

9.1 Proof by Induction

9.1.1 Intro to Proof by Induction / 9.1.2 Common Cases of Proof by Induction

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Total Marks /30

- 1 Prove by induction that for all positive integers n ,

$$f(n) = 2^{3n+1} + 3(5^{2n+1})$$

is divisible by 17

(6 marks)

- 2 Prove by induction that for all positive integers n ,

$$\begin{pmatrix} 3 & 0 \\ 6 & 1 \end{pmatrix}^n = \begin{pmatrix} 3^n & 0 \\ 3(3^n - 1) & 1 \end{pmatrix}$$

(6 marks)

- 3 Prove by induction that for $n \in \mathbb{Z}^+$

$$\sum_{r=1}^n (3r+1)(r+2) = n(n+2)(n+3)$$

(6 marks)

- 4 Prove by induction that for all positive **odd** integers n

$$f(n) = 4^n + 5^n + 6^n$$

is divisible by 15

(6 marks)

- 5 Prove by induction that for all positive integers n

$$f(n) = 3^{2n+4} - 2^{2n}$$

is divisible by 5

(6 marks)