

Due Thursday, Jan. 30 at the beginning of class.

1. Find the general solution of the equation:

(a)  $\frac{dy}{dx} = \frac{1-x^2}{y^2}$

(b)  $(t+y+1)dt - dy = 0$

(c)  $y^{-1}dy + ye^{\cos x} \sin x dx = 0$

(d)  $(x^2+1)\frac{dy}{dx} + xy = x$

(e)  $(x+xy^2)dx + e^{x^2}ydy = 0$

2. Solve the initial value problem:

(a)  $\frac{dy}{dx} - \frac{y}{x} = xe^x, \quad y(1) = e - 1$

(b)  $\frac{dy}{dx} = 2\sqrt{y+1} \cos x, \quad y(\pi) = 0$

(c)  $t^3 \frac{dx}{dt} + 3t^2x = t, \quad x(2) = 0$

(d)  $\sqrt{y}dx + (1+x)dy = 0, \quad y(0) = 1$

(e)  $\sin x \frac{dy}{dx} + y \cos x = x \sin x \quad y\left(\frac{\pi}{2}\right) = 2$

3. Suppose a brine containing 0.2 kg of salt per liter runs into a tank initially filled with 500 L of water containing 5 kg of salt. The brine enters the tank at a rate of 5 L/min. The mixture, kept uniform by stirring, is flowing out at a rate of 5 L/min. Find a concentration, in kilograms per liter, of salt in the tank after 10 min.

4. A cold beer initially at 35°F warms up to 40°F in 3 min while sitting in a room of temperature 70°F. How warm will the beer be if left out for 20 min?