

India's Number 1 Education App

MATHS

NCERT - FULL MARKS MATHEMATICS(TAMIL)

PRINCIPLE OF MATHEMATICAL INDUCTION

Example

1. For all $n \geq 1$ prove that

$$1^2 + 2^2 + 3^2 + 4^2 + \ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$$



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2. Prove by mathematical
$$rac{1}{1.2} + rac{1}{2.3} + \ldots + rac{1}{(n)(n+1)} = rac{n}{(n+1)}$$

induction



- **3.** For every positive integer n, prove that $7^n 3^n$ is divisible by 4.
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4. Prove that $(1+x)^n \geq (1+nx)$ for all natural number n where



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- 5. Prove that
- $2.7^n + 3.5^n 5$ is divisible by 24 for all $n \in N$



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6. By the principle of mathematic induction, prove that, for $n \geq 1$, $1^2 + 2^2 + 3^2 + \ldots + n^2 > \frac{n^3}{3}$

7. Prove the rule of exponents $(ab)^n = a^n b^n$ by using principle of mathematical induction for every natural number.



Exercise 4 1

1. By the principle of mathematical induction, prove that, for $n\geq 1$

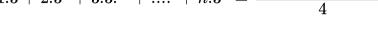
$$(1^3+2^3+3^3+\ldots\,+n^3=\left(rac{n(n+1)}{2}
ight)^2$$



- **2.** Find the value of 6P_4
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$$n \in N$$
:

 $1.3 + 2.3^2 + 3.3.^3 + \dots + n.3^n = \frac{(2n-1)3^{n+1} + 3}{4}$



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4. By the principal of mathematic induction, prove that, for $n\geq 1$

$$1.2 + 2.3 + 3.4 + \ldots + n. \, (n+1) = rac{n(n+1)(n+2)}{3}$$



5. Prove that by using the principle of mathematical induction for all

$$n \in N$$
:

 $1.3 + 3.5 + 5.7 + \dots + (2n-1)(2n+1) = \frac{n(4n^2 + 6n - 1)}{3}$



$$n \in N$$
:

 $1.2 + 2, 2^2 + 3.2^3 + \dots + n.2^n = (n-1)2^{n+1} + 2$



7. Prove that by using the principle of mathematical induction for all

$$n \in N$$
:

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots + \frac{1}{2^n} = 1 - \frac{1}{2^n}$$



8. Using the mathematical induction, show that for any natural number

$$\frac{1}{2.5} + \frac{1}{5.8} + \frac{1}{8.11} + \ldots + \frac{1}{(3n-1)(3n+2)} = \frac{n}{6n+4}$$



9. Using the mathematical induction, show that for any natural number

n, $rac{1}{1.2.3} + rac{1}{2.3.4} + rac{1}{3.4.5} + \ldots + rac{1}{n.\ (n+1).\ (n+2)} = rac{n(n+3)}{4(n+1)(n+2)}$



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10.
$$a + ar + ar^2 + \ldots + ar^{n-1} = rac{a(r^n-1)}{r-1}$$



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11. Use the principle of mathematical induction to prove that for every natural number n.

$$\left(1+rac{3}{1}
ight)\!\left(1+rac{5}{4}
ight)\!\left(1+rac{7}{9}
ight)\!...\!\left(1+rac{(2n+1)}{n^2}
ight)=(n+1)^2$$



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$$n \in N$$
:

$$\left(1+rac{1}{1}
ight)\!\left(1+rac{1}{2}
ight)\!\left(1+rac{1}{3}
ight)\!....\left(1+rac{1}{n}
ight)=(n+1)$$



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13. Prove that by using the principle of mathematical induction for all

$$n \in N$$
:

$$(1^2+3^2+5^2+...(2n-1)^2=rac{n(2n-1)(2n+1)}{3}$$



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14. Prove that by using the principle of mathematical induction for all

$$n \in N$$
:

$$\frac{1}{1.4} + \frac{1}{4.7} + \frac{1}{7.10} + \ldots + \frac{1}{(3n-2)(3n+1)} = \frac{n}{3n+1}$$



$$n \in N$$
:

$$\frac{1}{3.5} + \frac{1}{5.7} + \frac{1}{7.9} + \dots + \frac{1}{(2n+1)(2n+3)} = \frac{n}{3(2n+3)}$$



16. Prove that by using the principle of mathematical induction for all

$$n \in N$$
:

$$1+2+3+.... + n < rac{1}{8}(2n+1)^2$$



17. Prove that by using the principle of mathematical induction for all

$$n \in N$$
:

$$n(n+1)(n+5)$$
 is a multiple of 3



 $n \in N$:

 $10^{2n-1}+1$ is divisible by 11



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19. Prove that by using the principle of mathematical induction for all

 $n \in N$:

 $x^{2n} - y^{2n}$ is divisible by x+y



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20. Prove that by using the principle of mathematical induction for all

 $n \in N$:

 $3^{2n+2}-8n-9$ is divisible by 8



 $n \in N$:

 $41^n - 14^n$ is multiple of 27



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22. Prove that by using the principle of mathematical induction for all

 $n \in N$:

 $\left(2n+7\right)<\left(n+3\right)^2$



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