1. Which of the following integrals converge?

1) $\int_{2}^{\infty} \frac{1}{x-1}\, dx$ 2) $\int_{1}^{\infty} \frac{1}{e^x}\, dx$ 3) $\int_{1}^{\infty} \frac{dx}{\sqrt[4]{x}}$

(A) Only (2) and (3)

(B) None

(C) Only (2)

(D) Only (3)

(E) Only (1) and (2)

2. $\int_{0}^{\infty} \frac{1}{(x-1)^3}\, dx =$

(A) Diverges (B) $\frac{1}{3}$ (C) $\frac{1}{2}$ (D) $\frac{2}{3}$ (E) 1

3. $\int_{-\infty}^{\infty} \frac{e^x}{1+e^{2x}}\, dx =$

(A) $e + \frac{1}{e}$ (B) $\frac{\pi}{2}$ (C) diverges (D) π (E) $\frac{1}{2}$

4. The government claims to be able to stimulate the economy substantially by giving each taxpayer a $50 tax rebate. They reason that 90% of this amount will be spent first hand, then 90% of the 90% already spent would be spent second hand and so on. If this is true, how much total expenditure will result from this $50 rebate?

(A) $500 (B) $333.33 (C) $100 (D) $450 (E) $600

5. The partial fraction expression for $\frac{2x + 5}{(x + 2)^2(x + 3)^2}$ is

$$\frac{2x + 5}{(x + 2)^2(x + 3)^2} = \frac{1}{(x + 2)^2} - \frac{1}{(x + 3)^2}$$

From this, one can deduce that

$$\sum_{n=1}^{\infty} \frac{2n + 5}{(n + 2)^2(n + 3)^2} =$$

(A) diverges (B) 1 (C) $\frac{1}{4}$ (D) $\frac{7}{144}$ (E) $\frac{1}{9}$

6. Given the infinite series

1) $\sum_{n=1}^{\infty} \frac{n}{n + 3}$ 2) $\sum_{n=1}^{\infty} \frac{(-2)^n}{3^{n+1}}$ 3) $\sum_{n=1}^{\infty} \frac{5}{n^{3/4}}$

(A) all three series diverge

(B) (2) converges, but (1) and (3) diverge

(C) (3) converges, but (1) and (2) diverge

(D) (1) and (3) converge, but (2) diverges

(E) (2) and (3) converge, but (1) diverges

7. Given the infinite series

1) $\sum_{n=2}^{\infty} \frac{1}{n(\ln n)^2}$ 2) $\sum_{n=1}^{\infty} \frac{\sin^2 n}{n\sqrt{n}}$ 3) $\sum_{n=1}^{\infty} \frac{3n}{2n^2 - n + 1}$

(A) (1) converges, (2) diverges, (3) diverges

(B) (1) diverges, (2) converges, (3) diverges

(C) (1) diverges, (2) converges, (3) converges

(D) (1) converges, (2) converges, (3) diverges

(E) (1) converges, (2) diverges, (3) converges

8. When the Ratio Test is applied to the three infinite series

1) $\sum_{n=1}^{\infty} \frac{n^5}{2^n}$ 2) $\sum_{n=1}^{\infty} \frac{n!}{(3n + 2)!}$ 3) $\sum_{n=1}^{\infty} \frac{n}{n^2 + 1}$

the information it provides is

(A) (1) converges, (2) diverges, no information on (3)

(B) (1) converge, but (2) and (3) diverge

(C) (1) and (2) converge, no information on (3)

(D) (1) diverges, no information on (2) and (3)

(E) (1) converges, no information on (2), (3) diverges

9. Which one of the following series is conditionally convergent?

(A) $\sum_{n=1}^{\infty} \frac{(-3)^{n+1}}{n!}$ (B) $\sum_{n=1}^{\infty} (-1)^{n+1} \frac{2^n}{n^2 + 1}$

(C) $\sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{n^{3/2}}$

(D) $\sum_{n=1}^{\infty} (-1)^{n+1} \frac{n}{5n+1}$

(E) $\sum_{n=1}^{\infty} (-1)^{n+1} \frac{1}{\sqrt[3]{n}}$

10. As we shall see later on in the course,

$$\sin 1 = \sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{(2n-1)!}$$

Using the Alternating Series Error Estimate, the error involved in using only the first 3 terms is less than

(A) 0.0002 (B) 0.000003

(C) 0.04 (D) 0.008 (E) 0.00005

11. Which one of the following statement is false?

(A) If $\sum_{n=1}^{\infty} a_n$ diverges, then $\sum_{n=1,000,000}^{\infty} a_n$ diverges.

(B) If S_k denotes the kth partial sum of the series $\sum_{n=1}^{\infty} a_n$,

and $\lim_{n \varnothing \infty} S_k$ exists then, $\lim_{n \varnothing \infty} a_n = 0.$

(C) If $\sum_{n=1}^{\infty} a_n$ and $\sum_{n=1}^{\infty} b_n$ are series of positive terms and $\sum_{n=1}^{\infty} (a_n + b_n)$ converges,

then both $\sum_{n=1}^{\infty} a_n$ and $\sum_{n=1}^{\infty} b_n$ converge.

(D) If $\sum_{n=1}^{\infty} a_n$ is a series of positive terms and $\lim_{n \varnothing \infty} \frac{a_{n+1}}{a_n} = 0$

then $\sum_{n=1}^{\infty} a_n$ converges.

(E) If $\sum_{n=1}^{\infty} a_n$ is a series of positive terms and $\sum_{n=1}^{\infty} (-1)^{n-1} a_n$ converges,

then $\sum_{n=1}^{\infty} a_n$ converges.