Re: Average Distance to Circumference

Source: http://sci.tech−archive.net/Archive/sci.math/2007−02/msg05207.html

- *From*: matt271829−news@xxxxxxxxxxx
- *Date*: 28 Feb 2007 04:29:10 −0800

On Feb 28, 6:36 am, "Narasimham" <mathm...@xxxxxxxxxxx> wrote:

> On Feb 27, 9:25 am, Robert Israel
>
> <isr...@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx> wrote:
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>> HWa...@xxxxxxxxx writes:
>>
>>> Hi,
>>>
>>> First, I'd like to begin by saying this isn't a homework
>>> problem. I'm
>>> a high school student, and this isn't exactly the kind of
>>> problem they
>>> teach in geometry. It's something I came up with recently. I
>>> also
>>> apologize if this is the wrong group.
>>>
>>> So, assume we have a circle with a radius of ten meters. An
>>> insect is
>>> placed on a random point in the circle and immediately
>>> begins crawling
>>> in a random direction. On average, how far will it have to
>>> travel to
>>> get to the edge of the circle? Assume it follows a straight
>>> line.
>>> Also, what field of mathematics is this covered in?
>>
>> It's a problem in calculus of several variables.

>> Suppose the insect is placed at a point at distance r from the centre
>> and crawls at an angle theta from the direction to the centre.
>> The distance it must crawl is d, where by the Law of Cosines
>> 100 = d^2 + r^2 − 2 r d cos(theta). Solving this quadratic equation,
>> d = r cos(theta) + sqrt(100 − r^2 sin(theta)^2).

>> Unfortunately, if you're in high school the rest may not make
>> much sense to you yet. The joint probability density for r and
>> theta is f(r,theta) = r/(100 pi) for 0 <= r <= 10, 0 <= theta <= 2 pi,
>> so the expected distance is given by a double integral

>> int_0^{2 pi} int_0^{10} f(r,theta) (r cos(theta) + sqrt(100 − r^2
>> sin(theta)^2)) dr dtheta

> Probably the ambiguous third side d(angle not between given sides)
> admitting negative sign before radical −sqrt(100 − r^2.... would also
> give rise to the same result by symmetry? I did not check it.

Huh?

>> which works out to 80/(3 pi) or approximately 8.488263630 metres.
>> −−
>> Robert Israel isr...@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
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> If we consider infinitesmal triangles area rho^2/2 dtheta, and weight
> it with radius, then average radius after integrations would be 2 r/3.
> Why is such an approach wrong?

What is rho? If you are trying to say that the average distance from
the origin to the random point is 2r/3, where r is the radius of the
circle, then that's correct, but that wasn't the question.

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