MATHS

BOOKS - RS AGGARWAL MATHS (HINGLISH)

PRINCIPLE OF MATHEMATICAL INDUCTION

Solved Examples

1. If $p(n) = 1 + 3 + 5 + \ldots + (2n-1) = n^2$ then p(1)+p(2)+p(3) is

A. 6

B. 9

C. 14

D. None of these

Answer: C

Watch Video Solution

2. By the principle of mathematical induction that for all $n \in N$: $1 + 4 + 7 + \dots + (3n - 2) = \frac{1}{2}n(3n - 1)$ Write P(k+1)

A. $\frac{1}{2}k(3k - 1)$

B. $\frac{1}{2}(k + 1)(3k)$

C. $\frac{1}{2}(k + 1)(3k + 2)$

D. $\frac{1}{2}(k + 1)(3k + 3)$

Answer: C

Watch Video Solution

3. Prove by the principle of mathematical induction that for all $n \in N$: $1^2 + 2^2 + 3^2 + \quad + n^2 = \frac{1}{6}n(n + 1)(2n + 1)$

Watch Video Solution

4. According to principle of mathematical induction for all $n \in N$: $P(n) = 1^3 + 2^3 + 3^3 + \ldots + n^3 = \left(\frac{n(n+1)}{2}\right)^2$ Find P(2)

A. 8

B. 9

C. 10

D. 2

Answer: B

Watch Video Solution

5. Prove the following by using the principle of mathematical induction for all $n \in N$:$1.\ 2 + 2.\ 3 + 3.\ 4 + \ldots + n(n+1) = \left[\frac{n(n+1)(n+2)}{3}\right]$

Watch Video Solution

6. Prove the following by the principle of mathematical induction:

$$1.\ 3 + 2.\ 4 + 3.\ 5 + \ + (2n-1)(2n+1) = \frac{n\left(4n^2+6n-1\right)}{3}$$

Watch Video Solution

7. Using the principle of mathematical induction, prove that :

$1.\ 2.\ 3 + 2.\ 3.\ 4 + \ + n(n+1)(n+2) = \frac{n(n+1)(n+2)(n+3)}{4}$ for all $n \in N$.

Watch Video Solution

8. Using the principle of mathematical induction, prove that

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

Watch Video Solution

9. Prove the following by the principle of mathematical induction:

$$\frac{1}{3.\,5}+\frac{1}{5.\,7}+\frac{1}{7.\,9}+\frac{1}{(2n+1)(2n+3)}=\frac{n}{3(2n+3)}$$

Watch Video Solution

10. Using the principle of mathematical induction prove that

$$\frac{1}{1.\,2.\,3}+\frac{1}{2.\,3.\,4}+\frac{1}{3.\,4.\,5}++\frac{1}{n(n+1)(n+2)}=$$ (for all $n \in N$)

A. $\dfrac{n(n+4)}{4(n+1)(n+2)}$

B. $\dfrac{n(n+3)}{4(n+1)(n+2)}$

C. $\dfrac{n(n+3)}{4(n+4)(n+2)}$

D. None of these

Answer: B

Watch Video Solution

11. Using the principle of mathematical induction prove that :

$1.\,3 + 2.\,3^2 + 3.\,3^3 + \quad + n.3^n = \dfrac{(2n+1)3^{n+1}+3}{4}$ for all $n \in N$.

Watch Video Solution

12. Using the principle of mathematical induction, prove that

$\left(1-\frac{1}{2}\right)\left(1-\frac{1}{3}\right)\left(1-\frac{1}{4}\right)\ldots\left(1-\frac{1}{n+1}\right) = \frac{1}{(n+1)}$ for all $n \in N$

.

Watch Video Solution

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

for all $n \in N$: $a + ar + ar^2 + \vdots + ar^{n-1} = \dfrac{a(r^n - 1)}{r-1}$

Watch Video Solution

14. Prove the following by the principle of mathematical induction: $(ab)^n = a^n b^n$ for all $n \in N$.

Watch Video Solution

15. Using the principle of mathematical induction, prove that $(n^2 + n)$ is seven for all $n \in N$.

Watch Video Solution

16. 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.

Watch Video Solution

17. Using the principle of mathematical induction, prove that $(7^n - 3^n)$ is divisible by (for all $n \in N$).

A. 3

B. 4

C. 5

D. 6

Answer: B

Watch Video Solution

18. Prove the following by using the principle of mathematical induction for all $n \in N$: $10^{2n-1} + 1$ is divisible by 11.

Watch Video Solution

19. Prove the following by the principle of mathematical induction: $2.7^n + 3.5^n - 5$ is divisible 25 for all $n \in N$.

Watch Video Solution

20. Using the principle of mathematical induction. Prove that $(x^n - y^n)$ is divisible by $(x - y)$ for all $n \in N$.

Watch Video Solution

21. Using the principle of mathematical induction ,prove that $(1 + x)^n \geq (1 + nx)$ for all $n \in N$, where x>-1.

Watch Video Solution

22. Using the principle of mathematical induction, prove that $n < 2^n$ for all n $\in$ N

Watch Video Solution

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

Watch Video Solution

24. Using the principle of mathematical induction. Prove that $(1^2 + 2^2 + \ldots + n^2) > \frac{n^3}{3}$ for all values of $n \in N$.

Watch Video Solution

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

Watch Video Solution

Exercise 4

1. Using the principle of mathematical induction, prove each of the following for all $n \in N$

$1 + 2 + 3 + 4 + \ldots + N = \frac{1}{2}N(N + 1)$.

Watch Video Solution

Watch Video Solution

2. Using the principle of mathematical induction, prove each of the following for all $n \in N$

$2 + 4 + 6 + 8 + \ldots + 2n = n(n+1)$.

Watch Video Solution

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

Watch Video Solution

4. Using the principle of mathmatical induction, prove each of the following for all $n \in N$

$2 + 6 + 18 + \ldots + 2 \cdot 3^{n-1} = (3^n - 1)$.

Watch Video Solution

5. Prove the following by using the principle of mathematical induction for all $n \in N$: $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \ldots + \frac{1}{2^n} = 1 - \frac{1}{2^n}$

Watch Video Solution

6. Prove the following by using the principle of mathematical induction for all $n \in N$: $1^2 + 3^2 + 5^2 + \vdots + (2n-1)^2 = \frac{n(2n-1)(2n+1)}{3}$

Watch Video Solution

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

Watch Video Solution

8. Prove by using the principle of mathemtical induction: $3.2^2 + 3^{2.2}\ \hat{}\ 3 + \ldots + 3^n.2^{n+1} = \frac{12}{5}(6^n - 1)$

Watch Video Solution

9. Using the principle of mathematical induction prove that

$$1+\frac{1}{1+2}+\frac{1}{1+2+3}+\frac{1}{1+2+3+4}++\frac{1}{1+2+3++n}=\frac{2n}{n+1}$$

for all $n \in N$

Watch Video Solution

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

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

Watch Video Solution

11. Using the principle of mathematical induction, prove each of the following for all $n \in N$

$$\frac{1}{1\cdot 4}+\frac{1}{4\cdot 7}+\frac{1}{7\cdot 10}+\cdots+\frac{1}{(3n-2)(3n+1)}=\frac{n}{(3n+1)}.$$

Watch Video Solution

Watch Video Solution

12. Using the principle of mathmatical induction, prove each of the following for all $n \in N$

$$\frac{1}{1 \cdot 3} + \frac{1}{3 \cdot 5} + \frac{1}{5 \cdot 7} + \dots + \frac{1}{(2n-1)(2n+1)} = \frac{n}{(2n+1)}$$

Watch Video Solution

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

$$\frac{1}{2.\ 5} + \frac{1}{5.\ 8} + \frac{1}{8.\ 11} + \vdots + \frac{1}{(3n-1)(3n+2)} = \frac{n}{(6n+4)}$$

Watch Video Solution

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

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

Watch Video Solution

Watch Video Solution

15. Using the principle of mathmatical induction, prove each of the following for all $n \in N$

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

Watch Video Solution

16. Using the principle of mathmatical induction, prove each of the following for all $n \in N$

$n(n+1)(n+2)$ is a multiple of 6.

Watch Video Solution

17. Prove the following by using the principle of mathematical induction for all $n \in N$:$x^{2n}-y^{2n}$is divisible by $x+y$.

Watch Video Solution

18. Using the principle of mathematical induction, prove each of the following for all $n \in N$

$(x^{2n} - 1)$ is divisible by $(x - 1)$ and $(x + 1)$.

Watch Video Solution

19. Prove the following by using the principle of mathematical induction for all $n \in N$: $41^n - 14^n$ is a multiple of 27.

Watch Video Solution

20. Using the principle of mathmatical induction, prove each of the following for all $n \in N$

$(4^n + 15n - 1)$ is divisible by 9.

Watch Video Solution

21. Prove the following by using the principle of mathematical induction for all $n \in N$:$3^{2n+2} - 8n - 9$is divisible by 8.

Watch Video Solution

22. Using the principle of mathematical induction, prove that $(2^{3n} - 1)$ is divisible by 7 for all $n \in N$.

Watch Video Solution

23. Using the principle of mathematical induction, prove each of the following for all $n \in N$

$3^n \geq 2^n$

Watch Video Solution