

# Exercises: Reinforcement Learning

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## Exercise 1

### Claim

The return  $R_t = \sum_{h=0}^{\infty} \gamma^h r_{t+h+1}$  is bounded for  $0 \leq \gamma < 1$  and bounded rewards  $-10 \leq r_{t+h+1} \leq 10$  for all  $h \in \mathbb{N}$ .

### Proof

Using the geometric series, we find:

$$|R_t| \leq \sum_{h=0}^{\infty} |\gamma^h r_{t+h+1}| \leq \sum_{h=0}^{\infty} 10\gamma^h = \frac{10}{1-\gamma} < \infty$$

## Exercise 2

## Exercise 3

$\gamma = 1$  will work here because the reward function has a finite horizon.