

# Exercises on Mathematical Induction

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# Exercise 1

Use Mathematical Induction to prove that

$$\frac{1}{1 \cdot 2} + \frac{1}{2 \cdot 3} + \frac{1}{3 \cdot 4} + \cdots + \frac{1}{n(n+1)} = \frac{n}{n+1}$$

## Exercise 2

Use Mathematical Induction to prove that

$$1^2 + 3^2 + 5^2 + \cdots + (2n-1)^2 = \frac{4n^3 - n}{3}$$

## Exercise 3

Use Mathematical Induction to show that for  $n \geq 3$

$$2 + 7 + 12 + 17 + \cdots + (5n + 2) = \frac{(n + 1)(5n + 4)}{2}$$

## Exercise 4

Use Mathematical Induction to prove that

$$\frac{3}{1(2)(2)} + \frac{4}{2(3)(2^2)} + \frac{5}{3(4)(2^3)} + \cdots + \frac{n+2}{n(n+1)2^n} = 1 - \frac{1}{(n+1)2^n}$$

## Exercise 5

Use Mathematical Induction to prove that

$$\left(1 + \frac{1}{1}\right) \left(1 + \frac{1}{2}\right) \left(1 + \frac{1}{3}\right) \cdots \left(1 - \frac{1}{n}\right) = n + 1$$