

①

Determine whether each of the following series is convergent. (You should name any result or test that you use.)

$$(a) \sum_{n=1}^{\infty} \frac{1}{2^n} \quad [2]$$

$$(b) \sum_{n=1}^{\infty} \frac{n^4 2^n}{n!} \quad [4]$$

$$(c) \sum_{n=1}^{\infty} \frac{(-1)^{n+1} n^2}{4n^3 - 1} \quad [4]$$

②

(a) Determine whether or not the following sequences  $\{a_n\}$  are convergent:

$$(i) a_n = \frac{3^n + n^4}{2(n!) - n^{3/2}};$$

$$(ii) a_n = \frac{(-1)^{n+1} n}{2n + 3}. \quad [6]$$

(b) Determine whether or not the following limit exists:

$$\lim_{x \rightarrow 1} \left( \frac{x^2 - 1}{|x - 1|} \right). \quad [4]$$

③

Determine whether each of the following sequences  $\{a_n\}$  is convergent, stating the limit of the sequence (if it exists). You should name any result or Test that you use.

$$(a) a_n = \frac{2n! + 2^n}{3^n - 5n!} \quad 2/5$$

$$(a) a_n = \frac{n! + 2^n}{n^2 + 3(n!) + 1}, \quad n = 1, 2, \dots \quad [3]$$

$$(b) a_n = \frac{5^n}{4^n - n} \quad 5/4$$

$$(b) a_n = \frac{n^2 + 4^n - 4}{n^3 + 3^n - 5}, \quad n = 1, 2, \dots \quad [3]$$

$$(c) a_n = \frac{(-1)^{n+1} n^3}{3n^3 - 1} \quad \text{Not convergent}$$

$$(c) a_n = \frac{(-1)^n n^3}{4n^3 + n + 1}, \quad n = 1, 2, \dots \quad [4]$$

④

Determine whether each of the following sequences  $\{a_n\}$  is convergent, stating the limit of the sequence, if this exists:

$$(i) a_n = \frac{n^4 + 2n^3}{n! + n^2}; \quad [3]$$

$$(ii) a_n = \frac{n! + 5}{2^n}; \quad [3]$$

$$(iii) a_n = \frac{n^3 + n \cos n}{2n^3 + 1}. \quad [4]$$

⑤

Determine whether each of the following series is convergent. (You should name any result or test that you use.)

$$(a) \sum_{n=1}^{\infty} \frac{n^3}{3^n n!} \quad n! \checkmark$$

$$(a) \sum_{n=1}^{\infty} \frac{n^2 + 3}{2n^4 - n} \quad \checkmark$$

$$(b) \sum_{n=1}^{\infty} \frac{n^2}{2 + n^2} \quad \times$$

$$(b) \sum_{n=1}^{\infty} \frac{\sin n}{3n^3 + 1} \quad \checkmark$$

$$(c) \sum_{n=1}^{\infty} \frac{\cos(2\pi/n)}{4n^2 + 1} \quad \checkmark$$

$$(c) \sum_{n=1}^{\infty} \frac{(-1)^n n}{3n - 1} \quad \times$$

The above questions could also be used (separate parts) as part I questions.