

**RD Sharma**  
**Solutions**  
**Class 11 Maths**  
**Chapter 12**  
**Ex 12.1**

## Mathematical Induction Ex 12.1 Q1

$P(n) : n(n+1)$  is even

$P(3) : 3 \cdot (3+1)$  is even

## Mathematical Induction Ex 12.1 Q2

$P(n) : n^3 + n$  is divisible by 3

$P(3) : 3^3 + 3$  is divisible by 3

$\Rightarrow P(3) : 30$  is divisible by 3.

$\therefore P(3)$  is true

Now,

$P(4) : 4^3 + 3 = 67$  is divisible by 3

Since, 67 is not divisible by 3

So,  $P(4)$  is not true

### Mathematical Induction Ex 12.1 Q3

$P(n) : 2^n \geq 3n$

Given that  $P(r)$  is true

$\Rightarrow 2^r \geq 3r$

Multiplying both the sides by 2,

$$2 \cdot 2^r \geq 2 \cdot 3r$$

$$2^{r+1} \geq 6r$$

$$\geq 3r + 3r$$

$$\geq 3 + 3r,$$

$$[\text{Since } 3r \geq 3 \Rightarrow 3r + 3r \geq 3 + 3r]$$

$$2^{r+1} \geq 3(r+1)$$

$\Rightarrow P(r+1)$  is true

### Mathematical Induction Ex 12.1 Q4

Here,  $P(n) : n^2 + n$  is even

Given,  $P(r)$  is true

$$\Rightarrow r^2 + r \text{ is even}$$

$$\Rightarrow r^2 + r = 2\lambda \quad \text{--- (1)}$$

Now,

$$(r+1)^2 + (r+1)$$

$$= r^2 + 2r + 1 + r + 1$$

$$= (r^2 + r) + 2r + 2$$

$$= 2\lambda + 2r + 2 \quad \text{[Using equation (1)]}$$

$$= 2(\lambda + r + 1)$$

$$= 2\mu$$

$$\Rightarrow (r+1)^2 + (r+1) \text{ is even}$$

$$\Rightarrow P(r+1) \text{ is true}$$

### Mathematical Induction Ex 12.1 Q5

$$P(n) : 1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2} \text{ is true for all } n \in \mathbb{N}$$

### Mathematical Induction Ex 12.1 Q6

$P(n) : n^2 - n + 41$  is prime

$P(1) : 1 - 1 + 41$  is prime

$\Rightarrow P(1) : 41$  is prime

$\therefore P(1)$  is true.

$P(2) : 2^2 - 2 + 41$  is prime

$\Rightarrow P(2) : 43$  is prime

$\therefore P(2)$  is true.

$P(3) : 3^2 - 3 + 41$  is prime

$\Rightarrow P(3) : 47$  is prime

$\therefore P(3)$  is true.

$P(41) : (41)^2 - 41 + 41$  is prime

$P(41) : (41)^2$  is prime

$\Rightarrow P(41)$  is not true