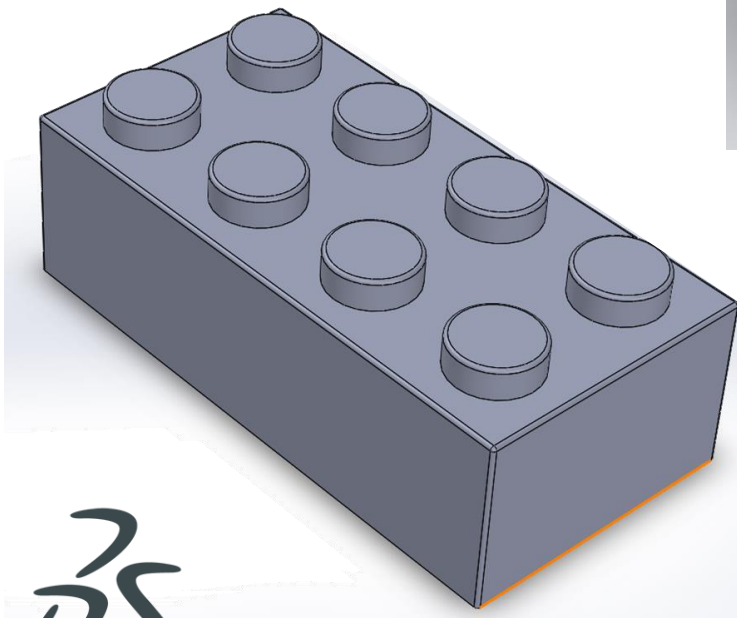
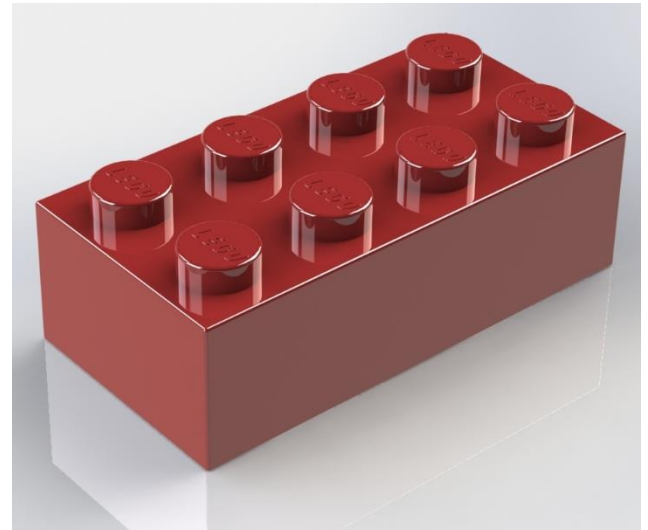


Solidworks/2014

3D Modelling Practice



SOLIDWORKS

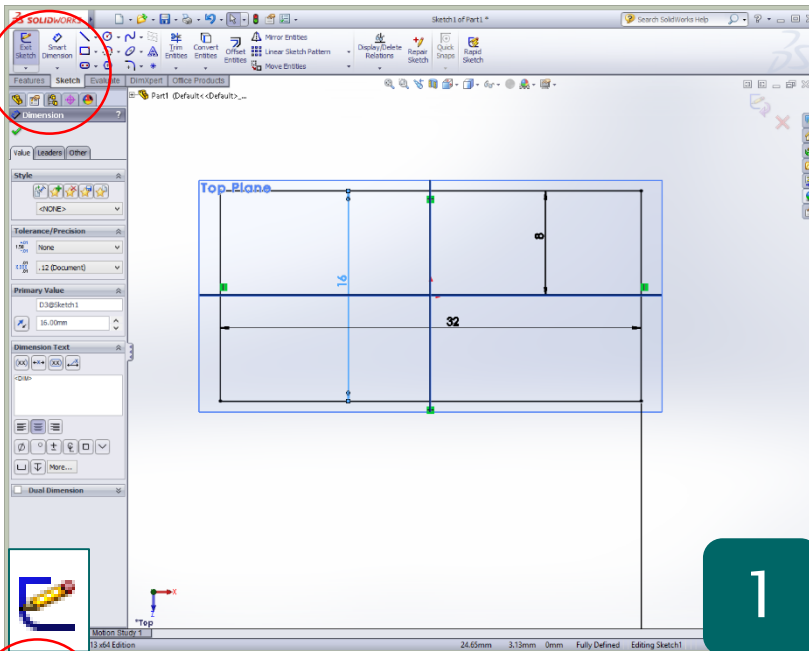
Learning Outcome; 4 x 4 Lego Brick

Skill Level; 1.1 - Beginner

3D; *Extrude Boss, Extruded Cut, Fillet (face/line), Pattern*

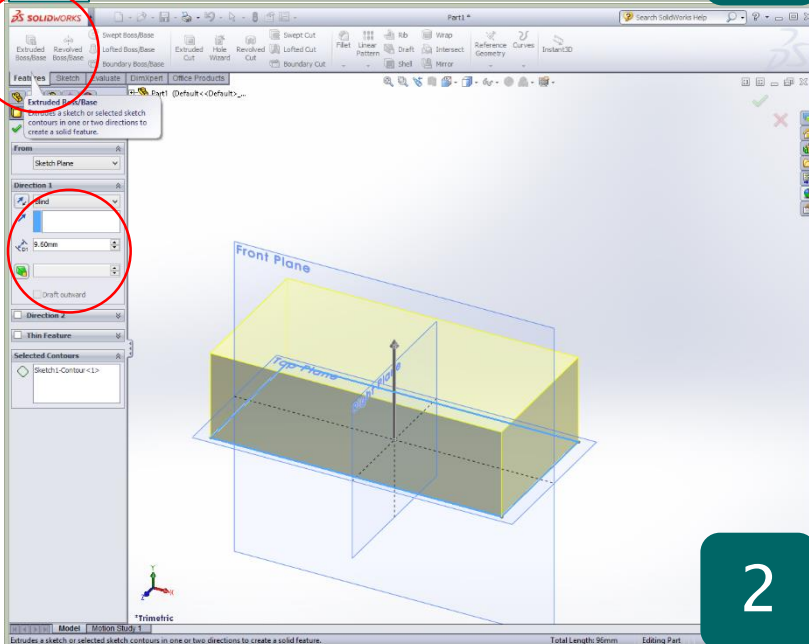
2D; *Planes, Smart Dimension, Line tool, Circle Tool, Mirror, Trim, Offset*





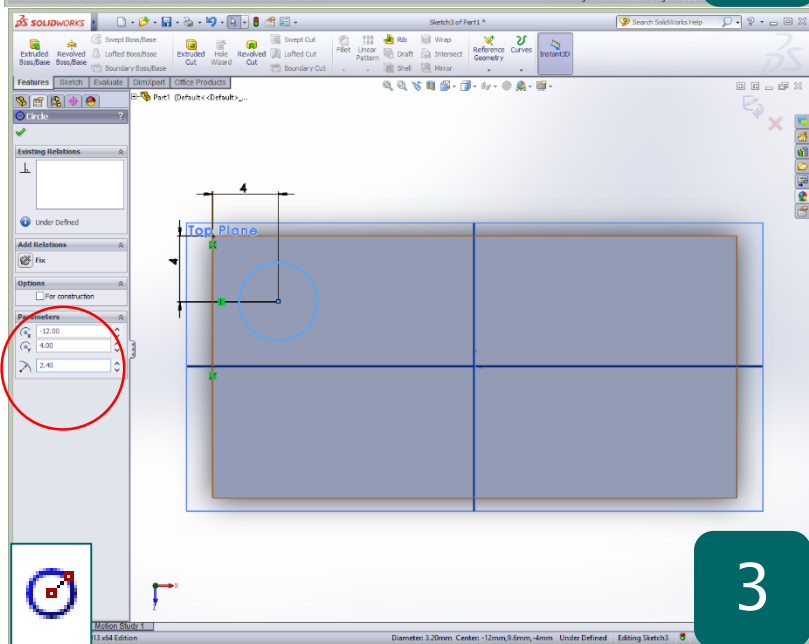
- Begin the Lego brick by using the rectangle tool as before.
- Select a 'sketch plane' and access the 'sketch toolbar' on the top left
- Click Sketch and draw a rectangle from the top left corner to the bottom right of the 'sketch planes'
- Use the 'smart dimension' tool to set the rectangle to **32 x 16mm** ensuring it remains central to the design planes
- Remember the 'smart dimension' tool allows you to select two line and modify the dimension in between them

Why? – When creating a sketch which will form the foundation of your model the dimensions must be related to the design planes to ensure the model is robust and well-constructed.



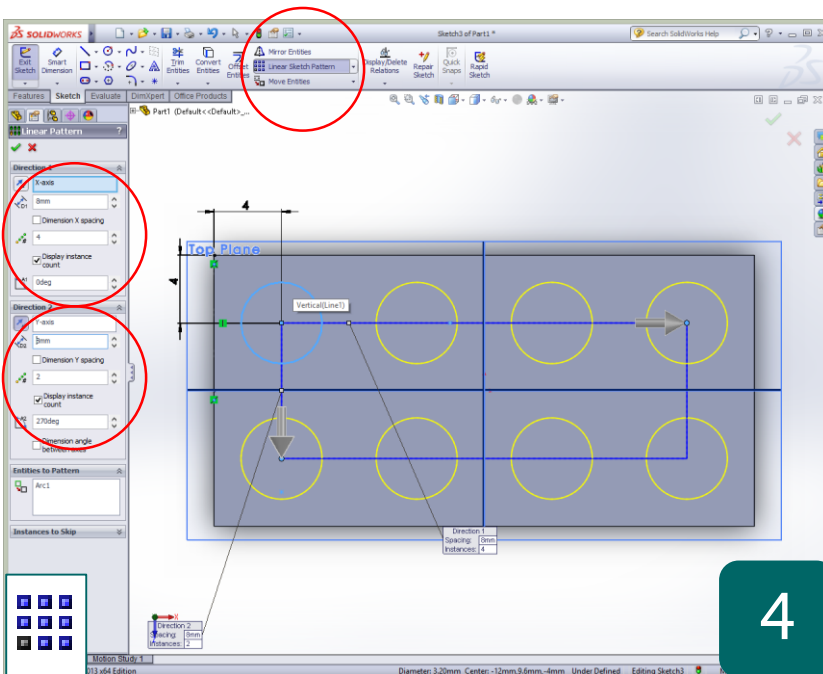
- Access the 'Features' menu and click the 'Extruded Boss' button
- Set the depth of the extrude to **9.6mm** in the feature menu on the left
- Confirm the feature with the green tick

Why? – In some cases you can use the dark grey arrow in the centre of the model to adjust the depth of the extrusion however it accuracy needed.



- Select the top face of the newly created cuboid and access the 'Sketch' menu
- Click 'Sketch' and use the **CTRL + 8** shortcut to bring your 2D view normal to the sketch
- Using the circle tool create a circle near the top left of the model with a radius of **2.4mm**
- Select the 'smart dimension' tool in the sketch toolbar and using the centre of the circle and the top/left edge of the rectangle dimension **4mm** for each as shown
- Confirm this with the green tick

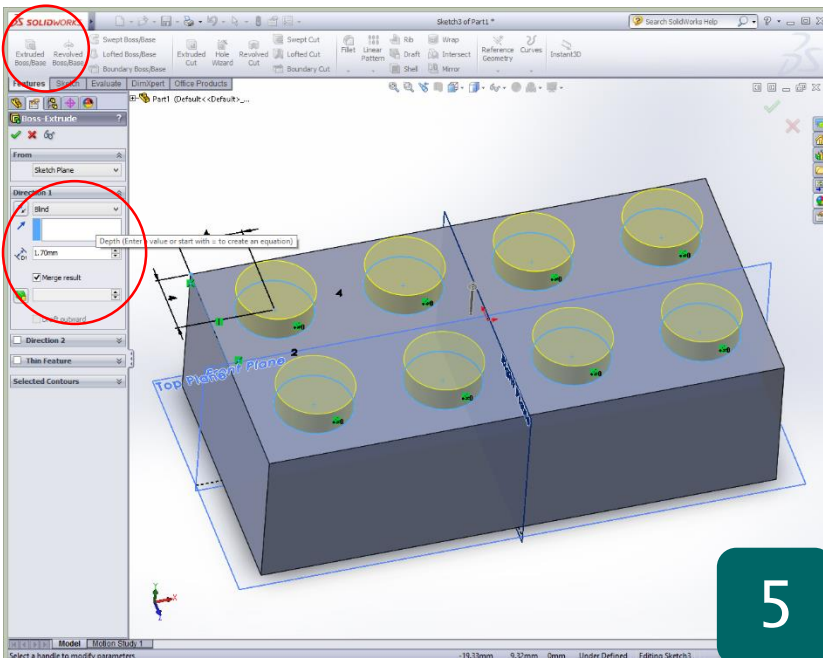
Why? – Using the smart dimension tool ensures you can locate a shape accurately without the need for construction lines which saves time



4

- Each of the circles is the same size and distance apart and therefore the **'Linear Pattern Tool'** can be used to save time
- Select the sketched circle then click the **'Linear Pattern'** tool from the sketch menu
- This will load a new feature menu on the left of the workspace
- Set the distance to **8mm** in the dimension box for **Direction 1** and **Direction 2**
- Change the number of repeats from 1 to **4** for **'Direction 1'**, and **2** for **'Direction 2'**
- If the preview looks the same as shown confirm the feature using the green tick

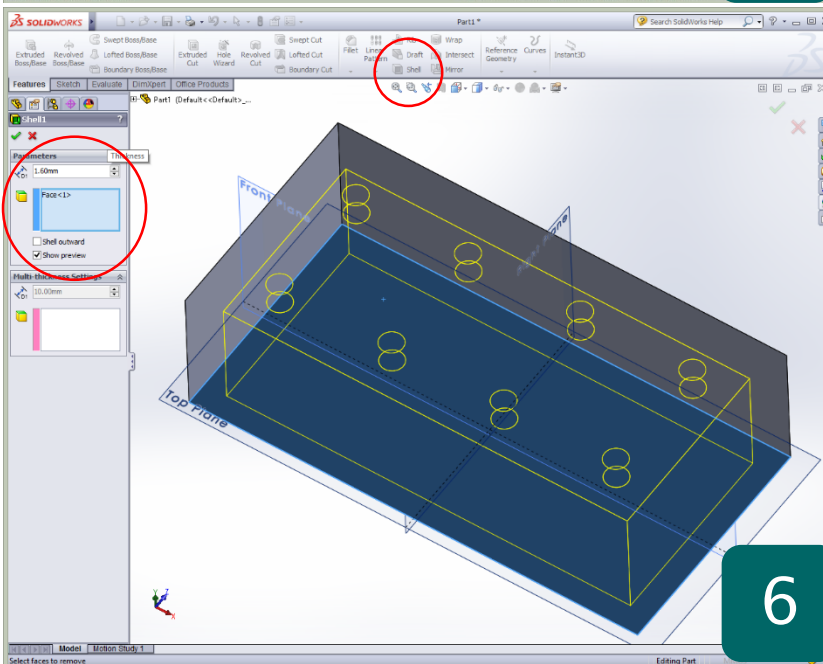
Why? – The pattern tool ensures your dimensions are consistent and save time in the modelling process. Features can also be patterned in the feature menu if required in the same way.



5

- Select the **'Extruded Boss'** tool from the **'features'** menu and extrude the sketch by **1.7mm** away from the block
- Confirm the extrude with the green tick if the preview is shown correctly

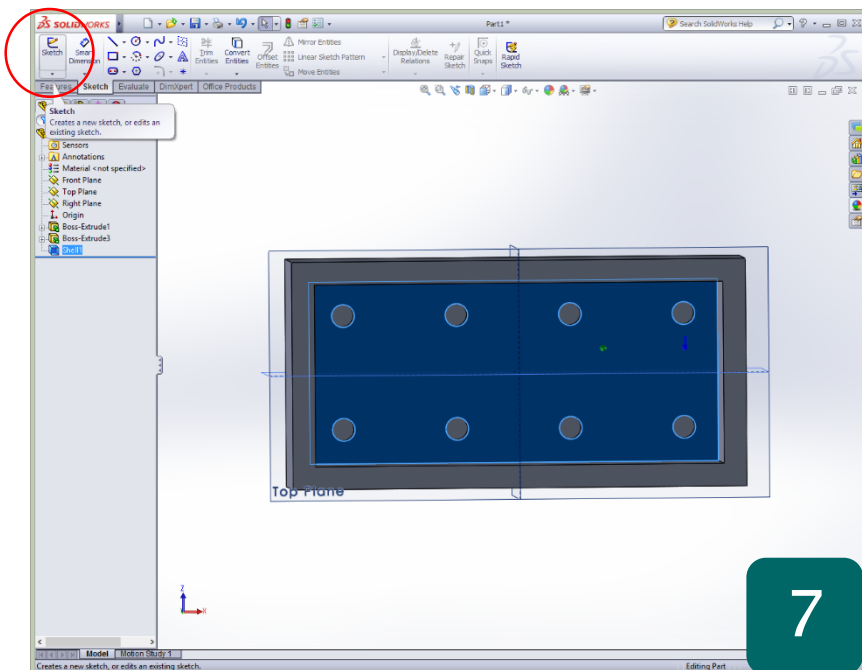
Why?; The extrude tool is the quickest way to create any 3D shape and can be used to add a draft angle to the sides to create a tapered extrusion. A second direction can also be added at the same time.



6

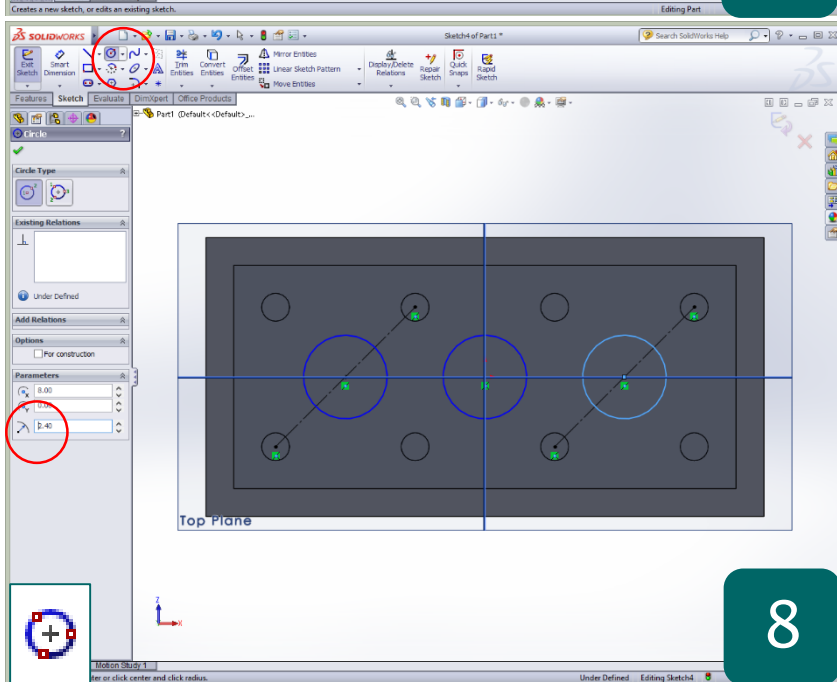
- All LEGO bricks are hollow with a wall thickness **1.6mm**
- Access the **'Features'** menu and find the **'Shell'** feature on the top right of the menu
- Click on the **'Shell'** button and select the bottom face of the model
- Set the wall thickness to **1.6mm** in the distance section of the left feature menu
- Click the green tick to confirm the feature
- If there is no obvious change go back into the feature and ensure you have selected the bottom face in the blue menu

Why? – The shell feature removes all of the interior of a solid model leaving only a wall thickness. This is useful when creating boxes and injection moulded products which have a constant wall thickness



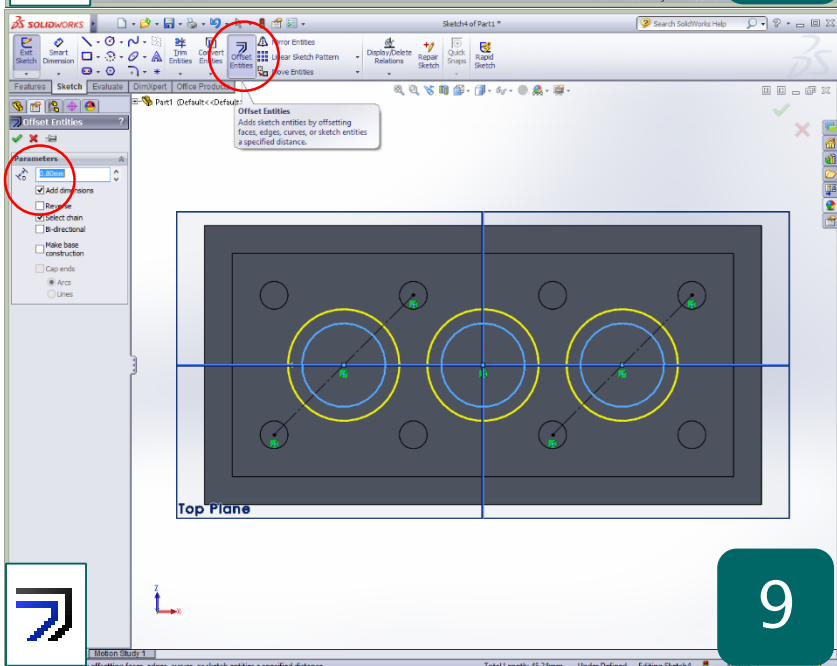
- If the 'shell' features worked correctly you should be left with a hollowed out block
- Click the inside face of the block
- Access the 'sketch' toolbar and click 'sketch'
- Orientate your workspace so that it is normal to the sketch using the **CTRL + 8** shortcut command

Why? – Always ensure the workspace is originated when sketching as you are working in 2D and errors can easily be made when viewing in 3D



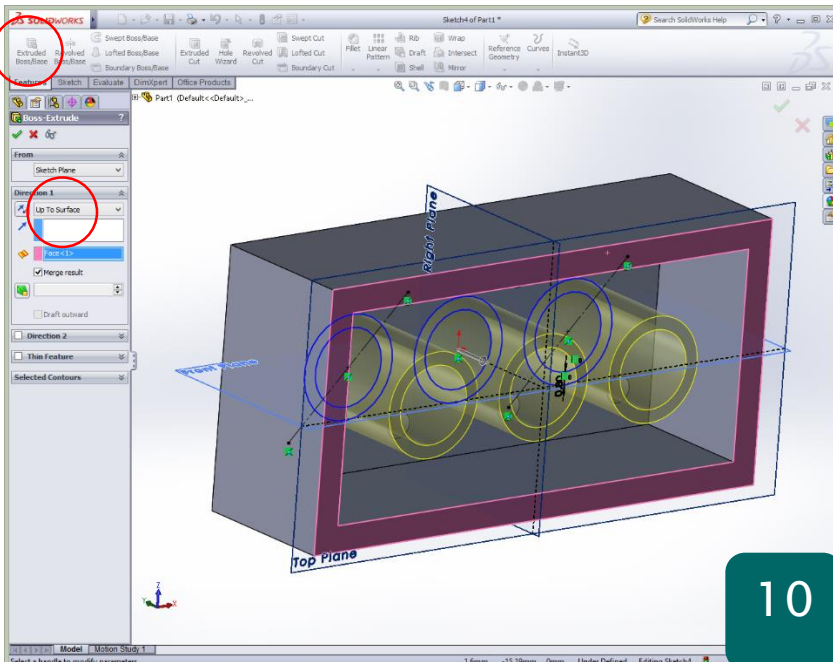
- Select the 'line tool' from the 'sketch' menu and hover over the small bottom left circle
- A smaller circle should appear and allow you to snap to the centre
- Draw a diagonal line from one centre to the other as shown in the picture
- Change the line to 'For construction' in the left tool menu
- Repeat this process with the far right circles as shown
- Select the 'circle' tool from the 'sketch' menu and hover over the midpoint of the construction line
- When found click to place the centre and type **2.4mm** into the dimension box
- Repeat using the midpoint of the block where the planes meet and other line

Why? – using the midpoints is the quickest way to complete this although they could be dimensioned



- Access the 'Sketch' toolbar and find the 'Offset Entities' tool on the top left
- Click to select it and type 0.8mm into the distance box in the feature menu
- Select all three large circles so that the preview looks as in the left image
- Click the green tick to confirm changes

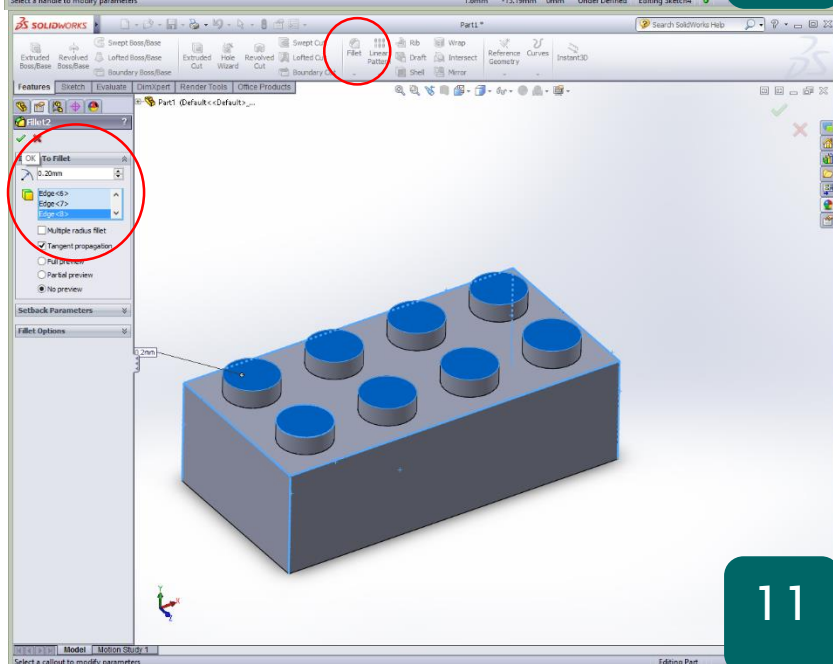
Why? – The offset tool allows you to take any line or shape and create a copy a set distance away. This can be in either direction of the line



10

- Access the **'Feature'** toolbar and click on the **'Extruded Boss'** feature
- Do not set a depth for the extrude
- Instead click the drop down menu next to the double arrows
- Select **'Up to surface'** and then select the bottom face of the block shown in the picture
- Click the green tick to confirm the feature

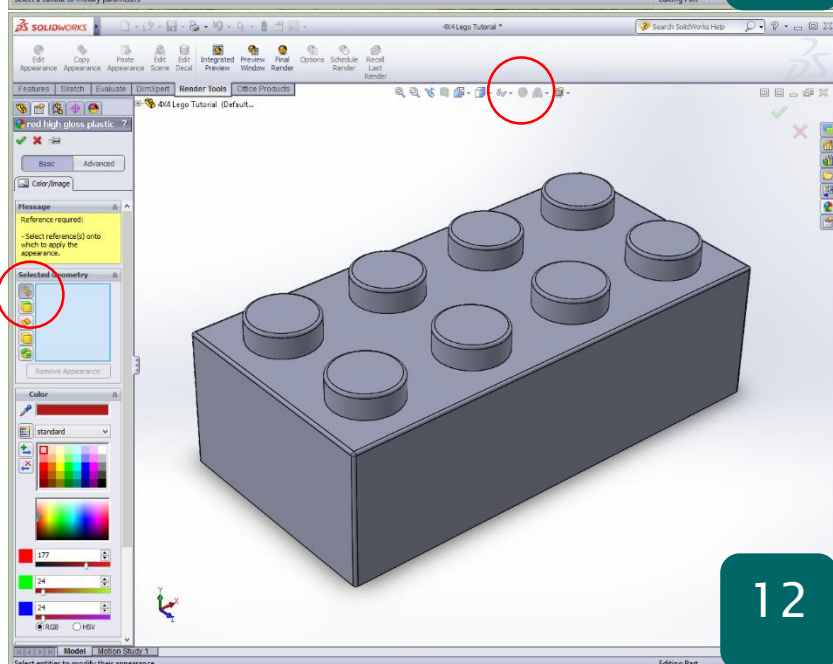
Why? – When extruding a shape you can choose a range of options such as 'up to surface' if you are unsure of the dimension or it is not important to the model.



11

- Finally the Lego brick must be finished with a range of small **'Fillet'**
- Access the **'features'** toolbar and select **'fillet'**
- Select all of the top faces of the cylinders and all of the exterior edges as shown in the diagram
- Do not select the base edges – these are straight
- Type in a radius of **0.2mm**
- Click the green tick to confirm

Why? – Lego bricks are injection moulded and are rounded in the mould to make assembly with other blocks easier and avoid sharp edges on the brick



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- Finally as before with the Dice the model requires a render to improve its realism
- Select the multicolour **'edit appearances'** ball in the middle of the screen
- Choose an appropriate material such as High Gloss Plastic and double click it in the right hand preview
- This will apply to the whole model
- Finally render using **'Photoview 360'** from the **'Office products'** toolbar above

Why? – Using the inbuilt Render software 'Photoview 360' adds detail creating a realistic light condition on the model. The materials will always appear realistic when properly rendered