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# The Cairo Affair

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## Part Ten: A Ratio is a Ratio, Horatio!

**D. and S. Birks**  
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Editing contributions by Daniel Birks.

Abstract: An Allegory of modern science.

## ***The Cairo Affair: Part Ten—A Ratio is a Ratio, Horatio!***

Dr. Z.: “Wow! I’m impressed, my friend! And I’m not easily impressed. A disproof of pi ( $\pi$ )! Everything you wanted to know about pi, but were afraid to ask! Just the facts, ma’am! (with a small laugh) But, let’s take it from the top, where pi ( $\pi$ ) first came on the scene.”

E.Q.: “Okay. In 1706, William Jones was the first to use the Greek letter  $\pi$  to represent the ratio of the circle’s circumference to its diameter,  $C/d$  (as approximately 3 to 1, or 3.14...):

$$\frac{C}{d} = 3.14159 \dots = \pi$$

And then, in 1748, Euler wrote:

***For the sake of brevity we will write this number as  $\pi$ ; thus  $\pi$  is equal to half the circumference of a circle of radius 1.***

There, you can see the beginnings of the lie: Jones’ definition of pi ( $\pi$ ) had the ratio of  $C/d$  as three to one, with the diameter as approximately a third of the circumference. But somehow Euler twisted that into a half!”

Dr. Z (chuckling): “You can’t help but appreciate Euler’s creative ‘math’:

1. With the diameter ( $d$ ) equal to two times the radius ( $2r$ ), Euler wrote

$$\pi = \frac{C}{d} \quad \text{as} \quad \pi = \frac{C}{2r} .$$

2. Then by defining the radius as one, Euler could write the equation

$$\pi = \frac{C}{2r} \quad \text{as} \quad \pi = \frac{C}{2(1)} ,$$

3. And end up with pi equal to half the circumference and 180 degrees

$$\pi = \frac{C}{2} = 180 \text{ degrees} . ”$$

E.Q.: “Right. At first glance, you almost buy it! It looks plausible enough.

Euler called the radius one, which made the diameter equal two. So dividing the circumference by the diameter (as two) he got half the circumference (or 180 degrees)!”

Archie: “But what a hoot! Sure, if I got out my Swiss Army Knife and ‘divided’ a circle with a diameter, I’d get half the circumference. You can always divide the circumference by two and get half the circumference. That’s a no-brainer. Problem is, you can never ever divide the length of the circumference by the length of the diameter,  $C/d$ , and get half the circumference. Like you said before...That’d be insane, Jane!

So Euler was playing a numbers game.”

Dr. Z: "Yeah, he was playing three-card Monte—that centuries-old game of misdirection! First, to draw you in, it all looks kosher. But keep your eye on the numbers:

$$\frac{6.28}{2} = \frac{3.14}{1} = \frac{C}{d}$$

No argument, the number 3.14 is half the number 6.28 (just as the number 1 is half of 2). Ha ha, but now the fun part: Euler's so-called 'math' only works where the diameter is two! And the diameter is never two anywhere else! So if you take the numbers further:

$$\frac{C}{d} = \frac{3.14}{1} = \frac{6.28}{2} = \frac{9.42}{3} = \frac{12.56}{4}, \text{ etc.} "$$

E.Q.: "Yep, when you divide 9.42 by 3, the result is 3.14. But 3.14 certainly isn't half of 9.42! Likewise, when you divide 12.56 by 4 the result is 3.14. But 3.14 isn't half of 12.56 either! The basic ratio of the circumference to the diameter, C/d (3.14/1, 6.28/2, 9.42/3, 12.56/4, etc.) is always three to one, period! So you can never divide the length of the circumference by the length of the diameter and get half the circumference."

Dr. Z (chuckling): "The halves and half nots? Almost makes you smile. So that gives us our 'Miguel Caballero' bulletproof, proof:

- a) As Euler defined pi ( $\pi$ ) as being equal to half the circumference (180 degrees),
- b) And as the length of the circumference divided by the length of the diameter, C/d, can **NEVER** equal half the circumference (or 180 degrees),
- c) According to Euler's own definition, **pi ( $\pi$ ) can never equal C/d!**

Archie: "TKO! So introducing the algebraic symbol pi ( $\pi$ ) into geometry smacked science in the kisser and knocked it on its keister! That's where all 'modern' math went awry!"

E.Q.: "That's right, Arch. Pi ( $\pi$ ) was a bad idea from the get-go! A ratio is a ratio, Horatio! The geometric ratio of C/d can never be a dimensionless number of 3.14...; it always has to be a ratio of approximately 3 to 1!  $\frac{C}{d} = \frac{3.14...}{1}$  "

Dr. Z: "That means we can throw out Euler's algebraic equation,  $\pi = \frac{C}{2} = 180$  degrees, and also Jones' algebraic equation,  $\frac{C}{d} = 3.14159 \dots = \pi \dots$

Man, we can throw out all the equations with pi ( $\pi$ ), and I'm gonna start with  $A = \pi r^2$  !"

E.Q.: "So, guys, we can all agree, we have to get rid of and clean up all the pi!"

Dr. Z: "Yeah, when you're out in the field of mathematics, you don't wanna step in the pi!"