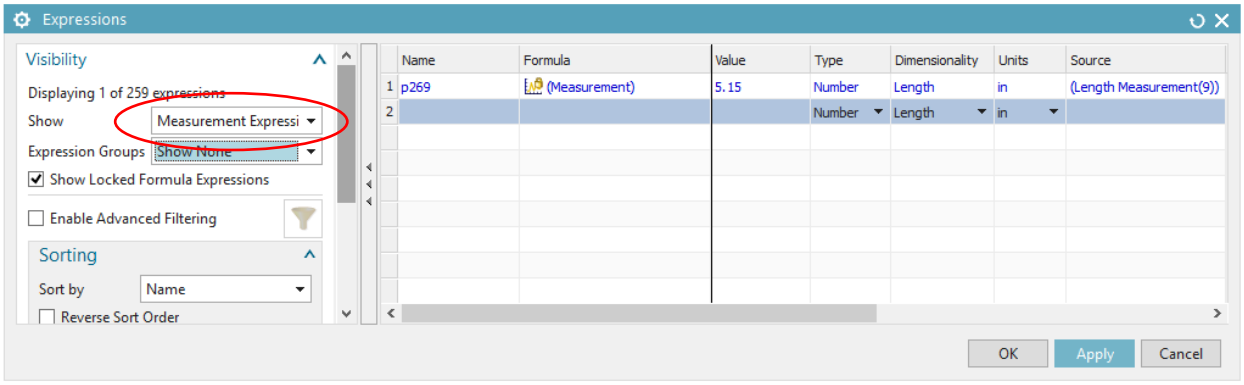
Measurement Expressions

The measurement expression is an incredibly useful expression command. It is essentially a way of capturing data such as surface area, volume, radius of gyration, etc. and using it in an expression that you can drive other geometric entities with. For example, if you create a bent up tube out of multiple arcs, splines and lines and you join them all together, you can assign a "**measure length**" measurement expression to them and you can in turn use that value to drive a straight tube. This way you can have a bent tube component part file with a straight tube represented on the drawing that shows the correct length.

In order to access the measurement expressions one has to access the **Analysis** menu and use many of the Analysis sub commands. When you edit the settings and choose "**Associative**", the results become measurement expressions.

To see the created measurement expressions from the expressions editor and select **"Measurement Expression"** from the **Show** dropdown box shown below.



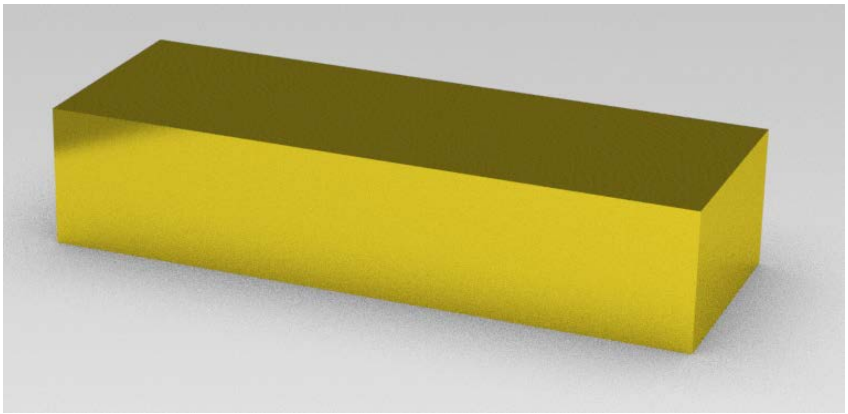
Exercise 4.1: Measurement Expression – Measure Bodies

Imagine you are in charge of a machine that spits out gold ingots. The only problem is you have to know exactly how much each one weighs and costs. You are given the length, width, height, draft angle, and edge blends. The density and price per ounce of gold are found on-line. All you have to do is to create a CAD model with a measurement expression that tells you the weight and create one more expression that calculates the total cost.

First create a bunch of standard expressions as shown below. Make sure the "**Draft_angle**" expression is set to the dimension of **angle** and the units of **degrees**.

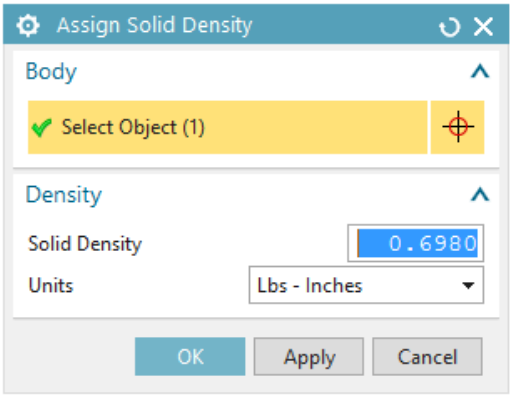
	Name	Formula	Value	Type	Dimensionality	Units
1	Corner_Radius	0.3	0.3	Number	Length	in
2	Draft_Angle	8	8	Number	Angle	degrees
3	Height	1.5	1.5	Number	Length	in
4	Length	7	7	Number	Length	in
5	Width	2.5	2.5	Number	Length	in

Next use the Length, Width and Height dimensions to create a block.



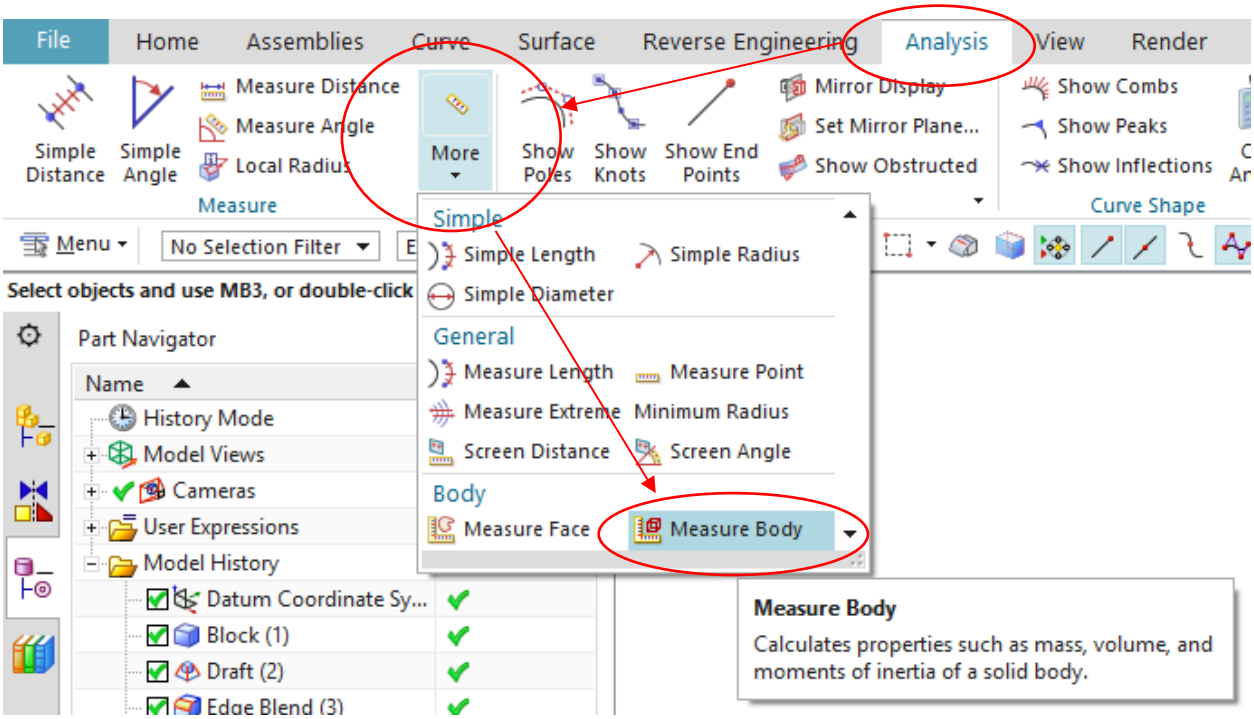
Then use the **Draft_angle**, and **Corner_radius** expressions to complete it. If you want to get fancy you can use the **Text** command to extrude lettering on the top.

Next apply the correct density to the model. The internet says the density of gold is 19.32 grams per cm^3. That is .698 lbs. per $inch^3$. If you do not have Gold as an option in your materials list you can edit the density of the solid by selecting **Edit / Feature / Solid Density**.



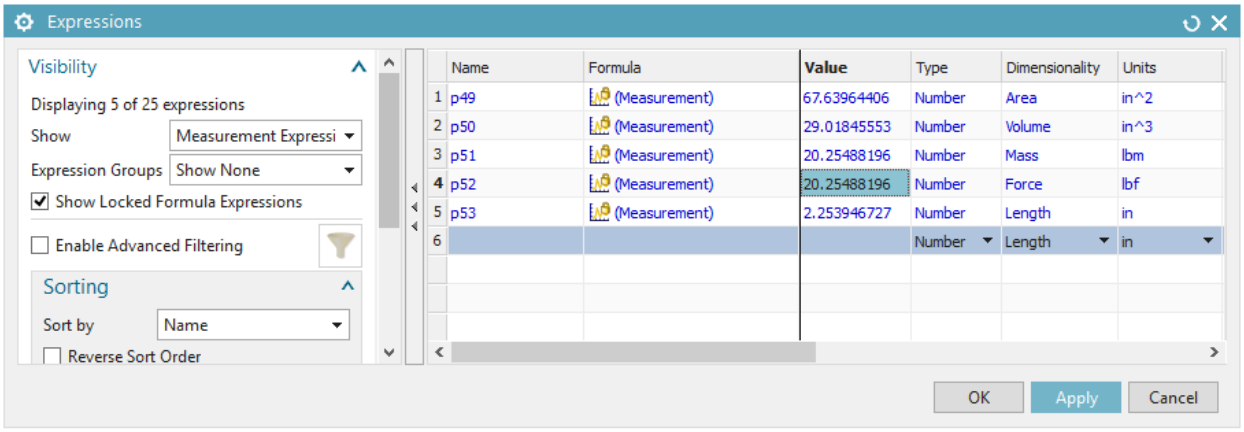
Enter in .698 and click on the solid body. Select OK.

Next access the Analysis tab and select the **Measure Bodies** option from the Measure **"More"** menu.

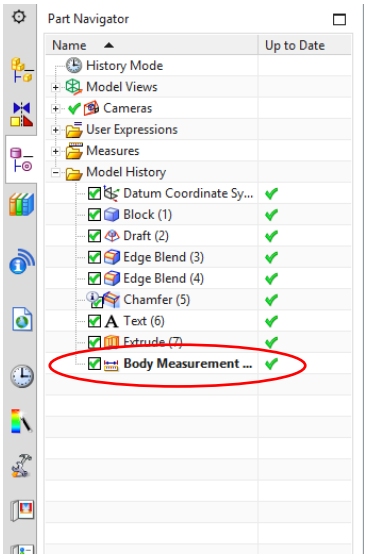


Select the gold bar, select **OK**, and a number of new expressions will be created. Make sure the Associative box is checked.

As you can see the weight of such a bar is 20.25 lbs. Not bad.



Notice also that this activity creates a **Body Measurement** feature in the Part Navigator.



Next make a stamp that tells you how much the bar is worth. First make an expression that assumes the price of gold to be $1752 per ounce. We have about $28,000 per pound. Change the dimension to "**Constant**" and create a new expression "price= (whatever parameter is associated with the weight)*28,000". In this case it's P52 (lbf). Do not use lbm.

	Name	Formula	Value	Type	Dimensionality	Units
1	p49	(Measurement)	67.63964406	Number	Area	in^2
2	p50	(Measurement)	29.01845553	Number	Volume	in^3
3	p51	(Measurement)	20.25488196	Number	Mass	lbm
4	p52	(Measurement)	20.25488196	Number	Force	lbf
5	p53	(Measurement)	2.253946727	Number	Length	in
6	Price	28000*p52	567136.6948	Number	Constant	

Finally, calculate what a 12 in length, by 4 inch wide by 4 inch high bar would be worth.

	Name	Formula	Value	Type	Dimensionality	Units
1	Corner_Radius	0.3	0.3	Number	Length	in
2	Draft_Angle	8	8	Number	Angle	degrees
3	Height	4	4	Number	Length	in
4	Length	12	12	Number	Length	in
5	Price	28000*p52	4474632.795	Number	Constant	
6	Width	4	4	Number	Length	in

A mere 4.5 million dollars – not bad for a day's work.

End of Exercise