MATHS

BOOKS - OMEGA PUBLICATION

PRINCIPLE OF MATHEMATICAL INDUCTION

Questions

1. Prove the following by using the principle of mathematical induction for all $n \in N$:- $1^3+2^3+3^3+...+n^3=\left(\frac{n(n+1)}{2}\right)^2$.

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2. Prove the following by using the principle of mathematical induction for all $n \in N$:- $1+3+3^2+....+3^{n-1}=\frac{(3^n-1)}{2}$.

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

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

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4. Using principle of mathematical induction, prove that

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

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

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

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

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

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

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

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8. Prove the following by using the principle of mathematical induction for all $n \in N$:- $1+2+3+\ldots+n<\frac{1}{8}(2n+1)^2$.

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9. Prove by the principle of mathematical induction $10^{2n-1}+1$ is divisible by 11.

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10. 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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11. Prove the following by using the principle of mathematical induction for all $n \in N$:- $(2n+7) < (n+3)^2$.

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12.

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

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

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

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Multiple Choice Questions

1. Let P(n) denote the statement that n^2+n is odd . It is seen that $P(n) \Rightarrow P(n+1)$, $P(n)$ is true for all

A. $n>1$

B. $n>2$

C. n

D. none of these

Answer: D

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2. The inequality $n! > 2^{n-1}$ is true

A. for all $n \in N$

B. for all $n > 2$

C. for all $n > 1$

D. for no $n \in N$.

Answer: B

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3. $2^{3n} - 7n - 1$ is divisible by

A. 36

B. 64

C. 49

D. 25

Answer: C

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4. $3^{2n} - 1$ is divisible by

A. 2

B. 4

C. 8

D. 16

Answer: C

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5. $2^{3n} - 1$ is divisible by

A. 2

B. 7

C. 3

D. none of these

Answer: B

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6. Let P(n) be the statement $2^n < n!$, where n is a natural number, then P(n) is true for

A. all n

B. all $n > 2$

C. all $n > 3$

D. none of these

Answer: C

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7. The smallest positive integer n, for which $n! < \left(\frac{n+1}{2}\right)^n$ holds, is

A. 1

B. 2

C. 3

D. 4

Answer: B

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8. If $n \in N$, then $3.5^{2n+1} + 2^{3n+1}$ is divisible by

A. 24

B. 64

C. 17

D. 676

Answer: C

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9. If n is a positive integer, then $2.7^n + 3.5^n - 5$ is divisible by

A. 24

B. 64

C. 17

D. 676

Answer: A

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10. $3^{3n} - 36n - 1$ is divisible by

A. 239

B. 547

C. 627

D. 676

Answer: D

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