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## A5\_4 Splash Mountain

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### Abstract

In the Gen V Pokédex entry for the Pokémon Magikarp it is stated that Magikarp can jump over mountains using the move ‘Splash’. This is a Pokémon move that does 0 damage in the game. By comparing the power of a horse’s kick and the move ‘Stomp’, we have determined that ‘Splash’ should have 221 Poképower in the game, giving it the second highest base Poképower in the games but also a very low accuracy due to the jump taking 36.94 s in total. Perhaps this is why the move is said to be useless.

### Introduction

Magikarp, a creature (referred to as a Pokémon in game) from the popular Nintendo Pokémon games, is stated in its Gen V Pokédex entry (an in-game encyclopedia that contains descriptions of all the Pokémon) to be able to leap mountains. “A Magikarp living for many years can leap a mountain using Splash. The move remains useless, though.”. Since the move ‘Splash’ is useless in game we explored the amount of power a Magikarp would impart if it could jump over mountains in the real world using (1).

$$P = Fv \quad (1)$$

Comparing this to a kick of a horse and the move ‘Stomp’, we were able to find the in-game power of the move ‘Splash’ if it was able to do damage.

Magikarp are native to an in-game area based off of the Kantō region in Japan. The largest mountains in this region are the Tanzawa Mountains, and as such we decided to have the Magikarp jump over its highest peak which is Mount Hiru at 1,673 m elevation [1]. The shortest width of the mountain range is 20 km, which

we assume to be the width of the mountain.

The power of a moving object can be found using (1). We will use this to calculate the power output of a Magikarp falling and compare it to the power of a horse’s stomp to find it’s value in Poképower.

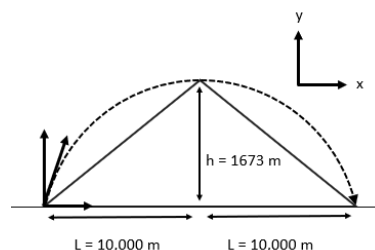


Figure 1: The dashed line shows the parabolic arc of a magikarp jumping over Mount Hiru.

Using trigonometry and SUVAT equations we can calculate the initial and final velocities of Magikarp as it jumps over Mount Hiru to find the power that Magikarp landing on another Pokémon will do.

## Equations of Motion

We are using standard SUVAT notation. In the y direction shown in Figure 1, from the start point to the peak of the trajectory,  $s = 1673$  m,  $a = -9.81$  m s<sup>-2</sup>,  $v = 0$  m s<sup>-1</sup> and therefore  $t = 18.47$  s. This gives us an initial velocity in the y direction as 181.17 m s<sup>-1</sup>. In the x direction shown in Figure 1, using the time calculated above,  $s = 20,000$  m,  $a = 0$  m s<sup>-2</sup>,  $t = 36.94$  s so  $u = 541.42$  m s<sup>-1</sup>. The resultant velocity of magikarp is therefore 570.93 m s<sup>-1</sup> using Pythagorean theorem.

## Assumptions

1. A horse's kick force is equal to a horse's stomp force
2. A horse of mass  $2x$  kg will be able to perform a stomp force twice the value of a horse of mass  $x$  kg
3. The velocity of a horse's kick is independent of mass
4. We ignore the effects of air resistance
5. The breed of the horse in [2] is a Cob, giving it an average estimated mass of 500 kg [3]
6. The trajectory of the move 'Splash' is always constant, therefore the Poképower of the move is constant.

## Results and Discussion

Mount Hiru is 1,673 m tall and 20,000 m wide. Using SUVAT equations and trigonometry we found that the initial velocity in the y direction is 181.17 m s<sup>-1</sup> and the initial velocity in the x direction is 541.42 m s<sup>-1</sup>. This will give Magikarp a resultant velocity of 570.93 m s<sup>-1</sup> as the initial and final speeds would be equal, assuming there is no change due to air resistance.

The force of the falling Magikarp will be equal to its weight,  $mg$ , where  $m$  is the mass of the Magikarp, 10 kg [4], and  $g$  is the gravitational field strength, 9.81 m/s<sup>2</sup>. This gives the Magikarp a weight of 98.1 N, giving the falling Magikarp a total power of 56.01 kW using (1).

"The force of a horse's kick has been compared to the impact of a small automobile moving 20 mph" [2]. This allows us to find the power out-

put of a horse's kick by comparing it to a small automobile. Using the average mass of a small automobile to be 990 kg [5] we found that the power output would be 86.8 kW using (1).

Rapidash (a Pokémon based off a horse) weighs 95 kg [6], so this would scale the kick down to 16.5 kW under our second assumption. The move 'Stomp' does 65 Poképower in-game, meaning that 1 Poképower in the game is equivalent to 253.8 W. We can therefore calculate that the power of a Magikarp falling on another Pokémon is 221 Poképower in-game, rounded to the nearest integer.

## Conclusion

In conclusion, if the move 'Splash' did Poképower according to its description in the Pokédex entry, by comparing to the relative Poképower of 'Stomp', it would be a 221 Poképower move. This would make it the second strongest move in the game in terms of base Poképower [7]. However considering the time taken to for the Magikarp to jump over the mountain would be 36.94 s, this would give the move a very low accuracy as most Pokémon would be easily able to dodge this attack. This might be the reason why the Pokédex entry states that this move is useless.

## References

- [1] [https://en.wikipedia.org/wiki/Tanzawa\\_Mountains](https://en.wikipedia.org/wiki/Tanzawa_Mountains)
- [2] <https://equimed.com/diseases-and-conditions/reference/kicking>
- [3] <https://www.horsemart.co.uk/community/article/health/what-is-the-average-weight-of-a-horse->
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