Kuta Software - Infinite Calculus

Name Key

Separable Differential Equations

Date _____ Period ____

Find the general solution of each differential equation.

1) $\frac{dy}{dx} = e^{x-y}$

$e^y = e^x + C$

$y = \ln(e^x + C)$

2) $\frac{dy}{dx} = \frac{1}{\sec^2 y}$; $y(2) = 0$

$\tan y = x + C$ → $\tan 0 = 2 + C$

$y = \tan^{-1}(x + C)$ $C = -2$

$y = \tan^{-1}(x - 2)$

3) $\frac{dy}{dx} = xe^y$

$-e^{-y} = \frac{x^2}{2} + C_1$

$y = -\ln\left(-\frac{x^2}{2} + C\right)$

4) $\frac{dy}{dx} = \frac{2x}{e^{2y}}$; $y(1) = 0$

$\frac{e^{2y}}{2} = x^2 + C_1$

$y = \frac{\ln(2x^2 + C)}{2}$ ⇒ $0 = \frac{\ln(2+C)}{2}$

$y = \frac{\ln(2x^2 - 1)}{2}$ $e^0 = \ln(2+C)$

$1 = 2 + C$

$C = -1$

5) $\frac{dy}{dx} = 2y - 1$; $y(0) = 4$

$\frac{\ln|2y-1|}{2} = x + C_1$

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

$4 = \frac{Ce^0 + 1}{2}$

$8 = C + 1$

$C = 7$

$y = \frac{7e^{2x} + 1}{2} = \frac{7}{2}e^{2x} + \frac{1}{2}$

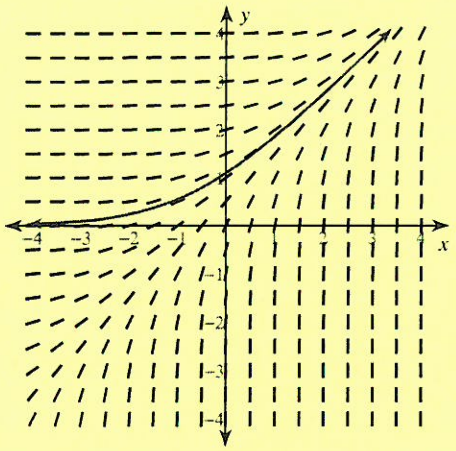
6) $\frac{dy}{dx} = 2yx + yx^2$

$\ln|y| = x^2 + \frac{x^3}{3} + C_1$

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

For each problem, find the particular solution of the differential equation that satisfies the initial condition. You may use a graphing calculator to sketch the solution on the provided graph.

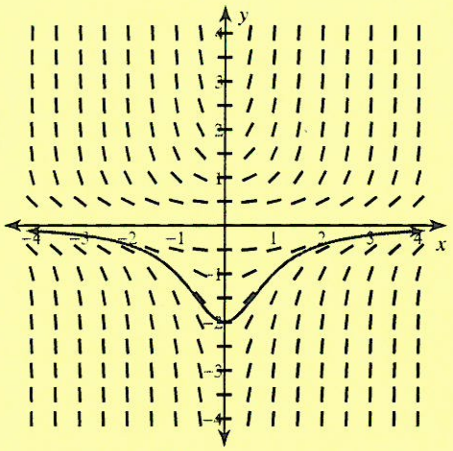
7) $\frac{dy}{dx} = 2e^{x-y}$, $y(1) = \ln(2e+1)$



$e^y = 2e^x + 1$

$y = \ln(2e^x + 1)$

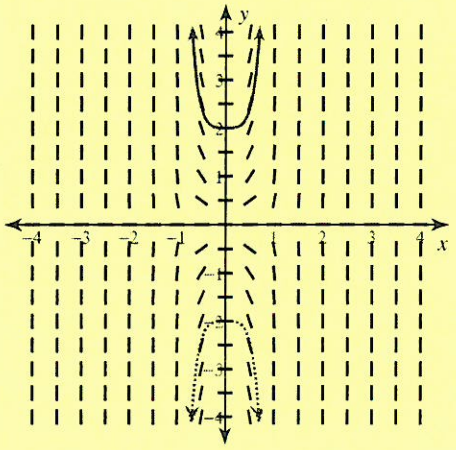
8) $\frac{dy}{dx} = xy^2$, $y(2) = -\frac{2}{5}$



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

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

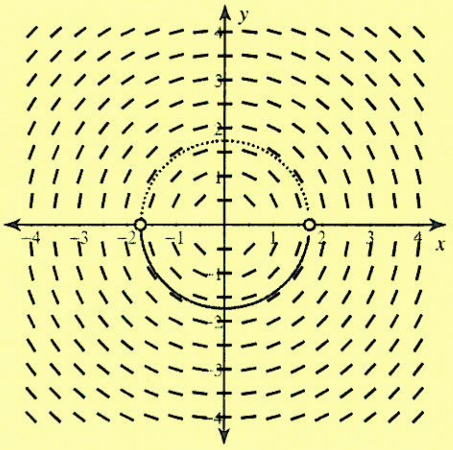
9) $\frac{dy}{dx} = 12x^3y$, $y(0) = 2$



$\ln|y| = 3x^4 + \ln 2$

$y = 2e^{3x^4}$

10) $\frac{dy}{dx} = -\frac{x}{y}$, $y(1) = -\sqrt{2}$



$\frac{y^2}{2} = -\frac{x^2}{2} + \frac{3}{2}$ → $y = \pm\sqrt{-x^2+3}$

$y = -\sqrt{-x^2+3}$, $-\sqrt{3} < x < \sqrt{3}$

Choose − from ± b/c of condition $y(1) = -\sqrt{2}$.

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