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2/17/14

607

# 1, 3, 11, 13

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

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

$$\ln|y| = \ln|x| + C$$

$$y = \pm e^{\ln|x| + C}$$

$$y = \pm e^{\ln|x|} e^C$$

$$y = \pm x e^C$$

#3  $(x^2 + 1)y' = xy$

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

$$\int \frac{dy}{y} = \int \frac{xdx}{(x^2 + 1)}$$

$$u = x^2 + 1$$

$$du = 2x dx$$

$$\frac{du}{2} = x dx$$

$$\ln|y| = \frac{1}{2} \int \frac{du}{u}$$

$$\ln|y| = \frac{1}{2} \ln|u|$$

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

$$y = \pm e^{\frac{1}{2} \ln|x^2 + 1| + C}$$

$$y = \pm e^C \sqrt{|x^2 + 1|}$$

$$y = \pm e^C \sqrt{x^2 + 1}$$

#11.  $\frac{dx}{dx} = x^2 + 1$ ,  $x(1) = 0$

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

$$\tan^{-1} x = x + C$$

$$\tan^{-1}(0) = 1 + C$$

$$0 = 1 + C$$

$$C = -1$$

$$\tan^{-1} x = x - 1$$

$$x = \tan(x-1)$$

#13.  $x \cos x = (2x + e^{3x}) x'$ ,  $x(0) = 0$

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

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

$$u = x$$

$$v = \sin x$$

$$u dv = v du \Rightarrow \int u dv = \cos x dx$$

$$\int x \cos x dx = x \sin x - \int \sin x dx$$

$$= x \sin x + \cos x$$

$$x \sin x + \cos x = x^2 + \frac{1}{3} e^{3x} + C$$

$$0 \sin(0) + \cos(0) = 0^2 + \frac{1}{3} e^0 + C$$

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

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

$$x \sin x + \cos x - \frac{2}{3} = x^2 + \frac{1}{3} e^{3x}$$

Separation of Variables  
ps. 607 1,3,11,13

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①  $\frac{dy}{dx} = \frac{y}{x}$

$0 = (1)y^{1+s} = \frac{y^0}{x^0}$

⑩

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

$x^0 y^0 = x^0 y^0$   
 $1+s = 1+s$

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

$x^0 (1+s) = \frac{y^0}{(1+s)}$

$\ln|y| = \ln|x| + c$   
 $e^{\ln|y|} = e^{\ln|x|+c}$

$s+x = y^{1+s}$   
 $s+1 = 0^{1+s}$   
 $s+1 = 0$

$y = x \cdot e^c$   
 $y = kx$

$(1-x) \text{ not } = y$

③  $(x^2+1) \frac{dy}{dx} = xy$

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

$dD = (0)y + \frac{y^0}{x^0} (x^2 + 1)^s = x^0 \cos x$

⑫

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

$u = x^2+1$

$\ln|y| = \frac{1}{2} \int \frac{du}{u}$   
 $\ln|y| = \frac{1}{2} \ln|x^2+1| + c$

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

$y = k\sqrt{x^2+1}$

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Additional to our program?  
E1.11.29 105.29

⑪  $\frac{dy}{dx} = y^2 + 1, y(1) = 0$

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

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

$\tan^{-1} y = x + c$

$\tan^{-1} 0 = 1 + c$

$0 = 1 + c$

$c = -1$

$y = \tan(x-1)$

①  $\frac{y}{x} = \frac{y^2}{x^2}$

$\frac{y}{x} = \frac{y^2}{x^2}$

$\frac{y}{x} = \frac{y^2}{x^2}$

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

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

$\ln y = \ln x + c$

⑬  $x \cos x = (2y + e^{3y}) \frac{dy}{dx}, y(0) = 0$

③  $x^2 = \frac{y^2}{1+5y}$

$\frac{d}{dx} (x^2) = \frac{d}{dx} \left( \frac{y^2}{1+5y} \right)$

$2x = \frac{2y \cdot \frac{dy}{dx} (1+5y) - y^2 \cdot 5 \frac{dy}{dx}}{(1+5y)^2}$

$\frac{2x}{2} = \frac{2y \frac{dy}{dx} (1+5y) - 5y^2 \frac{dy}{dx}}{(1+5y)^2}$

$x = \frac{2y \frac{dy}{dx} (1+5y) - 5y^2 \frac{dy}{dx}}{(1+5y)^2}$

$x = \frac{2y \frac{dy}{dx} (1+5y) - 5y^2 \frac{dy}{dx}}{(1+5y)^2}$