

Taylor's College Subang Jaya
Cambridge A Levels
Further Mathematics P1 Test No. 01

Duration : **50 minutes**

Setter : **Chin K. F., Kev**

Answer all questions.

1. Prove by induction that $f(n) = n^3 + 11n$ is divisible by 6, $\forall n \in \mathbb{N}$. [6]

2. a) Show that $1(n) + 2(n-1) + 3(n-2) + \dots + (n-1)2 + n(1) = \frac{1}{6}n(n+1)(n+2)$. [5]

b) Find the numbers A , B , and C such that $1 + r^2 \equiv A(r+2)(r+1) + B(r+1) + C$ for all values of r . [2]

Hence, or otherwise, prove that $\sum_{r=1}^n (1 + r^2)(r!) = n[(n+1)!]$. [4]

[Hints : $\sum_{r=1}^n r = \frac{1}{2}n(n+1)$, $\sum_{r=1}^n r^2 = \frac{1}{6}n(n+1)(2n+1)$, $\sum_{r=1}^n r^3 = \frac{1}{4}n^2(n+1)^2$]

3. Let $f(x) = \frac{a^2x^2 - b^2}{c^2x^2 - d^2}$, $a, b, c, d > 0$. Express $f(x)$ as sum of partial fractions. [1]

The curve C has equation $y = f(x)$.

a) Find all the equations of the asymptotes of C . [1]

b) Find the stationary points of C , and determine their nature. [6]

c) Sketch C , indicating any axial intercepts. [6]