[49] 1. Evaluate each of the following integrals.

a) $\int xe^{x^2}\,dx$

b) $\int (3x+4)\sin 2x\,dx$

c) $\int \cos^3 x\,dx$

d) $\int \sqrt{1 - x^2}\, dx$

e) $\int \frac{2x^2 + 1}{x(x^2 + 1)}\, dx$

f) $\int x \ln x\, dx$

g) $\displaystyle\int \tan^2 x\,dx$

[18] 2. Compute each of the following limits. (Give clear reasons for your answers.)

a) $\displaystyle\lim_{x\to 0} \frac{e^x - 1 - x}{x^2}$

b) $\displaystyle\lim_{x\to\infty} xe^{-x}$

c) $\displaystyle\lim_{x\to\infty} \left(1 + \frac{2}{x}\right)^x$

[16] 3. Evaluate the following, if possible. Otherwise, show that it does not exist (diverges).

a) $\int_0^\infty xe^{-x}dx$

b) $\int_{-1}^1 \frac{dx}{x^3}$

[35] 4. Determine whether each of the following infinite series is absolutely convergent, conditionally convergent or divergent: (State the test(s) that you have used and show **ALL** work.)

a) $\sum_1^\infty \frac{2^n}{n}$

b) $\sum_{1}^{\infty} \frac{4+\sin n}{n}$

c) $\sum_{2}^{\infty} \frac{(-1)^n}{n \ln n}$

d) $\sum_{1}^{\infty} \frac{n!3^n}{(2n)!}$

e) $\sum \frac{(-1)^n}{\sqrt{n^3+1}}$

[18] 5. Find the Maclaurin Series for the following.

a) $f(x) = \frac{x}{2-x}$

b) $f(x) = \frac{\sin x - x}{x}$

c) $f(x) = x \cos x^2$

[16] 6. a) Find the Maclaurin Series for $f(x) = e^{-x^2}$.

b) Use this to estimate the value of the following within .001. $\int_0^1 e^{-x^2}\,dx$. (You may leave your answer as the sum and difference of fractions if you wish.)

7. Find the first four nonzero terms in the Taylor Series for

$$f(x) = e^{\cos x} \text{ at } x = \frac{\pi}{2}$$

[10] 8. Find the **interval of convergence** for the power series. (Hint: The series **converges** at both endpoints of the interval. You therefore need **NOT** determine the convergence at the endpoints.)

$$\sum_{1}^{\infty} \frac{(2x-3)^n}{n\sqrt{n}}$$

[10] 9. Find the equation of the tangent line to the following curve at $(-3, -8)$.

$$x = t^3 - 4t, \qquad y = t^2 + 5t - 14$$

[10] 10. Find the arclength of the curve given by $x = \dfrac{t^3}{3} + 4,\ y = \dfrac{t^2}{2} - 7$ for $1 \le t \le 3$.

[10] 11. Set up, but **do not evaluate**, an integral, in polar coordinates, that gives the area of the region that is **outside** the circle $r = 3$ and **inside the circle** $r = 6\sin\theta$.