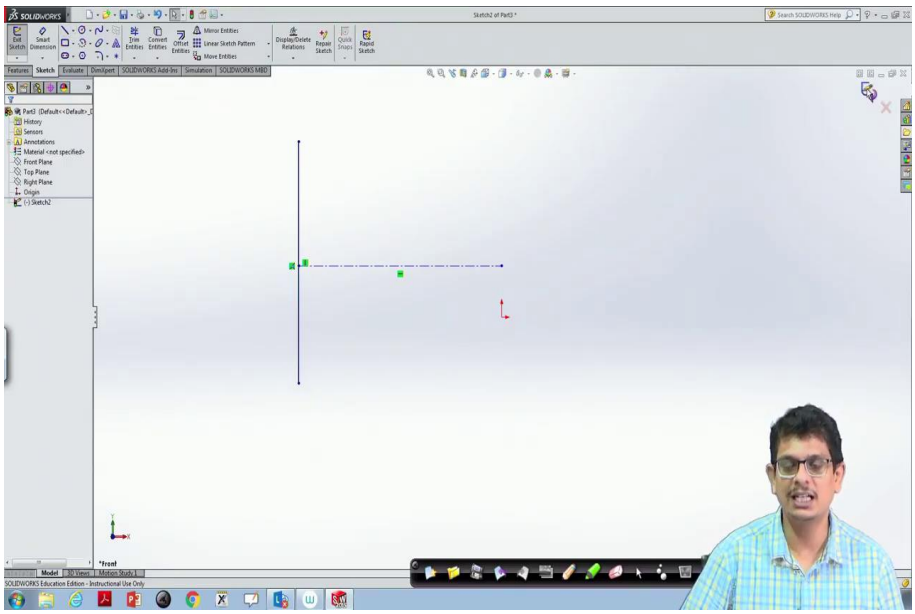

Now, I would like to draw a line, Centerline; draw from one location to other location, then press Enter, Escape. Now, similarly, I would like to draw something like a Line. So, it automatically detects where is that perpendicular kind of system I can press that, then Enter, press Escape.

We are still in escape mode. I would like to delete only this line, then I click that press Delete button on your keyboard. So, whenever you would like to delete one particular object, you have to be on the Sketch mode.

If you come out of sketch mode pick one of them. Usually, if you are not specifying any other things, it deletes the entire object. So, you have to be careful in terms of using the deleted object. Now, I would like to draw a rectangle on this plane.

So, first what I will do? I will delete this on the frontal plane Normal To I will go. I can always use the scroll button, right now I am using in between these 2 mouse clicks there is something like a scroll button. If we are scrolling it, it zooms onto that plane or zooms out of that plane.

So, now we are zooming in, it is zooming out. I would like to adjust this; I can always use this Zoom to Area. There are buttons like Zoom to Area, zoom out of that plane also.

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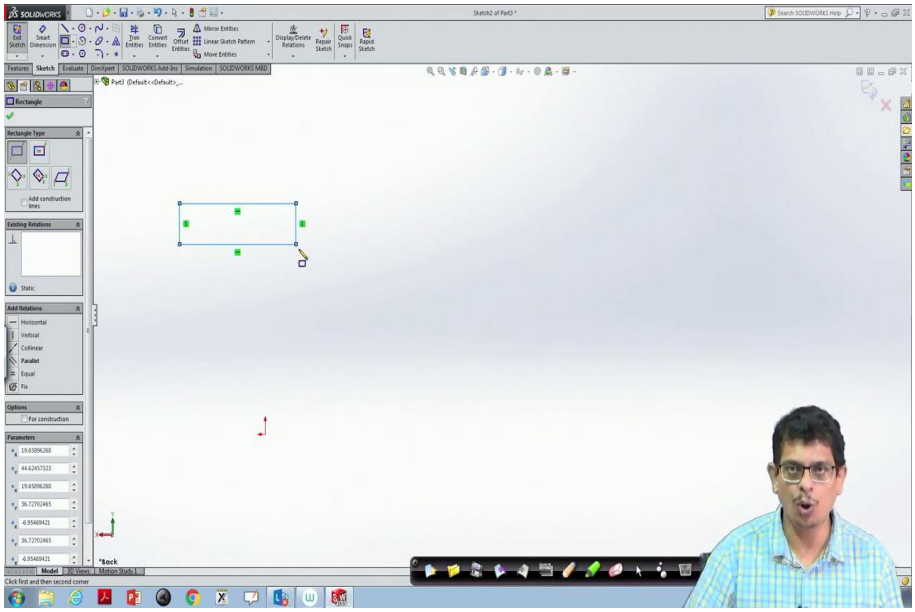

Now, on that frontal plane, I would like to draw a corner rectangle. From one location what I have to do? Corner rectangle means I have to specify one corner to other corner.

So, what I will do is click corner rectangle, then click means click, hold it. Let us do that once again. If I want to delete everything in this Sketch mode what I can do is, use your left click button, hold it; hold it mean press continuously without releasing then select the object, then it selects everything, then you can delete.

So, now I would like to draw a corner rectangle for that normal to that plane. Click Corner Rectangle; I did not touch any mouse because I already clicked that corner moved out of that now what we are going to do is, pick one of the corner points.

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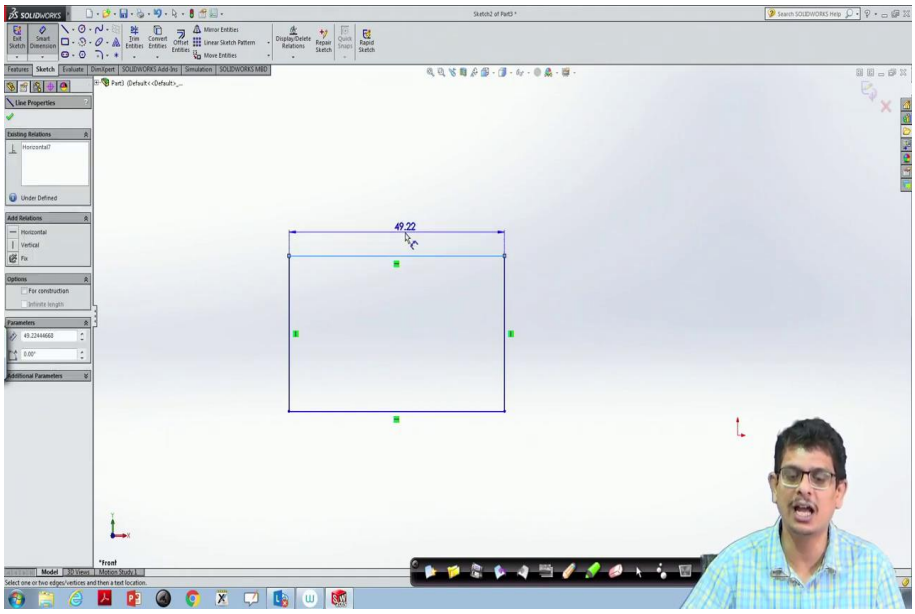

Pick means click; hold it. Hold that mouse, then move your mouse by holding that button press and hold that and now move it to one location. Once it is done you will have that rectangle on the plane. Now, I would like to have so and so specified dimensions of that rectangle. For that again I can use the smart dimension. Click one of them. Now, it is 49.22.

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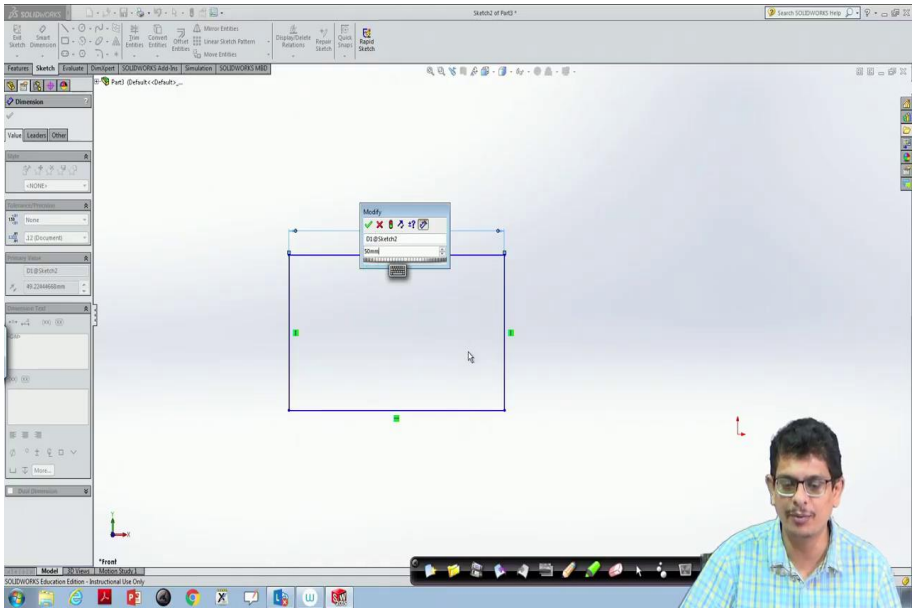

What I would like to have are 50 millimetres I would like to have. So, go 50 millimetres, then click Ok.

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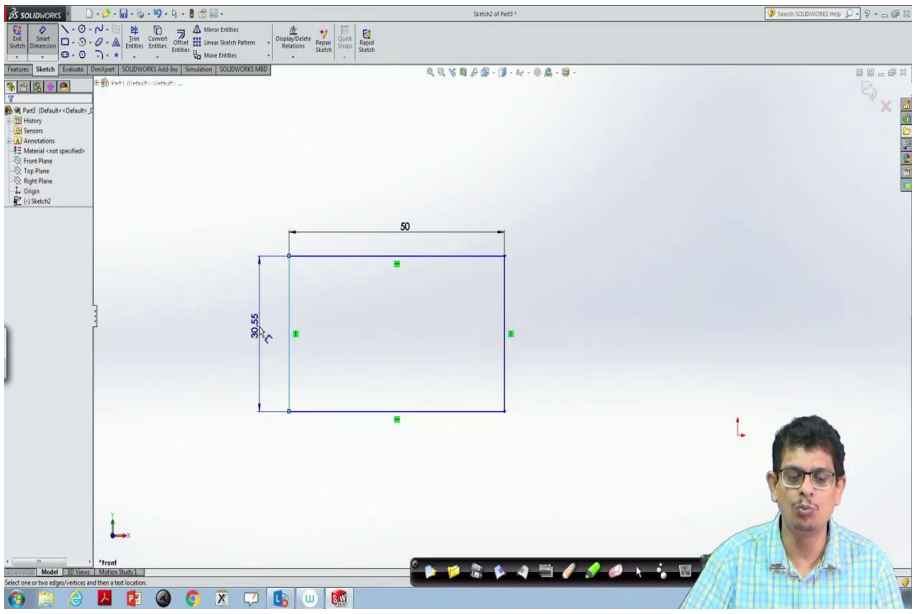

Then press Escape; that means, 50 millimetres is fixed on that side. On the other side, I would like to adjust the dimensions again what I can use is, click that move it to some 25 millimetres.

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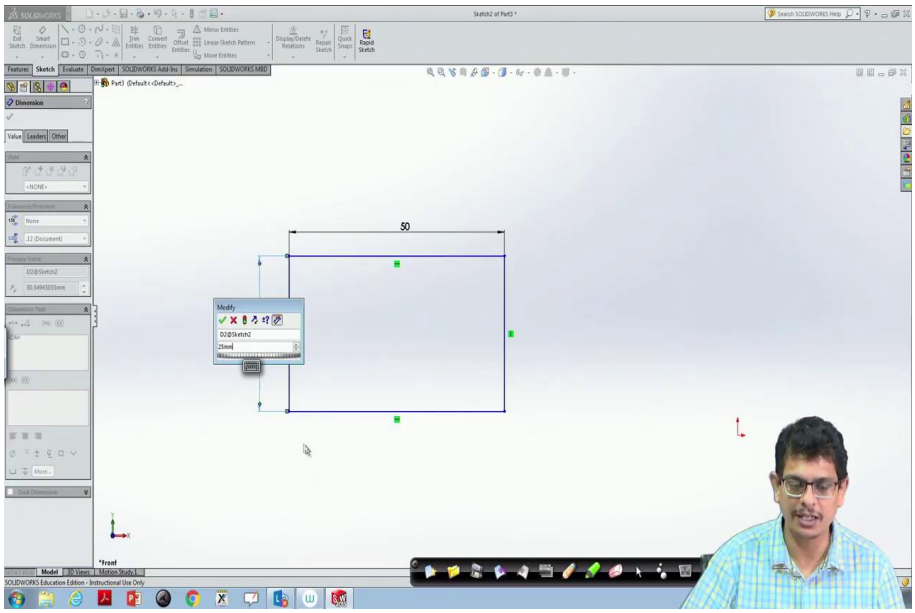

So, millimetres and click Ok, then press Escape.

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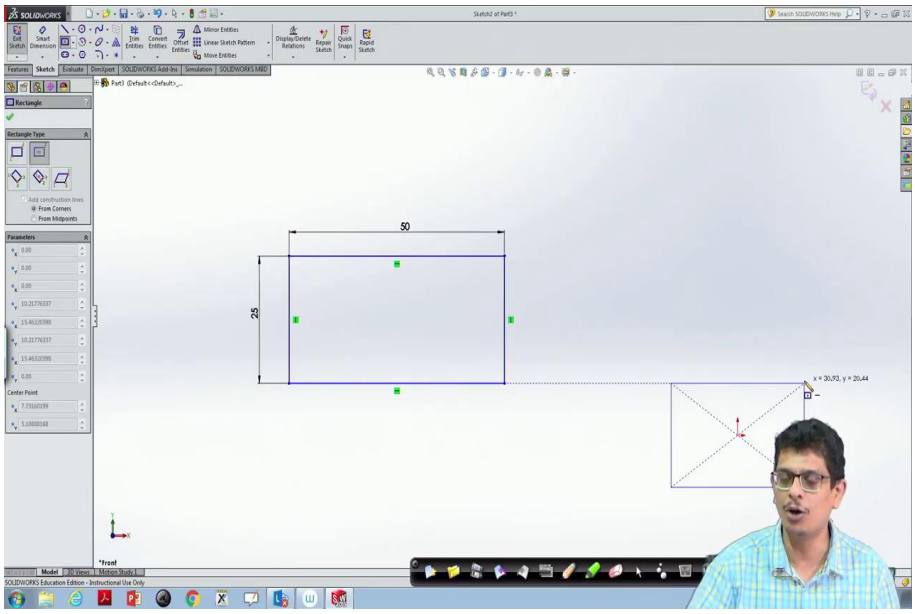

If you are done, then it creates the entire rectangle with proper dimensions. Now, we will go and create another kind of rectangle whenever we would like to construct the different things we use.

This rectangle what we call? Center Rectangle. That means I will be in a position to pick one point from where I have to begin rectangle on the entire page. This is more like our 2-dimensional page on a frontal plane in the normal direction, once I click that frontal plane we are going to construct.

Any 2D drawing we are going to construct only on that one particular plane and the recommended plane what we are going to use is the frontal plane. Now, there is one point from where the centre of the rectangle supposed to be there, that kind of rectangle what we are calling centre rectangle.

For example, this is the one what I picked. Now, for that what I have to do? Pick one of the points; Give a left click on that one of the points, then move. I am not pressing holding it, I just click. So, it has selected that corner point.

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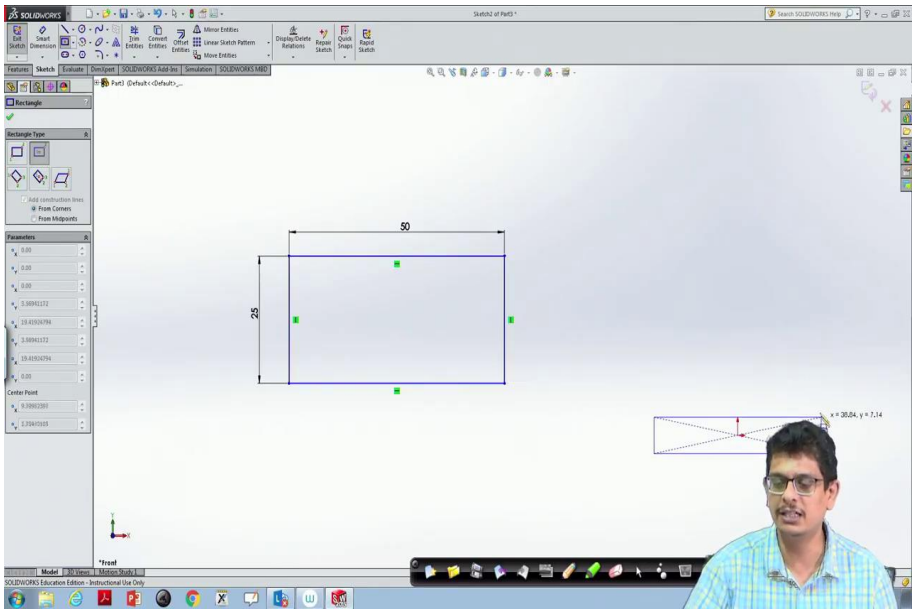

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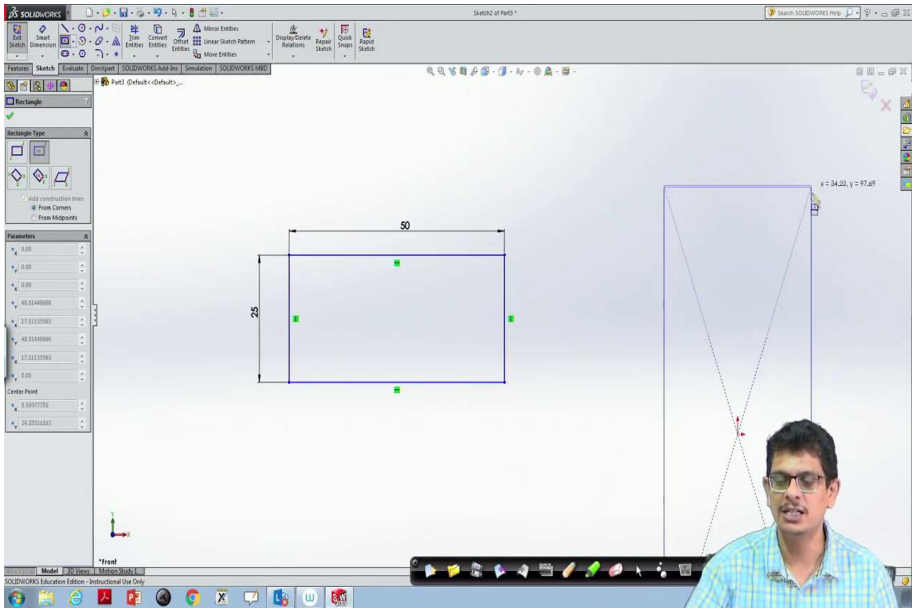

Now, I just nicely move my mouse, release at different locations, based on that I will be in a position to construct a rectangle.

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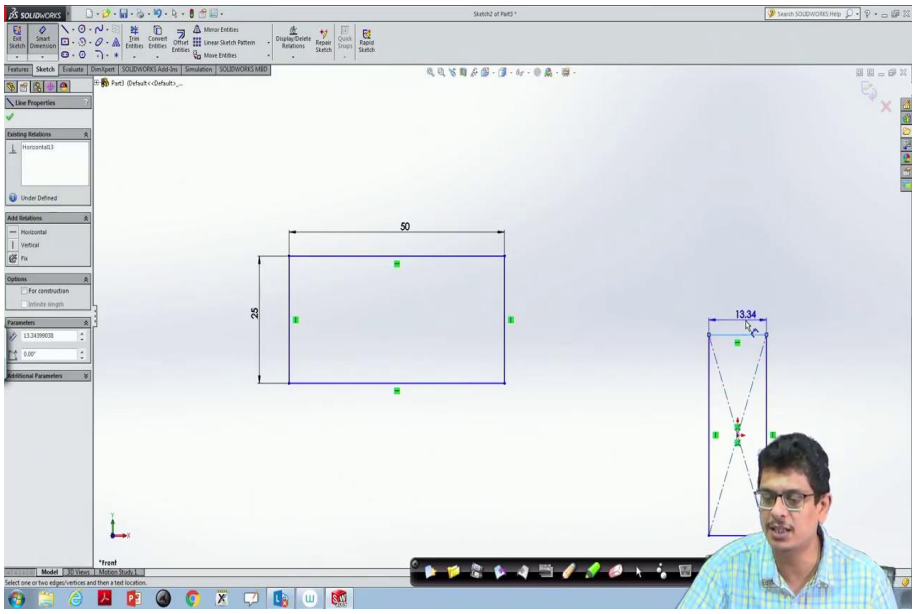

Now, click again. Now, my hands are also empty rectangle has been constructed. Now, I would like to have a Smart Dimension to specify this supposed to be 10 units 10 millimetres. Click Ok.

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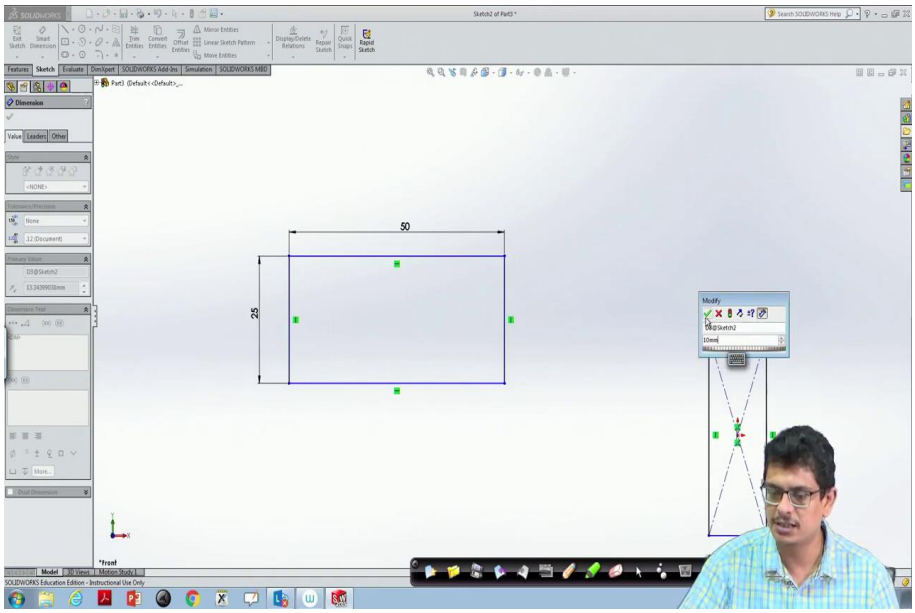

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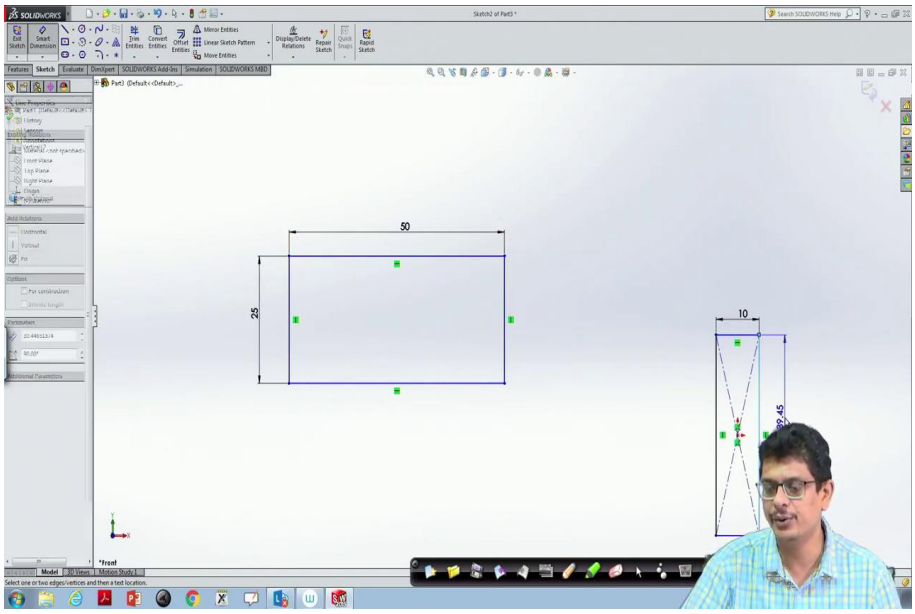

Now, other dimensions I would like to use. For that again I can click Smart Dimension or already I am on Smart Dimension; that is the reason the Smart Dimension is highlighted here.

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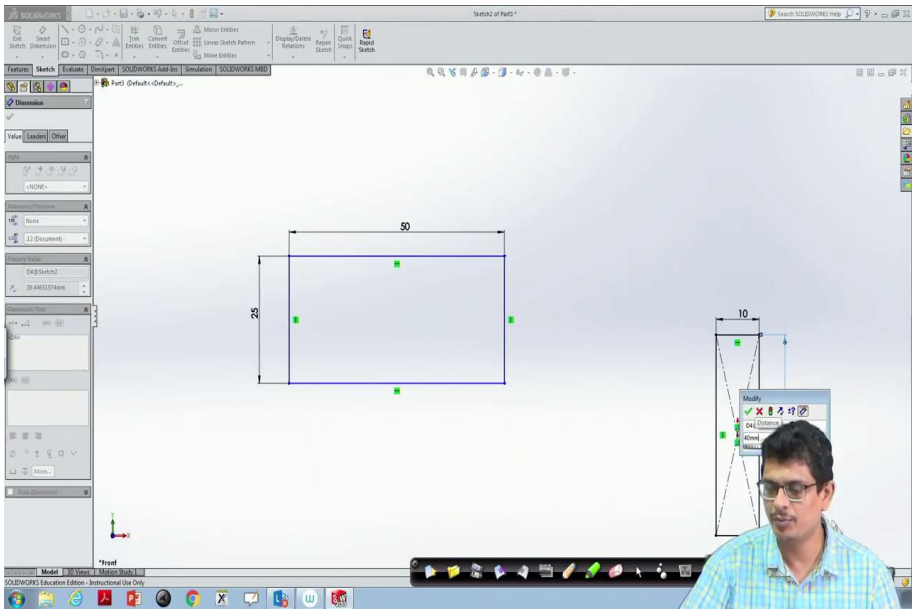

So, again click the Smart Dimensions and use it to be 40 units like millimetres > ok.

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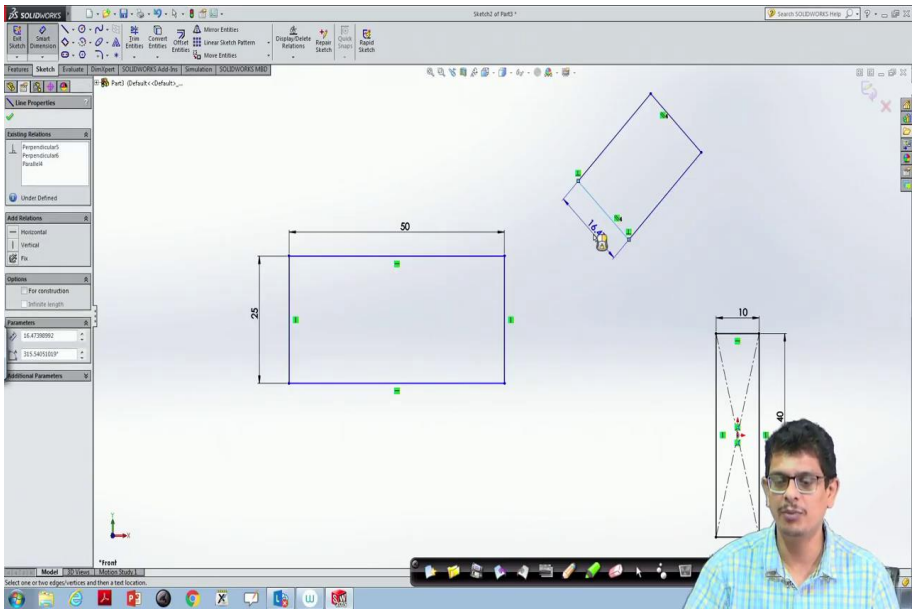

Then press Escape and Escape. So, we are done with that centre rectangle also. Now, we can use some other kind of rectangle. Here there is another option like 3 Point Corner Rectangle. We have 3 different points. I would like to construct a corner rectangle. So, what I have to do? Pick that, then move your mouse without holding any button, pick the first point, the second point may be the third point. Once it is done Escape, press Escape twice. So, it fixes the object.

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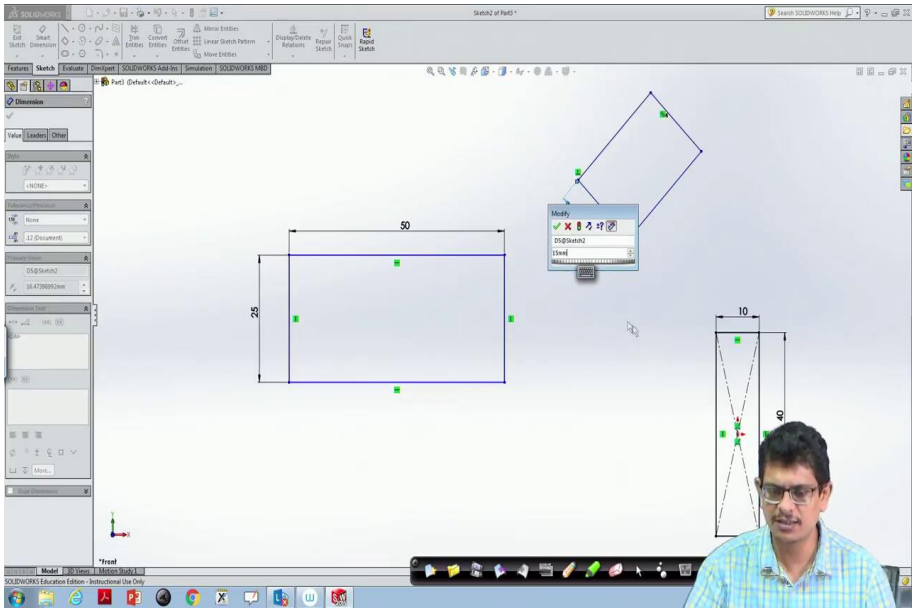

Now, use Smart Dimensions maybe change it to 15 units.

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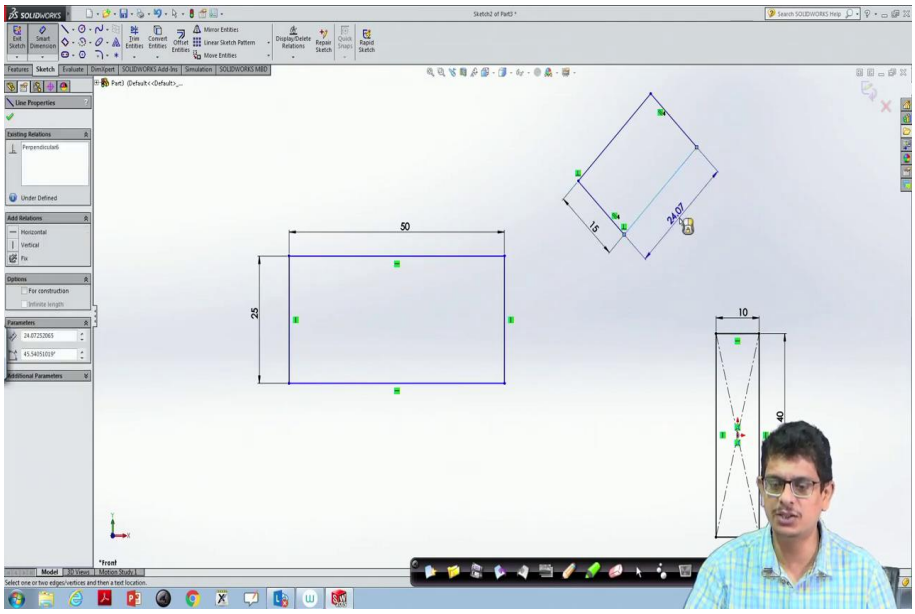

And, perhaps this one 24 units.

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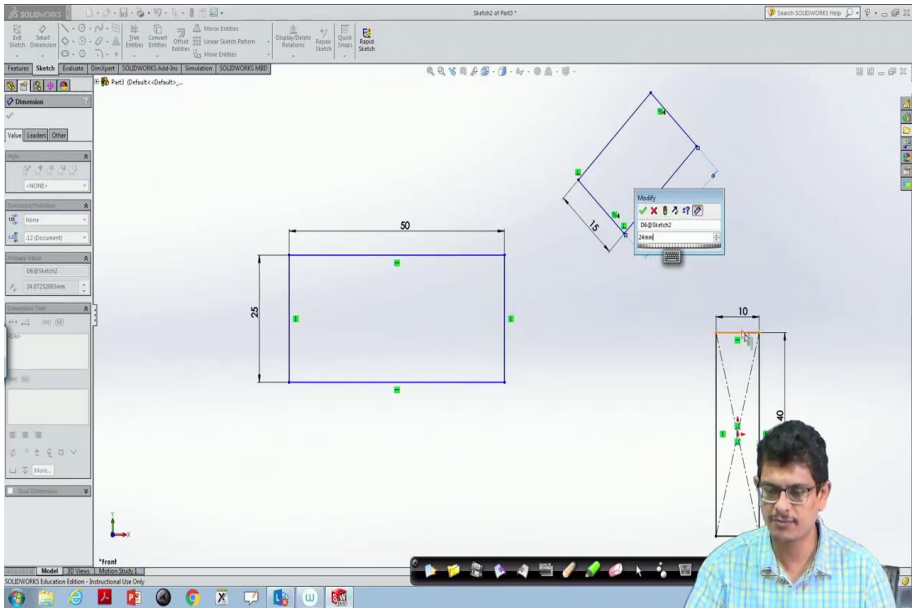

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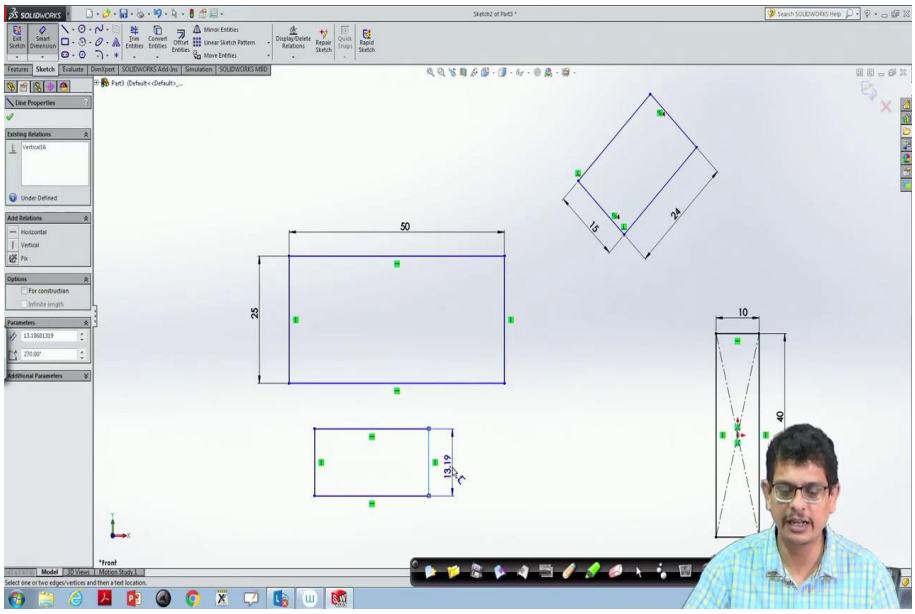

Then press Escape. This is the way we have to construct these corner rectangles using 3 points.

Now, maybe we want to construct a square. How to do that? The same rectangle we can use it. We use smart dimensions to adjust on both sides we use something like any of these corner rectangles from one point to other point. First I will draw it like a rectangle, then I will use Smart Dimensions.

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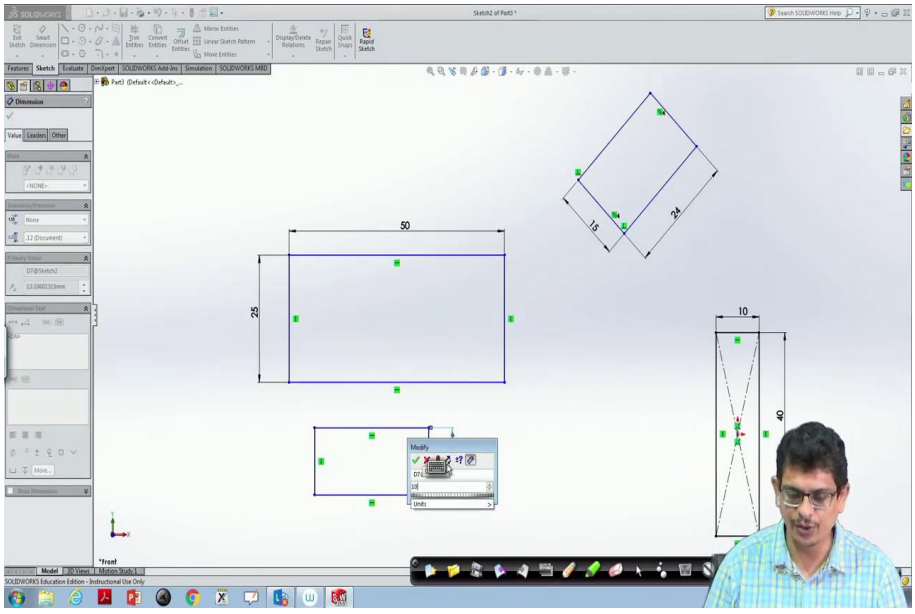

Click this one as 10 units.

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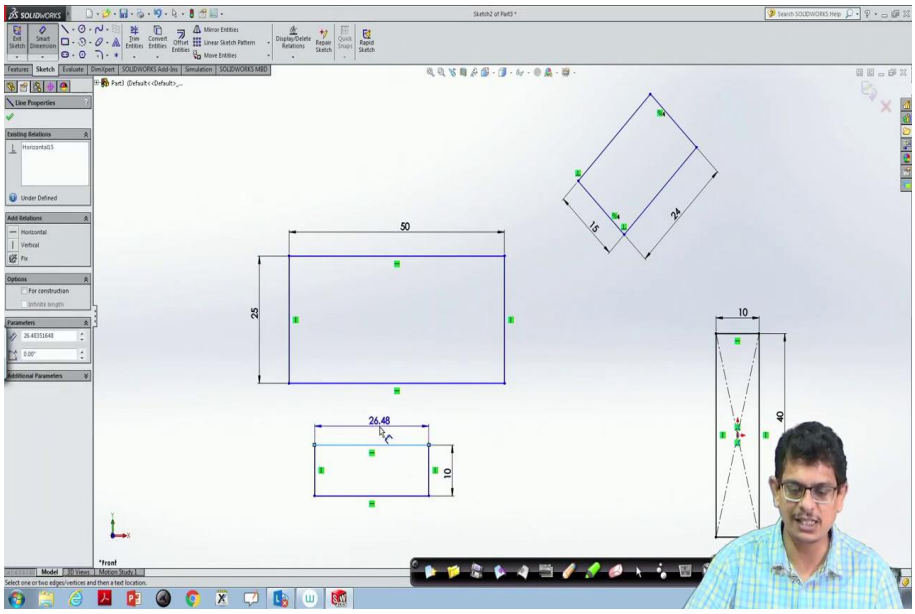

And, this one also 10 units. Then press Escape Escape Escape.

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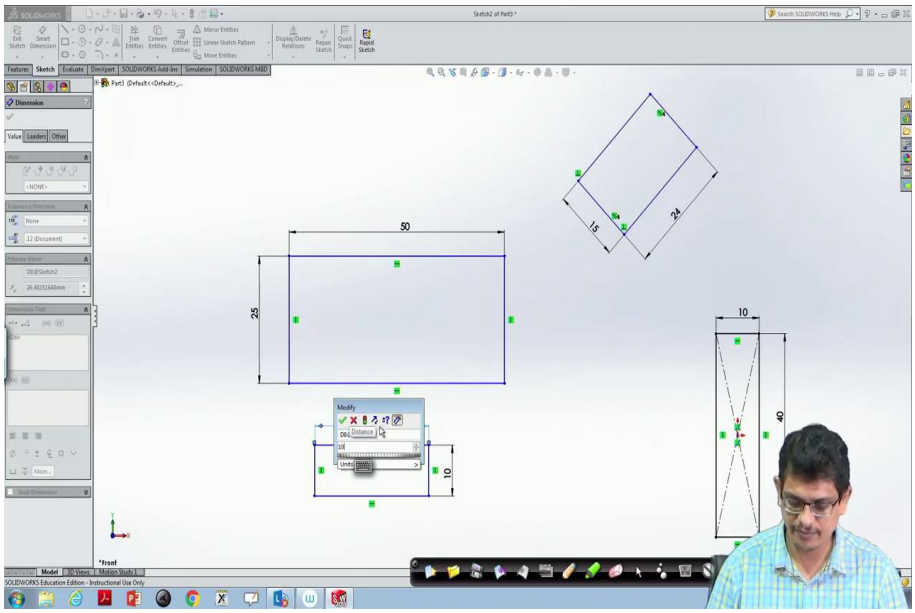

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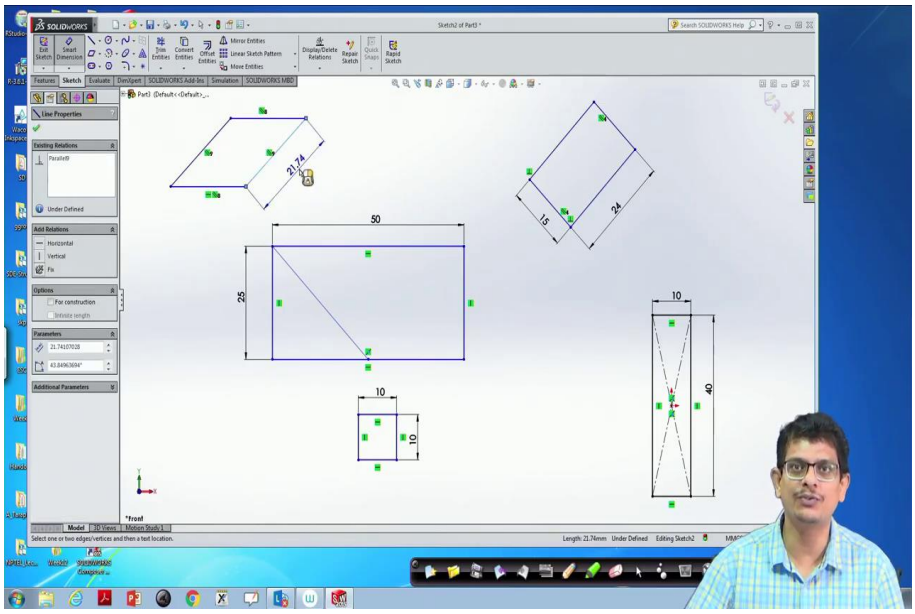

So, the same command as rectangle one can construct squares also. You would like to construct any square, any other rectangle line within the object it is pretty straight forward. You click the Line, pick one of the points from there to the midpoint of that line, you would like to connect; then press Enter. We are done with that Line.

Now, parallelogram we would like to construct because rectangles always make those edges 90 degrees, squares also 90 degrees. Parallelogram if I would like to construct what I have to do click that parallelogram. Now, if you are seeing even the mouse it the cursor level it shows something like a parallelogram.

If you are carefully looking at on this left-hand side, there are options. So, your Solidwork shows a variety of options whether you want this corner to corner kind of thing or perhaps centre corner kind of things or 3 point kind of things and many more.

And, this parallelogram we can use in that way also. Similar to rectangle how to corner we have constructed, corner to corner parallelogram also we can construct it.

The default option here is highlighted as you have to pick the first point, second point, some inclination angle 3. If we are doing it construct, let us do that. The first point, second point, you see the third point if I am moving it adjusts it is inclination angle and done. Now, based on my dimensions Smart Dimension, what I can do is I can use that maybe specify that.

Now, I do not want only in terms of length, but something like angular dimensions I would like to have it. For that purpose also, we can use smart dimension there is something like horizontally ok Ordinate Dimensions let us pick that.

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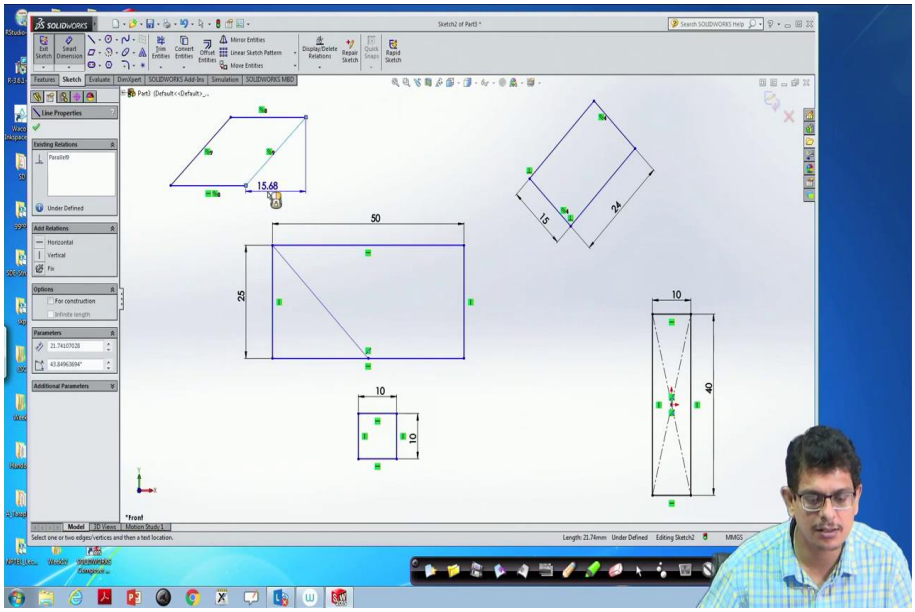

For example, the horizontal distances between these 2 points supposed to be 15 units.

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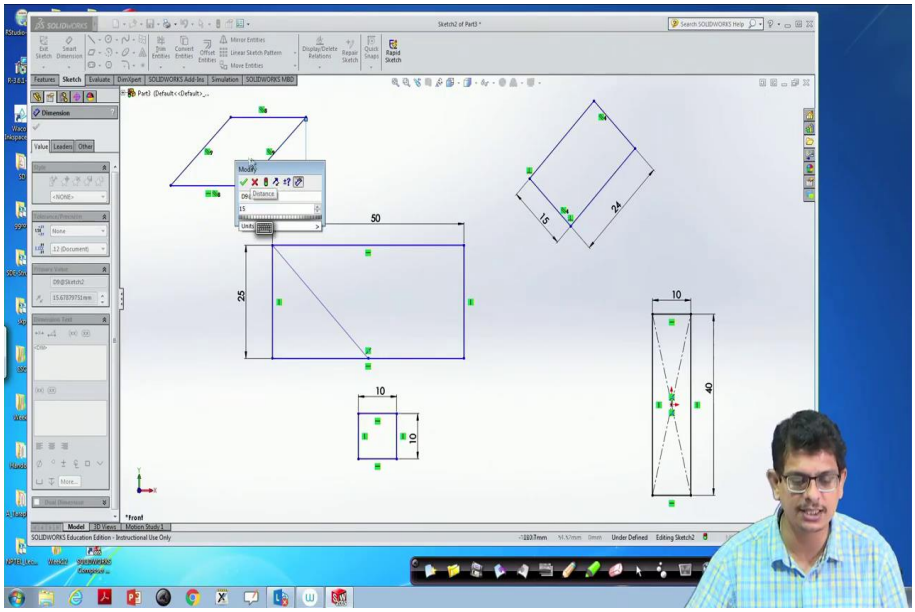

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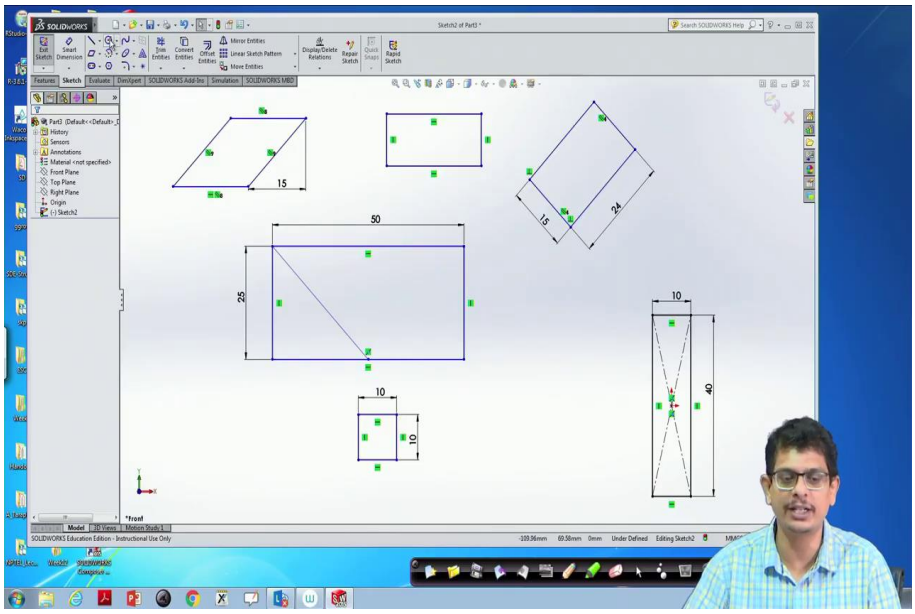

Then we click 15. From one of the corner to other corner, the horizontal distance supposed to be 15; similarly, vertical also we can adjust it. In the same parallelogram, we would like to use 2 corner points. The first point, second point, if we are picking, then it constructs directly a rectangle because the rectangle is part of this parallelogram. Now, we can straight away close this sheet to open a new one or we are interested in saving these drawings.

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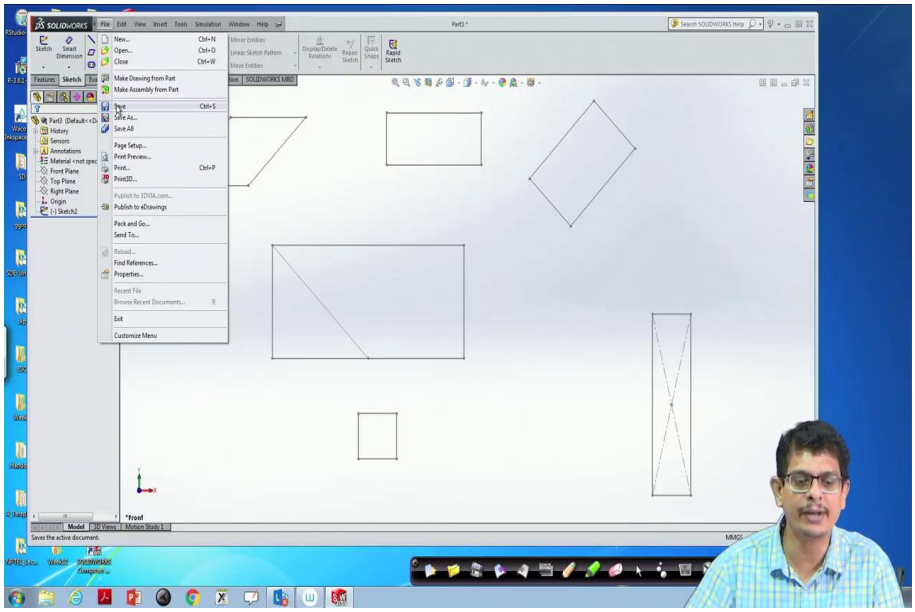

Then what we have to do is, come out of Sketch mode, go there top. There is something like New, Save kind of things. I can always save my drawing like Save.

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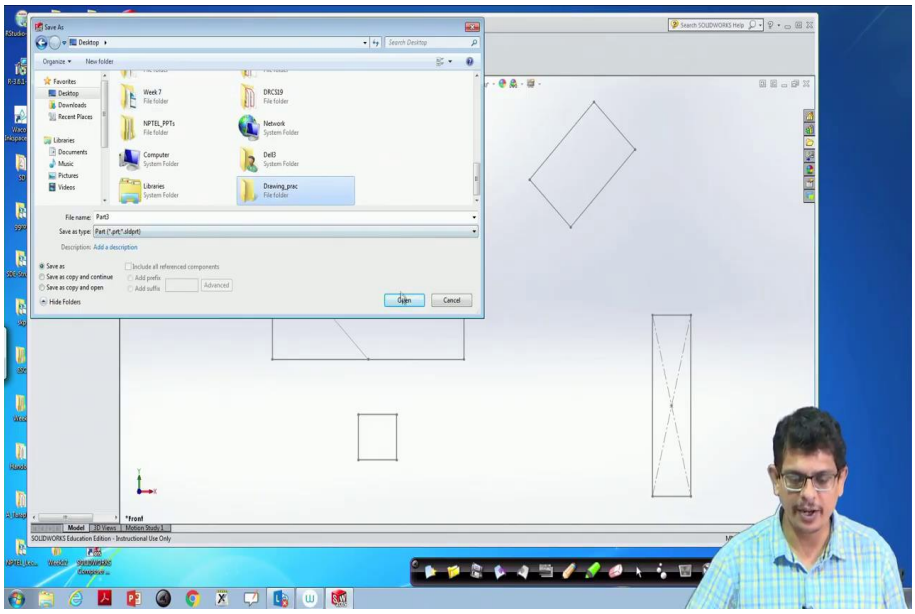

To one particular thing perhaps you can construct something at Desktop, always preferable is constructing a directory in New Folder, Drawing practice.

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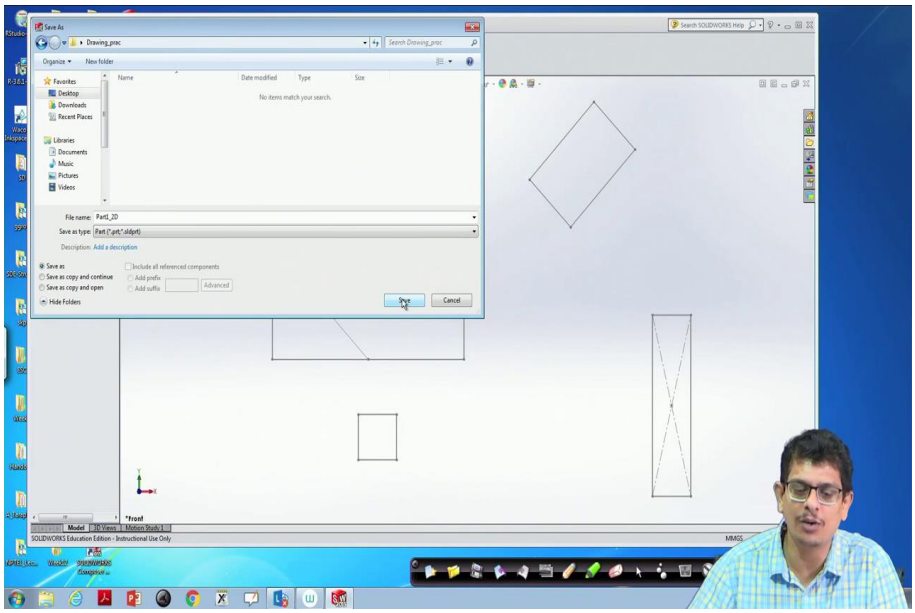

Then click Open. This is the first drawing what we would like to have I am just naming it like Part1 2D drawing. Now, the notation here for saving drawings is because Solidworks use a specialized format for saving drawings, there is something like Part option sld part. It means that Solidworks part or it is part of the drawing.

You can always save it at different versions also like you have different kind of formats JPEG you can save it and so on, but if you are going to save it like part drawing like dot prt or dot sld part, later you can invoke the drawing and update the things, add further more details or edit the drawing also we can do. The first step is you always have to save it. So, drawing always be saved.

Now, close this drawing by straight away clicking. Now, we would like to open it. Open the new one, then we click the New one. If we want to Open the older one, there is an option like Part1 2D. If you are just moving your mouse on Solidwork, it straight away shows the minimized version of what is that part we have already worked on.

So, you want to edit that one, click that one. It straight away opens the drawing and these dimensions you may not see it at this level unless we convert this entire thing into a drawing sheet. Solidworks detects what kind of dimensions when you are constructing it shows those dimensions and saves internally. Thereafter, when you save that, it would not directly show the dimensions unless you convert or invoke other built-in functions.

So, in the next class, we will learn more about other kind of things like how to draw circles on 2D sheets perhaps something like slots, straight slot - how to construct it, how to construct ellipse, how to construct a different kind of pentagonal kind of structures and other things.

Thank you very much.