

Name \_\_\_\_\_

Score \_\_\_\_\_

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

1. (8 pts) Find the general solution of the differential equation  $2y'' + 6y' - y = 0$
2. (8 pts) Find the general solution of the differential equation  $6y'' - 4y' + y = 0$
3. (14 pts) Solve the initial-value problem  $y'' + 8y' + 25y = 0$ ,  $y(0) = 5$ ,  $y'(0) = -2$
4. (14 pts) Find the general solution of the differential equation  $y'' - 3y' - 10y = 3 - 50x^2$
5. (14 pts) Find the general solution of the differential equation  $y'' - 4y = 6e^{-2x} + 4 - 3x$
6. (8 pts) Find the general solution of the differential equation  $2x^2y'' - 9xy' + 9y = 0$
7. (8 pts) Find the general solution of the differential equation  $2x^2y'' - 4xy' + 9y = 0$
8. (8 pts) Solve the initial-value problem  $x^2y'' + 9xy' - 20y = 0$ ,  $y(1) = 6$ ,  $y'(1) = -2$
9. (14 pts) Use the method of *Variation of Parameters* to find a particular solution of  $y'' - 2y' + y = e^x \ln x$
10. (10 pts) A mass weighing 9 lbs is attached to a 4 ft spring and stretches the spring so that its new length is 7 ft. This mass is replaced by another mass which weighs 12 lbs. The medium through which the spring-mass system moves creates a damping force equal to one and a half the instantaneous velocity. The mass is released at a point  $\frac{1}{2}$  ft above the equilibrium position with an initial upward velocity of 1 ft/s. Find the equation of motion.