

# Precursor Investigation Into the Choice Between ATT% and BossDamage%

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## Abstract

It is conventional wisdom in MapleStory that potential lines ATT% are superior to all alternatives and the ideal WSE combination is 6-3-0 i.e. 6 ATT% lines, 3 Boss% lines and 0 damage% lines across the three pieces of equipment (Main weapon, sub weapon, and Emblem). This wisdom, however, does not appear to be mathematically correct on some levels; this write-up attempts to examine further and yield an intuitive understanding of the interplay between BossDamage% and ATT%.

## 1 Introduction

### 1.1 Damage Formula

Source: [StrategyWiki](#)

$$\text{Damage on Boss} = K \times \left(1 + \frac{\text{ATT}\%}{100}\right) \times \left(1 + \frac{\text{Boss}\%}{100}\right) \quad (1)$$

where  $K$  is the rest of the formula including Stats, Final Damage%, Damage%, etc.

ATT% is the total amount of +ATT%,

Boss% is the total amount of +BossDamage%

### 1.2 Setup

The setup takes into account a typical Reboot player who has some negligible amount of ATT% from *Hero's Echo*, *Familiar Badge* effect, and *Weapon Soul* effect. Let's call this quantity **[base ATT]** or  $A_b$  symbolically. In most cases, this quantity is small enough to be considered negligible.

Similarly, there is an existing amount of BossDamage% that cannot be exchanged for ATT% (e.g. from Gollux set effect, from Weapon's innate stats, etc.) Let's call this quantity **[base Boss]** or  $B_b$  symbolically.

## 2 The Algebra

Expanding equation (1), we have:

$$\begin{aligned}\text{Damage on Boss} = D &= K \times \left(1 + \frac{A_b + A}{100}\right) \times \left(1 + \frac{B_b + B}{100}\right) \\ &= \frac{K}{10000} \times (100 + A_b + A) \times (100 + B_b + B)\end{aligned}$$

Taking a closer look at the quantity of added ATT%:

$$\begin{aligned}\frac{\partial}{\partial A} D &= \frac{K}{10000} \times \frac{\partial}{\partial A} (100 + B_b + B)A \\ &= L \times (100 + B_b + B)\end{aligned}$$

Similarly for the quantity of added BossDamage%:

$$\begin{aligned}\frac{\partial}{\partial B} D &= \frac{K}{10000} \times \frac{\partial}{\partial B} (100 + A_b + A)B \\ &= L \times (100 + A_b + A)\end{aligned}$$

Intuitively, this result makes sense. For every point of ATT%, the damage goes up by a quantity that is dependent on the existing total amount of BossDamage% and vice versa, indicative of the multiplicative interplay between these two values.

## 3 Opportunity Cost

However, the choice that the player has to make is not between one point of ATT% and one point of BossDamage%. Specifically, each unit of "opportunity cost" is one potential line out of six: three on Main Weapon, and three on Sub Weapon (the Emblem cannot have BossDamage%). Each of these potential lines can take on a value of:

1. 12% ATT
2. 9% ATT
3. 40% Boss Damage
4. 30% Boss Damage

Or, roughly speaking, for every 1 point of ATT% acquired, 3 points of Boss% was lost; in other words: each point of ATT% has a cost value of 3 and each point of Boss% has a cost value of 1. Let's name this quantity  $C$  for [cost]. We thus obtain the modified versions of the derivatives as:

$$\frac{\partial}{\partial A} D = L \times (100 + B_b + B) = 3C \tag{2}$$

and

$$\frac{\partial}{\partial B} D = L \times (100 + A_b + A) = 1C \tag{3}$$

Thus it appears that, all else being equal, the player should always choose **Boss Damage%** over **ATT%**.

## 4 The Breakpoint

Yet not all else is equal. The base amount of **ATT%**  $A_b$ , for instance, is very small (around 10% for most players) while the base amount of **Boss Damage%**  $B_b$  is easily much higher (well over 100% for most players). At which point, then is it worth considering choosing ATT% over Boss Damage%?

We simply set the derivatives equal to each other.

$$\begin{aligned}\frac{\partial}{\partial A}D &= \frac{\partial}{\partial B}D \\ L \times (100 + B_b + B) &= 3L \times (100 + A_b + A) \\ 100 + B_b + B &= 300 + 3A_b + 3A\end{aligned}$$

or

$$B + B_b = 200 + 3(A + A_b) \tag{4}$$

### 4.1 Special Case 1

For simplicity's sake, assume  $A_b = 0$  and that the player should go all in on one option between **ATT%** and **Boss%**, since one of them is objectively superior in each given circumstance. In this case, if the player chooses not to invest any potential lines into **ATT%**:

$$B + B_b = 200 \tag{5}$$

then they are free to invest into **Boss%** until the total amount reaches 200, at which point the derivatives equalize and **ATT%** is now more valuable **per point**. This value serves as the starting goal for players before further considerations are warranted.

### 4.2 Other Considerations

For each individual circumstances, the player should input their stats into equation (4) to find their own combination of **ATT%** and **Boss%**.