MATHS

NCERT - NCERT MATHEMATICS (GUJRATI)

PRINCIPLE OF MATHEMATICAL INDUCTION

Example

1. For all $n \geq 1$, prove that, $1^2 + 2^2 + 3^2 + 4^2 + \ldots\ldots + n^2 = \frac{n(n+1)(2n+1)}{6}$

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2. Prove that $2^n > n$ for all positive integers n.

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

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \ldots\ldots + \frac{1}{n(n+1)} = \frac{n}{n+1}$$

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4. For every positive integer n, prove that $7^n - 3^n$ is divisible by 4.

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5. Prove that $(1+x)^n \geq (1+nx)$ for all natural number n where $x > -1$

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

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7. Prove that, $1^2 + 2^2 + \ldots\ldots + n^2 > \frac{n^3}{3}, n \in N$

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

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Exercise 4 1

1. Prove the following by using the principle of mathematical induction for all $n \in N$

$1 + 3 + 3^2 + \ldots\ldots\ldots\ldots + 3^{n-1} = \frac{3^n - 1}{2}$

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2. Prove the following by using the principle of mathematical induction for all $n \in N$

$$1^3 + 2^3 + 3^3 + \dots\dots\dots\dots\dots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$$

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3. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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4. Prove the following by using the principle of mathematical induction for all $n \in N$

$$1.2.3. + 2.3.4 + \dots\dots + n(n+1)(n+2) = \frac{n(n+1)(n+2)(n+3)}{4}$$

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5. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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6. Prove the following by using the principle of mathematical induction for all $n \in N$

$$1.2 + 2.3 + 3.4 + \dots\dots + n.(n+1) = \left[\frac{n(n+1)(n+2)}{3}\right]$$

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7. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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8. Prove the following by using the principle of mathematical induction for all $n \in N$

$$1.2 + 2.2^2 + 3.2^3 + \ldots\ldots\ldots + n.2^n = (n-1)2^{n+1} + 2$$

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9. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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10. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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11. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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12. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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13. Prove the following by using the principle of mathematical induction for all $n \in N$

$$\left(1+\frac{3}{1}\right)\left(1+\frac{5}{4}\right)\left(1+\frac{7}{9}\right)\times\ldots\ldots\times\left(1+\frac{(2n+1)}{n^2}\right)=(n+1)^2$$

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14. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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15. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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16. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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17. Prove the following by using the principle of mathematical induction

for all $n \in N$

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

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18. Prove the following by using the principle of mathematical induction

for all $n \in N$

$$1 + 2 + 3 + \ldots\ldots\ldots + n < \frac{1}{8}(2n+1)^2$$

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19. Prove the following by using the principle of mathematical induction

for all $n \in N$

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

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20. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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21. Prove the following 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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22. Prove the following by using the principle of mathematical induction for all $n \in N$

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

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23. Prove the following by using the principle of mathematical induction

for all $n \in N$

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

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24. Prove the following by using the principle of mathematical induction

for all $n \in N$

$(2n + 7) < (n + 3)^2$

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