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How many strides from Hobbiton to Mordor?

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Abstract
This paper uses ratios in order to determine the number of strides an average sized hobbit would have to take to complete the journey from Hobbiton to Mount Doom. It was found that an average human male is approximately 1.7 times taller than the average hobbit, making a hobbit's stride length around 46 centimetres. This value was then applied to the distance between the start and end points of the quest, showing that the hobbit would be required to take a grand total of 4870433 strides to complete the journey.

Introduction
The plot of *The Lord of the Rings*, a popular fantasy trilogy, centres on a Hobbit's quest to destroy the 'One Ring', Sauron's tool of evil dominion, in the fires of Mount Doom [1]. This paper aims to determine how many strides the titular hobbit, Frodo Baggins, would need to have taken to travel from his home in Hobbiton all the way to Mordor, the location of Mount Doom.

Theory
Hobbits, also known as halflings, are a fictional race of diminutive humanoids which inhabit J.R.R Tolkien's realm of Middle Earth. In '*The Lord of the Rings*', a hobbit by the name of Frodo Baggins is forced to flee his home in the Shire to destroy the One Ring, a dark and dangerous magical artefact, in the place it was forged – the fires of Mount Doom.

The journey from Hobbiton to Mount Doom was largely completed on foot and can be split into four distinct parts (see table 1) [1]. For the purposes of this paper, it will be assumed that the hobbits walk with an even stride regardless of the terrain.

According to Tolkien, hobbits can range between approximately 60 and 120 cm in height [1]. Here, it is assumed that both Frodo and Samwise are of average height for hobbits (i.e. 106.68 cm). The average height of a human male, on the other hand, is 177 cm. This makes humans, on average, around 1.659 times taller than hobbits.

Journey Part	Start and End Points	Distance (km)	Mode of Transport
1	Hobbiton to Rivendell	737.08	Foot
2	Rivendell to Lothlorien	743.52	Foot
3	Lothlorien to Rauros Falls	626.04	Boat
4	Rauros Falls to Mount Doom	756.39	Foot

Table 1 – The four main parts of the journey from Hobbiton to Mount Doom, including modes of transport and distances travelled.

To determine how far a person travels with each step, the length of a stride is measured from heel to heel. The average stride length for a male in the US is approximately 76.2 cm [2]. Using the previously determined height ratio, it is possible to use this value to determine that the average stride length for a hobbit would be 45.93 cm (0.4593 m). This can then be used in conjunction with the distances recorded in table 1 to determine the number of steps it would take a hobbit to complete the journey (see table 2). As the section from Lothlorien to Rauros Falls is completed via boat, it has been discounted from the calculations.

Journey Part	Start and End Points	Total Strides Required
1	Hobbiton to Rivendell	1604790
2	Rivendell to Lothlorien	1618811
3	Lothlorien to Rauros Falls	n/a
4	Rauros Falls to Mount Doom	1646832

Table 2 – The total number of strides required to complete each leg of the journey from Hobbiton to Mount Doom, calculated using the ratio between human and hobbit stride length. The distances to each destination were then divided by the hobbit stride length. The number of strides has been rounded to the closest whole number.

According to these calculations, Frodo would be required to take a grand total of 4,870,433 strides to complete his quest. However, Frodo does not manage to complete the entire journey under his own steam. Upon reaching the slopes of Mount Doom, he is unable to continue and must be carried onwards by his friend and companion, Samwise Gamgee. To determine how many strides it would have taken Samwise to carry Frodo up Mount Doom, trigonometry was used to establish the distance to the summit (figure 1 and equation 1).

$$hypotenuse = \frac{opposite}{\sin\theta}. \qquad (1)$$

In the book, Mount Doom is said to be approximately 1,371.6 m tall [1]. However, no indication of the degree of incline is made. In the film, the scenes of the mountain were largely shot on the slopes of Mount Ruapehu, an active volcano in New Zealand [3]. The climbing grade of this mountain ranges between New Zealand Grade 1 and Grade 2, meaning that climbing is fairly easy, but steeper sections may be difficult [4]. From this, it can be assumed that the incline of Mount Ruapehu (and therefore Mount Doom) is approximately 60°.

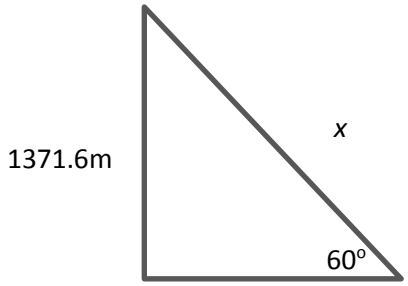

Figure 1 – A diagram illustrating the trigonometric method of finding how far Samwise would have had to carry Frodo to reach the summit of Mount Doom, with x representing the aforementioned distance.

This gives a distance of 1583.79 m, equating to 3448 hobbit strides. This means that Frodo only managed to complete 4,866,985 strides of his journey [1].

Conclusion

In order for Frodo to traverse the entire 2,236.99 km distance from Hobbiton to Mount Doom (disregarding the section travelled via river), he would have needed to take approximately 4,870,433 strides. However, as Frodo was unable to climb the slopes of Mount Doom himself and had to be carried by his friend Samwise, he only completed 4,866,985 strides of his journey.

References

[1] Tolkien, J.R.R. (1954) *The Lord of the Rings*. UK: Alley and Unwin.

[2] Nina, K. (2018) *The average walking stride length.* Live Healthy. Available at: http://livehealthy.chron.com/average-walking-stride-length-7494.html [Accessed 7th March 2018]

[3] Wikipedia (2018) *Mount Doom.* Wikipedia. Available at: https://en.wikipedia.org/wiki/Mount_Doom [Accessed 21st March 2018]

[4] Summit Post (2018) *Mount Ruapehu.* Summitpost.org. Available at: https://www.summitpost.org/mount-ruapehu/153697 [Accessed 21st March 2018]