Math 1100 Lesson # 15 **Name:**______________________________

Directions: Work all problems in the assignment. If you need more room use the back of the page to complete the problem.

Appendix c.2

Problem 6. Decide whether the variables in the differential equation can be separated.

$$x\frac{dy}{dx} = \frac{1}{y}$$

Problem 24. Use separation of variables to find the general solution of the differential equation.

$$\frac{dy}{dx} = \frac{x^2 + 2}{3y^2}$$

Problem 42. **Sales:** The rate of increase in sales S (in thousands of units) of a product is proportional to the current level of sales and inversely proportional to the sqaure of the time t. This is described by the differential equation

$$\frac{dS}{dt} = \frac{kS}{t^2}$$

where t is the time in years. The saturation point for the market is $50,000$ units. That is, the limit as $t \to \infty$ is 50. After 1 year, 10,000 units have been sold. Find S as a function of t.

Appendix c.3

Problem 14. Solve the differential equation

$$y' + 5y = e^{5t}$$

Problem 26. Match the solution of the differential equation in the text to the following differential equation.

$$y' - 2xy = x$$

Problem 42. **Investment** Let A be the amount in a fund earning interest at the annual rate of r, compounded continuously. If the continuous cash flow of P dollars per year is withdrawn from the fund, then the rate of decrease of A is given by the differential equation

$$\frac{dA}{dt} = rA - P$$

where $A = A_0$, when $t = 0$.

(a) Solve this function for A as a function of t.

(b) Use the result of part (a) to find A when $A_0 = \$2,000,000$, $r = 7\%$, $P = \$250,000$, and $t = 5$ years.

(c) Find A_0 if a retired person wants a continuous cash flow of \$40,000 per years for 20 years. Assume that the person's investment will earn 8%, compounded continuously.

Appendix c.4

Problem 10. **Sales Growth** Use the result of Problem 9 to write S in terms of a function of t if (a) $L = 100$, $S = 25$ when $t = 2$ and (b) $L = 500$, $S = 50$ when $t = 1$.

You will need the following information for the solution of the problem defined above.

Problem 9. **Sales Growth** The rate of change in sales S (in thousands of units) of a new product is proportional to the difference between L and S (in thousands of units) at any time t. When $t = 0$, $S = 0$. Write and solve the differential equation for this sales model. (This is a worked example on the web site associated with this course.)

Problem 16. **Sales Growth** The rate of change in sales S (in thousands of units) of a new product is proportional to the product of S and $L - S$. L (in thousands of units) is the estimated maximum level of sales, and $S = 10$ when $t = 0$. Write and solve the differential equation for this sales model.

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