

The Wonder That Is Pi

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This blog began life more than two decades ago, as part of a series of lectures I delivered to very bright first-year engineering students at an Australian university.

The number π (pronounced “pie”) has been recognized from time immemorial because its physical significance can be grasped easily: it is the ratio of the circumference of a circle to its diameter. But who would have thought that such an innocent ratio would exercise such endless fascination because of the complexities enfolded into it?

Not surprisingly, some students I met recently wanted to know more about π . Accordingly, I have refreshed and revised my original presentation to better accord with the form and substance of a blog. The online references have also been updated to keep up with a rapidly changing Web.

If there are any errors or omissions, please [email](#) me your feedback.

Circumference, diameter and π

The straight line or [geodesic](#) is the shortest distance between any two points on a plane, sphere, or other space. The circle is the [locus](#) traversed by a moving point that is [equidistant](#) from another fixed point on a two-dimensional plane. It is the most [symmetrical](#) figure on the plane. The [diameter](#) is the name given both to any straight line passing through the centre of the circle—intersecting it at two points—as well as to its length. When we divide the [perimeter](#) of circle, more properly called its [circumference](#), C , by its diameter, d , we get the enigmatic constant π , which has a value between 3.141 and 3.142:

$$\frac{C}{d} = \pi. \quad (1)$$

The diameter d is twice the radius r , and substituting for d into Equation (1), we get the well-known school formula:

$$C = \pi d = 2\pi r \approx 2 \left[\frac{22}{7} \right] r \approx 6.28r. \quad (2)$$

Note, however, that π is *not exactly equal* to $\frac{22}{7}$. This value is a convenient *rational fraction approximation* for π that serves well in elementary contexts.¹

You might reasonably wonder whether the ratio of the circumference to the diameter of *any* circle is *always* π . The answer is “Yes”, because *all circles are similar*. The ratios of corresponding lengths of similar figures are equal. This idea is also covered in my blog [“A tale of two measures: degrees and radians”](#).

Figure 1 shows the relationships in Equation (1) and Equation (2) pictorially. The circumference of a circle is about 6.28 times its radius. Why this should be so is a mystery of Nature.

¹See [“A tale of two measures: degrees and radians”](#).

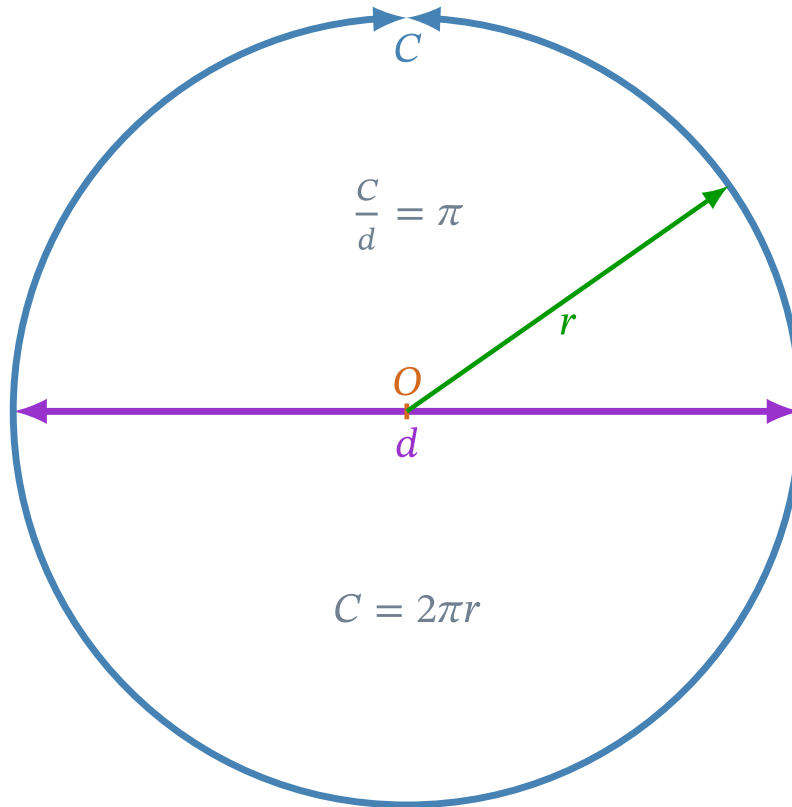


Figure 1: The ratio of the circumference to the diameter of *any* circle is π .

Acknowledgements

Feedback

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