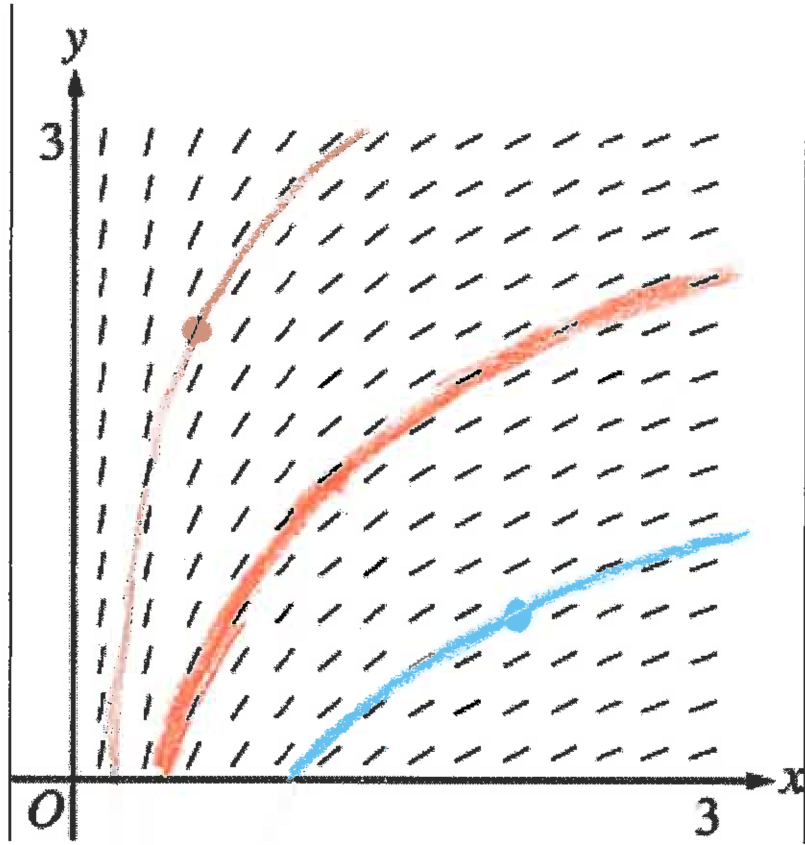
From the May 2008 *AP Calculus Course Description:*
15.

From: http://apcentral.collegeboard.com/apc/public/repository/ap08_calculus_slopefields_worksheet.pdf



No ATTENDANCE QUIZ TODAY

$y' = \frac{1}{x}$

(A) $y = x^2$ (B) $y = e^x$ (C) $y = e^{-x}$ (D) $y = \cos x$ (E) $y = \ln x$

The slope field from a certain differential equation is shown above. Which of the following could be a specific solution to that differential equation?

(A) $y = x^2$ (B) $y = e^x$ (C) $y = e^{-x}$ (D) $y = \cos x$ (E) $y = \ln x$

2.3: Modeling with differential equations.

Suppose salty water enters and leaves a tank at a rate of 2 liters/minute.

Suppose also that the salt concentration of the water entering the tank varies with respect to time according to $Q(t) \cdot tsin(t^2)$ g/liters where $Q(t)$ = amount of salt in tank in grams. (Note: this is not realistic).

$Q(0) = 5$ initial condition

If the tank contains 4 liters of water and initially contains 5g of salt, find a formula for the amount of salt in the tank after t minutes.

Let $Q(t)$ = amount of salt in tank in grams.

Note $Q(0) = 5$ g

rate in $=$ (2 liters/min)($Q(t) \cdot tsin(t^2)$ g/liters)

$$= 2Qtsin(t^2) \text{ g/min}$$

rate out $=$ (2 liters/min)$\left(\frac{Q(t)g}{4\text{liters}}\right) = \frac{Q}{2}$ g/min

$\frac{dQ}{dt}$ = rate in - rate out $= 2Qtsin(t^2) - \frac{Q}{2}$

$\frac{dQ}{dt} = Q(2tsin(t^2) - \frac{1}{2})$

This is a first order linear ODE. It is also a separable ODE. Thus can use either 2.1 or 2.2 methods.