Important Questions 2010
Class-XII- Maths
Mathematical Induction

Prove the followings by using Principle of Mathematical Induction:

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

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

Q.3. $1+4+7+L\ L\ +(3n-2)=\frac{n(3n-1)}{2};n\in N$

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

Q.5 . . 12 + 32 + 52 +----------+(2n – 1)2 = $\frac{n(2n-1)(2n+1)}{3}$

Q.6. 1.3 + 2.4 + 3.5 +--------+n.(n+2) = 1/6 n(n+1)(2n+7)

Q.7. $\frac{1}{2.5}+\frac{1}{5.8}+\frac{1}{8.11}+....+\frac{1}{(3n\ -\ 1)(3n+2)}=\frac{n}{6n+4}$.

Q.8. 1.2.3 + 2.3.4 + … + n (n + 1) (n+2) = $\frac{n(n+1)(n+2)(n+3)}{4}$for all n ÎN.

Q.9. $\frac{1}{1.3}+\frac{1}{3.11}+\frac{1}{11.15}+\frac{1}{(4n-1)(4n+3)}=\frac{n}{3(4n+3)}$

Q.10. $\left(1+\frac{1}{2}\right)\left(1+\frac{1}{3}\right)\left(1+\frac{1}{4}\right)-----\left(1+\frac{1}{n+1}\right)=\frac{1}{n+1}$

Q.11. $\frac{1}{1.2}+\frac{1}{2.3}+\frac{1}{3.4}+------+\text{ton terms}=\frac{n}{n+1}$

Q.12. 1 + 4 + 7 +-------+(3n-2) = $\frac{1}{2}n(3n-1)$

Q.13. 12 + 22 + 32 +---------+ to n term = $\frac{n(n+1)(2n+1)}{6}$.

Q.14. 3.6 + 6.9 + 9.12 +--------+3n(3n+3) =3n (n+1) (n+2)

Q.15. $1+x+x^2+.....+x^n=\frac{1-x^{n+1}}{1-x};x\in N$

Q.16. $1^3+2^3+3^3+.....+n^3=\left[\frac{n(n+1)}{2}\right]^2;n\in N$

Q.17. $1.3 + 2.3^2 + 3.3^2 + \ldots + n.3^n = \frac{(2n-1)3^{n+1}+3}{4}$ for all n ÎN.

Q.18. $a + ar + ar^2 + \text{----------} + ar^{n-1} = \frac{a(r^n - 1)}{r - 1}$

Q.19. Prove : $10^{2n-1} + 1$ is divisible by 11.

Q.20. Prove : $2.7^n + 3.5^n - 5$ is divisible by 24 for all n ∈N

Q.21. Prove: $10^n + 3.4^{n+2} + 5$ is divisible by 9 $\forall n \in N$

Q.22. Prove: $5^{2n} - 1$ is divisible by 24 for all n ÎN.

Q.23. Prove: $3^{2n} + 7$ is divisible by 8 for all n ÎN.

Q.24. Prove: $5^{2n+2} - 24n - 25$ is divisible by 576 for all n ÎN.

Q.25. Prove: $7^{2n} + 23n - 3$, $3n-1$ is divisible by 25 for all n ÎN.

Q.26. Prove: $n^3 + (n + 1)^3 + (n - 2)^3$ is a multiple of 9

Q.27. Prove: $4^n + 15n - 1$ is divisible by 9.

Q.28. Prove: $2^{3n} - 1$ is divisible by 7

Q.29. Prove: $3^{2n+2} - 8n - 9$ is divisible by 64 for every natural number n .

Q.30. Prove: $2.7^n + 3.5^n - 5$ is divisible by 24 for all n ÎN.

Q.31. Prove: $11^{n+2} + 12^{2n+1}$ is divisible by 133 for all n ÎN.

Q.32. Prove: $x^{2n-1} + y^{2n-1}$ is divisible by x + y for all n ÎN.

Q.33. Prove : x^{2n-1} is divisible by (x – 1)

Q.34. Prove by mathematical induction that $41^n - 14^n$ is a multiple of 27.

Q.35. Prove : $1 + 2 + 3 \ldots + n < \frac{1}{8}(2n+1)^2$ for all n ÎN.

Q.36 . Prove: $1^2 + 2^2 + \text{----------} + n^2 > \frac{\quad\quad}{\quad\quad}$, n ∈N.

Q.37. Prove: $3^n > n$ for all n∈N

Q.38. Prove the rule of exponents $(ab)^n = a^n b^n$

Q.39. Prove by the principle of mathematical induction that: n (n+1) (2n+1) is divisible by 6 for all n Î N

Q.40. If $x \neq y$ then prove that $x^n - y^n$ is divisible by $x - y$ for every natural number n.

Q.41 . Prove by induction that $(2n + 7) < (n + 3)^2$ for all natural numbers n. Using this, prove by induction that $(n + 3)^2$ £ 2^{n+3} for all n ÎN.