MATHS

BOOKS - VIKRAM PUBLICATION (ANDHRA PUBLICATION)

MATHEMATICAL INDUCTION

Solved Problems

1. Use mathematical induction to prove that statement $1^3+2^3+3^3+\ldots+n^3=\frac{n^2(n+1)^2}{4}, \forall n \in N$

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2. Use mathematical induction to prove that statement $\sum_{k=1}^{n}(2K-1)^2=\frac{n(2n-1)(2n+1)}{3}$ for all $n \in N$

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3. $2 + 3.2 + 4.2^2 + \ldots\ldots$ upto n terms =

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4. Using the principle of finite Mathematical Induction prove the following:

(iii) $\frac{1}{1.4} + \frac{1}{4.7} + \frac{1}{7.10} + \ldots\ldots\ldots + \text{n terms} = \frac{n}{3n+1}$.

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5. Use mathematical induction to prove that $2n - 3 \leq 2^{n-2}$ for all $n \geq 5, n \in N$

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6. Use Mathematical induction to prove that $(1+x)^n > 1+nx$ for $n \geq 2, x > -1, x \neq 0$

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7. Prove that $x^n - y^n$ is divisible by x - y for all positive integers n.

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8. Prove that $x^m + y^m$ is divisible by x + y, when m is an odd natural number.

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9. By Mathematical Induction , show that $49^n + 16n - 1$ is divisible by 64 for all positive Integer n .

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10. Using the principle of Mathematical Induction, show that $2.4^{2n+1} + 3^{3n+1}$ is divisible by 11, $\forall n \in N$

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Exercise 2 A

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

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2. $2.\ 3 + 3.4 + 4.5 +$ ... upto n terms

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3. Prove by the method of induction,

$$\frac{1}{1.3}+\frac{1}{3.5}+\frac{1}{5.7}+\ldots+\frac{1}{(2n-1)(2n+1)}=\frac{n}{2n+1}$$

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4. $4^3+8^3+12^3+\ldots$ upto n terms $=16n^2(n+1)^2$

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5. Using Mathematical induction. For all $n \in N$. Show that

$$a+(a+d)+(a+2d)+\ldots\ldots\ldots\ldots n\text{upto n terms}=\frac{n}{2}[2a+(n-1)$$

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6. Using the principle of finite Mathematical Induction prove the following:

(iv) $a + ar + ar^2 + \ldots\ldots + \text{n terms} = \dfrac{a(r^n - 1)}{r - 1}, r \neq 1.$

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7. $2 + 7 + 12 + \ldots + (5n - 3) = \dfrac{n(5n - 1)}{2}$

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

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9. Prove the following

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

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10. $1^2 + 2^2 + \ldots + n^2 > \frac{v^3}{3}$

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11. $4^n - 3n - 1$ is divisible by 9

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12. Using the principle of finite Mathematical Induction prove the following:

(v) $3.5^{2n+1} + 2^{3n+1}$ is divisible by $17, \ \forall n \in N.$

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13. $1.2.3. + 2.3.4 + 3.4.5 + \ldots$ upto n terms $= \frac{n(n+1)(n+2)(n+3)}{4}$

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14. Prove That $\frac{1^3}{1} + \frac{1^3 + 2^3}{1+3} + \frac{1^3 + 2^3 + 3^3}{1+3+5}$ + . . . upto n terms $= \frac{n}{24}\left[2n^2 + 9n + 13\right]$

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15. Using the principle of finite Mathematical Induction prove that

$$1^2 + \left(1^2 + 2^2\right) + \left(1^2 + 2^2 + 3^2\right) + \text{n terms} = \frac{n(n+1)^2(n+2)}{12}, \forall n \in N$$

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