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CIRCLES 1

For students to make sense of the formula '$C = \pi d$', where C is the circumference and d is the diameter of a circle, it is not easy yet is most important. Indeed, sense-making of mathematics *per se* is fundamental to students becoming more confident and, therefore, more competent mathematicians. How students' understanding is formed, so they can use and apply the required knowledge to a range of situations, is equally important.

The idea I offer here is one I have used with some 'success' and is based upon students working with strips of scrap paper of different lengths. The idea works as follows:

- Take a strip of paper and measure its length to the nearest millimetre.
- Join the two ends together with sellotape without any overlap; the previous measure is now the circumference of the circle.
- By rolling a finger of each hand around the inside of the strip form a shape as close as possible to a circle.
- Measure the diameter of the circle; to do this students might take two or three measures to establish as accurate a measure as possible.
- Record the two measures of diameter and circumference.
- Repeat these steps for a number of different length strips.

Students can draw a graph of d against C, to help them recognize the connection between the two measures. By graphing the multiples of three on the same pair of axes, students may recognize a similarity between the two graphs.

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CIRCLES 2

The intention here is for students to become familiar with and form connections, both algebraically and graphically, between pairs of symbols C, d, r, and the constant π. I find the following questions can be useful.

How are d and r connected (i.e. $d = r \times 2$)?
What does the graph of r against d look like?

How are r and d connected?
What does the graph of d against r look like?

How are C and d connected?
What does the graph of d against C look like?

How are d and C connected?
What does the graph of C against d look like?

How are C and r connected?
What does the graph of r against C look like?

How are r and C connected?
What does the graph of C against r look like?

To calculate the area of a circle, again, teachers will have their favourite tasks. One approach I have found useful is to 'tell' students what the formula is and then ask them to gather data to try to verify the formula.

I ask students to draw a number of circles on 1cm-square paper, each with different radii, and count whole and part squares to gain approximate answers. Any radii between 2 cm and 10 cm can be chosen (on A4 paper) and if students are encouraged to use radii such as 3.8 cm or 6.2 cm, they can see how accurate their results are by comparison to applying the formula.

By adding the symbol A (area) to the earlier list, students can attempt to construct complex connections. With the four symbols r, d, C and A there are 12 pairs of connections (counting reverses), the most complicated perhaps being the connection between A and C.