CHAPTER-4

PRINCIPLE OF MATHEMATICAL INDUCTION

5 Marks Questions

Type No-1

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

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

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

3) $1^3+2^3+3^3+.....+n^3=\frac{n^2(n+1)^2}{4}$ (U)

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

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

6) $1.2.3+2.3.4+.....+n(n+1)(n+2)=\frac{n(n+1)(n+2)(n+3)}{4}$ (U)

7) $1.2+2.3+3.4+.....+n.(n+1)=\frac{n(n+1)(n+2)}{3}$ (U)

8) $1.3+3.5+5.7+.....+(2n-1)(2n+1)=\frac{n(4n^2+6n-1)}{3}$ (S)

9) $1.3+2.3^2+3.3^3+.....+n.3^n=\frac{(2n-1)3^{n+1}+3}{4}$ (S)

10) $1.2+2.2^2+3.2^3+.....+n.2^n=(n-1)2^{n+1}+2$ (A)

11) $a+ar+ar^2+.....+ar^{n-1}=\frac{a(r^n-1)}{r-1}.(r\neq 1)$ (A)

12) $1^2+2^2+3^2+.....+n^2>\frac{n^3}{3}$ (A)

Type No-2

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

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

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

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

4) $\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+.....+\frac{1}{2^n}=1-\frac{1}{2^n}$ (S)

5) $1+\frac{1}{1+2}+\frac{1}{1+2+3}+.....+\frac{1}{1+2+3+....+n}=\frac{2n}{n+1}$ (S)

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

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

Type No-3

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

1) 7^n-3^n *is divisible by* 4. (A)

2) $2.7^n+3.5^n-5$ *is divisible by* 24. (A)

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

5) $x^{2n}-y^{2n}$ *is divisible by* $x+y$. (S)

6) $3^{2n+2}-8n-9$ *is divisible by* 8. (S)

7) 41^n-14^n *is multiple of* 27. (A)

8) Pr*ove the rule of* exp*onents* $(ab)^n=(a)^n(b)^n$. (A)

9) $(2n+7)<(n+3)^2$. (A)

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