

**XI Maths Worksheet**

Time: 60 min

**Chapter#4 : Principle of Mathematical Induction**

Full Marks:

Q.1 Let P (n) be the statement n(n + 1) is an even number then find P(6). (1 mark)

Q.2 Prove the following by using the principle of mathematical induction for all  $n \in \mathbb{N}$ : (5 marks)

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

Q.3 Prove the following by using the principle of mathematical induction for all  $n \in \mathbb{N}$ : (5 marks)

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

Q.4 Prove by using the principle of mathematical induction  $3^{2n} - 1$  is divisible by 8 for  $n \in \mathbb{N}$ . (3 marks)

Q.5 Prove the following by using the principle of mathematical induction for all  $n \in \mathbb{N}$ : (3 marks)

$$1 + 3 + 3^2 + \dots + 3^{n-1} = \frac{(3^n - 1)}{2}$$

Q.6 Prove by using the principle of mathematical induction for all  $n \in \mathbb{N}$ .

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

Q.7 Prove by using the principle of mathematical induction for all  $n \in \mathbb{N}$ :

$$1 + 3 + 3^2 + \dots + 3^{n-1} = \frac{3^n - 1}{2}$$

Q.8 Prove that the product of two consecutive natural numbers is an even number. (3 marks)

Q.9 Prove the following by using the principle of mathematical induction for all  $n \in \mathbb{N}$ . (3 marks)

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

Q.10 Use the principle of mathematical induction to prove that  $1+5+9+13+ \dots + (4n-3) = n(2n-1)$ ,  $n \in \mathbb{N}$

Q.11 Prove that :  
 $2.7^n + 3.5^n - 5$  is divisible by 24 for all  $n \in \mathbb{N}$ .

Q.12 Prove the following by using the principle of mathematical induction for all  $n \in \mathbb{N}$ : (3 marks)

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

Q.13 Prove by using the principle of mathematical induction  $3^n < 4^n$  for all  $n \in \mathbb{N}$ . (3 marks)

Q.14 For every positive integer n, prove that  $7^n - 3^n$  is divisible by 4.

Q.15 prove by using the principle of mathematical induction for  $n \in \mathbb{N}$  :  
 $(2n+7) < (n+3)^2$

Q.16 Prove the following by using the principle of mathematical induction for all  $n \in \mathbb{N}$ : (3 marks)

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

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Q.17 Suppose  $P(n)$ :  $n(n+1)(n+2)$  is divisible by 6. Show that  $P(1)$ ,  $P(2)$  and  $P(3)$  are true. (1 mark)

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Q.18 Let  $P(n)$  be the statement  $n^2 > 25$ , prove that whenever  $P(k)$  is true,  $P(k + 1)$  is also true. (2 marks)

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Q.19 Let  $P(n)$  be the statement " $n^2 - n + 41$  is prime". Show that  $P(1)$ ,  $P(2)$ ,  $P(3)$  are true whereas  $P(41)$  is not true. (2 marks)

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Q.20 Explain the principle of mathematical induction. (1 mark)

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