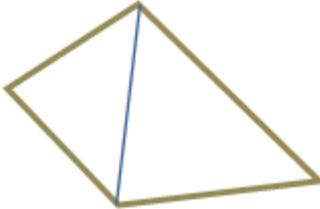# *Polygons**

Ms Jones is teaching about shapes and their properties in a Year 6 class (student age 10-11). "We know that the sum of the angles in a triangle is 180 degrees", she says. She then asks:

Ms Jones: Can you find a formula for the sum of the angles *for any polygon?* You may wish to start with filling in the table (she shows them Figure 1), calculating the sum of the angles of other polygons!

Name of polygon	Number of sides	Sum of angles
triangle	3	180

Figure 1. Ms Jones' table

Figure 2. Anna's quadrilateral

Figure 3. Anna's pentagon

Neil: This is too hard. *Any* polygon?! This could have thousands of sides! …. And what's the point? Can't I just measure the angles every time I need to know anything about them?

Anna: Well, I will start with a small one. What's it called? Quadri-something …lateral. Quadrilateral! *[She draws the quadrilateral in Figure 2 and then draws one of its diagonals.]* Look at this! This is now two triangles. So, 180 plus 180 is... 360. [*She fills in the table with "quadrilateral, 4, 360" in Figure 4*]. I think this may work for a five-sided polygon too, a …pentagon! *[She draws the pentagon in Figure 3 and then draws two diagonals from one vertex.]* That's now three triangles! 3 times 180.… is 540**!** [*She fills in the table with "pentagon, 5, 540" in Figure 4*].   For a six sided polygon…a hexagon…

Barack [a little weary]**:** Anna, this is taking too long... Look! [*Barack shows Anna her table in Figure 4*]. If we have three sides, we end up with one lot of 180 degrees. For four sides, you did two times 180, for five sides you did three times 180… Isn't it always the number of sides minus two, times 180?!

Name of polygon	*Number of sides*	*Sum of angles*
triangle	*3*	*180*
quadrilateral	4	360
pentagon	5	540

Figure 4. Anna's table

Clive [quite annoyed]**:** Ah ... Too complicated both of you. A triangle is three angles for 180. That's 60 degrees each. Add one angle every time so for a four sided shape it is 180+60…240.... And so on! Easy and boring!
 You are the teacher and you just heard what Neil, Anna, Barack and Clive said….

Find a formula for the sum of angles for any polygon. Explain your answer.
How would you respond to Anna?
How would you respond to Barack?
How would you respond to Clive?
How would you respond to the whole class – also in the light of Neil's initial comment – and conclude the lesson?