Answer the problems on separate paper. You do not need to rewrite the problem statements on your answer sheets. Do your own work. Show all relevant steps which lead to your solutions. *Retain* this question sheet for your records.

1.   Using integration by parts find: $\displaystyle\int \frac{x^2}{\sqrt{x+1}}\, dx$

2.   Find: $\displaystyle\int \sin^3 x\, \cos^3 x\, dx$

3.   Find: $\displaystyle\int \frac{1}{(4-x^2)^{3/2}}\, dx$

4.   Find: $\displaystyle\int \frac{2x^2+1}{x^2+x-2}\, dx$

5.   Find: $\displaystyle\int \frac{2x^2+12}{(x+2)(x^2+4)}\, dx$

6.   Solve the initial value problem: $\begin{cases} x\dfrac{dy}{dx} + 2y = x e^{x^3} \\ y(1) = -1 \end{cases}$

7.   Find: $\displaystyle\int x\sqrt{3x-4}\, dx$

8.   Determine whether the following improper integral converges. If it converges, find its value.

$$\int_1^\infty \frac{x}{e^{2x^2}}\, dx$$

9.   Determine whether the following sequences converge. If any of the sequences converge, find their limits.

a. $\left\{ \dfrac{2n}{7\sqrt{n}+50} \right\}$ b. $\left\{ \dfrac{n+(-1)^n}{n-(-1)^n} \right\}$

10.   Determine whether the following series converge. If any of the series converge, find their sums.

a. $\displaystyle\sum_{k=1}^\infty \frac{(-3)^k}{100\cdot 2^k}$ b. $\displaystyle\sum_{k=1}^\infty \frac{1}{\sqrt[3]{k^2}} - \frac{1}{\sqrt[3]{(k+1)^2}}$