A Maths Christmas 2019 Problem for First Year Mathematicians
A variation on a theme by Von Neumann

Having been an avid, dexterous and loyal user of *Python*, and having thrust many a first year through the roller-coasting joys of the software's coils, Dr Ramsden found himself in the envious position of being the recipient of a rather special and positively unique Python Christmas pudding, awarded only to those who entered long battle with the Software and are still standing.

Due to the delicate nature of the pudding and, in addition, due to fear of sabotage from marauding bands of students out to collect anything Python (the "PythoKnights" as they are known - an accolade that is undoubtedly self-proclaimed rather than one that has organically grown in a societal environment that identifies and applauds distinctive behaviour), and by anything I do mean anything, including the rumoured hair from the beard of Guido van Rossum, the immortal who conceived Python, that is supposed to be in the South Kensington Campus (wherabouts are unknown much to the chagrin and desparation of many a PythoKnight), the pudding was dispatched with special delivery to the IC Shop. Dr Ramsden was summoned there and he proceeded eagerly and with an air of expectant impatience to collect the prized object.

But it seems that the wrong (or right) butterfly flapped its wings somewhere, and as soon as Dr Ramsden exited the shop with pudding in hand, his luck brought him face-to-face with Professor Papageorgiou who happened to have brought his dog Angel to College that day. The said dog (not the brightest spark in the fire but of the sweetest disposition) perked up on sighting Dr Ramsden and the colourful package in his hand. In addition, having spent almost an entire life giving chase to her tail in slowly drifting circular motions, she was probably duly inspired by the sight of Dr Ramsden and swiftly traded the circular motions to fast rectilinear trajectories.

But not only: and here is where the problem begins. In one of those flashes of inspiration that only dogs are capable of, Angel immediately snatched the Python pudding out of Dr Moore's unsuspecting hand, and proceeded to run in a straight line down the walkway. Professor Papageorgiou immediately recorded the time (it was 10:07 am) and the distance to the end of the walkway that ended in a wall with a staircase on the side - that distance was 80 metres. At the same time Dr Ramsden decided to give chase and recover what was his from the jaws of the running hound, hence set off at once directly behind Angel. Professor Papageorgiou once more noted the corresponding speeds of the two runners and found that the dog's speed was *exactly twice* that of Dr Ramsden. The dog ran at 8 km/h whereas Dr Ramsden could manage a mere 4 km/h.

Every time the dog reached the wall, she immediately turned back and ran towards Dr Ramsden, and every time she reached Dr Ramsden she turned back and ran towards the wall, and this carried on with Professor Papageorgiou not having the slightest idea as to what thoughts may have been going through the runners' heads. He was struck by an interesting problem, however, that of finding the *total* distance that the dog would have to travel before she is finally caught by Dr Ramsden and having the Python pudding extracted from her mouth.

Now, both Professor Papageorgiou and Dr Ramsden know how to find it because they are very good at summing infinite series; the dog simply does not care and after a short excursion in the space of rectilinear motions has returned to perfecting the circle once more. The question is: *can you find the distance*?

[The first person to return the correct answer will receive a signed copy of Dr Ramsden's Python notes.]