



VIMBAI HIGH SCHOOL

UPPER 6th Term 1 2018

Tuesday 20 March 2018

Mathematical Induction

40 MARKS

1Hour

ANSWER ALL QUESTIONS

PRESENT YOUR WORK NEATLY



+

1. If $p = \frac{1}{x+5}$, then prove by mathematical induction that for $n \geq 1$:

$$\frac{d^n p}{dx^n} = \frac{(-1)^n n!}{(x+5)^{n+1}}. \quad [7]$$

2. Prove using the principles of mathematical induction that $9^n - 2^n$ is divisible by 7 for all $n \in \mathbb{N}$ [5]

3. Given that a sequence $V_1, V_2, V_3, \dots$ is defined by $V_1 = \frac{1}{3}$; ($n \geq 2$)

$$V_n = V_{n-1} + \frac{1}{n+1}. \text{ Prove by induction that for } n \in \mathbb{Z}^+, V_n = \frac{n}{n+1}. \quad [7]$$

4. a) Prove by induction that for all positive integers n

$$\sum_{r=1}^n 10^r = \frac{10}{9}(10^n - 1) \quad [6]$$

b) Hence evaluate

$$\sum_{r=3}^5 10^r \quad [2]$$

5. Use Induction to show that:

$$a + ar + ar^2 + \dots + ar^{n-1} = \frac{a(r^n - 1)}{r - 1} \text{ for all } n \in \mathbb{Z}^+. \quad [6]$$

6. Prove that for all $n \geq 0$, $\int_0^\infty x^n e^{-x} dx = n! . \quad [7]$

Proverbs 16 vs. 3 ~ Tarakino N.P. (Trockers)

Don't judge each day by the harvest you reap, but by the seeds you plant ~ Robert Louis Stevenson

Page 1