Answer the problems on separate paper. You do <u>not</u> need to rewrite the problem statements on your answer sheets. Work carefully. Do your own work. **<u>Show all relevant supporting steps!</u>** Attach this sheet to the front of your answers.

Bald solutions to integral problems – indefinite or definite, proper or improper – without accompanying documentative/associative/supportive work will ***not*** receive credit.

Part I.   Find each of the following anti-derivatives. **No** reference may be given to entries from integral tables for solutions of problems in this section.

1. (9 pts) $\displaystyle \int \sqrt{x}(x^2 - 3\sqrt{x} + 2)\,dx$

2. (9 pts) $\displaystyle \int \frac{\sqrt{3+\sqrt{x}}}{4\sqrt{x}}\,dx$

3. (9 pts) $\displaystyle \int (\sqrt{x}+4)\ln(2x)\,dx$

4. (9 pts) $\displaystyle \int \sin^5 x \cos^2 x\,dx$

Part II.   Find each of the following anti-derivatives. Reference may be made to entries from integral tables in the solutions of problems in this section. Any solution based on usage from integral tables should be appropriately and fully documented.

5. (9 pts) $\displaystyle \int \frac{3}{7x\sqrt{15-x^2}}\,dx$

6. (9 pts) $\displaystyle \int x^2 \cos 6x\,dx$

7. (9 pts) $\displaystyle \int \sec^4 x \tan^3 x\,dx$

8. (9 pts) $\displaystyle \int \tanh^3 2x \operatorname{sech}^2 2x\,dx$

Part III.   Integral tables may be used if desired but are not required. For each problem, provide appropriate accompanying documentative/associative/supportive work.

9. (9 pts) Solve the initial value problem:

$$\frac{dy}{dx} = \frac{y}{x} + 2x, \qquad y(-1) = 3$$

10. (9 pts) Find the partial fraction decomposition of the following rational function

$$\frac{9x^2 + 22x + 41}{(x+2)(x-1)(x^2+7)}$$

11. (15 pts)   Compute the following definite integrals

a. $\displaystyle \int_1^3 9x\sqrt{9-x^2}\,dx$

b. $\displaystyle \int_1^3 \frac{dx}{9x\sqrt{9-x^2}}$

c. $\displaystyle \int_1^\infty \frac{9x}{\sqrt{9+x^2}}\,dx$