

A

Math185 Quiz §9.3, §9.5
Thursday, 18 March 2010

Last Name:
First Name:

1. *Separable Equations* Find the solution of the differential equation that satisfies the given initial conditions.

$$x \cos x = (2y + e^{3y})y', \quad y(0) = 0$$

$$x \cos x = (2y + e^{3y}) \frac{dy}{dx}$$
$$\int x \cos x dx = \int (2y + e^{3y}) dy$$

$$\textcircled{I} \int x \cos x dx$$
$$u = x \quad dv = \cos x dx$$
$$du = dx \quad v = \sin x$$
$$= x \sin x - \int \sin x dx$$
$$= x \sin x + \cos x$$

$$x \sin x + \cos x = \frac{2y^2}{2} + \frac{e^{3y}}{3} + C$$

$$x \sin x + \cos x = y^2 + \frac{e^{3y}}{3} + C$$

when $x=0, y=0$

$$0 \sin 0 + \cos 0 = 0^2 + \frac{e^0}{3} + C$$

$$1 = \frac{1}{3} + C$$

$$C = \frac{2}{3}$$

$$x \sin x + \cos x = y^2 + \frac{e^{3y}}{3} + \frac{2}{3}$$

2. Linear Differential Equations Solve the initial value problem.

$$t \frac{dy}{dt} + 2y = t^3, \quad y(1) = 0$$

$$\frac{dy}{dt} + \frac{2}{t}y = t^2$$

$$I = e^{\int 2/t dt} = e^{2 \ln t} = e^{\ln t^2} = t^2$$

$$t^2 y' + 2ty = t^4$$

$$(t^2 y)' = t^4$$

$$t^2 y = \int t^4 dt + C$$

$$y = \frac{\int t^4 dt + C}{t^2}$$

$$y = \frac{t^5/5 + C}{t^2}$$

$$t=1, y=0$$

$$0 = \frac{1/5 + C}{1}$$

$$C = -\frac{1}{5}$$

$$y = \frac{\left(\frac{t^5}{5} - \frac{1}{5} \right)}{t^2}$$

$$y = \frac{t^3}{5} - \frac{1}{5t^2}$$

B

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1. *Separable Equations* Find the solution of the differential equation that satisfies the given initial conditions.

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

$$\int \frac{1+y^2}{y} dy = \int \cos x dx$$

$$\int \left(\frac{1}{y} + y\right) dy = \int \cos x dx$$

$$\ln|y| + \frac{y^2}{2} = \sin x + C$$

$x=0, y=1$

$$\ln 1 + \frac{1^2}{2} = \sin 0 + C$$

$$\frac{1}{2} = C$$

$$\ln|y| + \frac{y^2}{2} = \sin x + \frac{1}{2}$$

2. Linear Differential Equations Solve the initial value problem.

$$t \frac{dy}{dt} - 2ty = 3t^2 e^{t^2}, \quad y(0) = 5$$

$$y' - 2y = 3te^{t^2}$$

$$I = e^{\int -2 dt} = e^{-2t}$$

$$e^{-2t} y' - 2e^{-2t} y = 3te^{t^2} e^{-2t}$$

$$(e^{-2t} y)' = 3te^{t^2 - 2t}$$

$$e^{-2t} y = \int 3te^{t^2 - 2t} dt + C$$

$$y = \frac{\int 3te^{t^2 - 2t} dt + C}{e^{-2t}}$$

$3 \int t e^{t^2 - 2t} dt$
cannot integrate