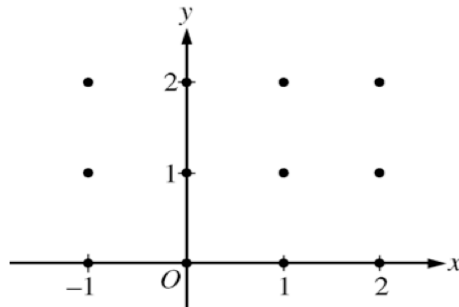


2005

4. Consider the differential equation $\frac{dy}{dx} = 2x - y$.

- (a) On the axes provided, sketch a slope field for the given differential equation at the twelve points indicated, and sketch the solution curve that passes through the point $(0, 1)$.

(Note: Use the axes provided in the pink test booklet.)



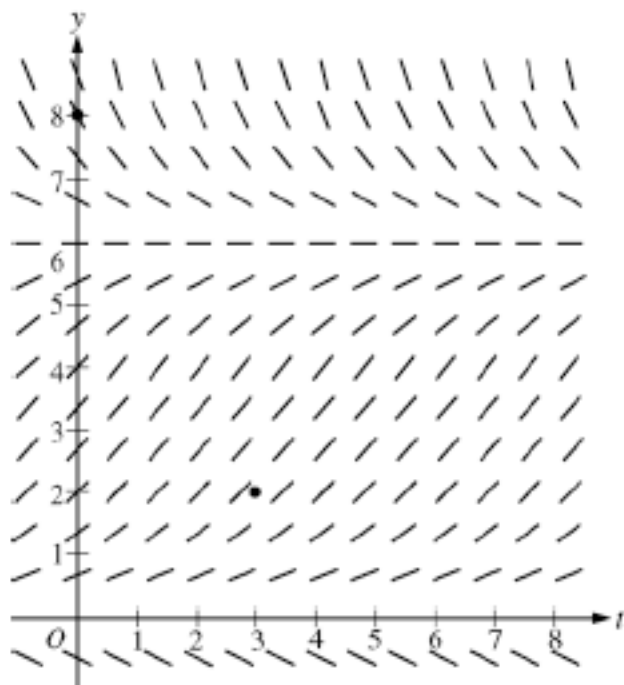
- (b) The solution curve that passes through the point $(0, 1)$ has a local minimum at $x = \ln\left(\frac{3}{2}\right)$. What is the y -coordinate of this local minimum?
- (c) Let $y = f(x)$ be the particular solution to the given differential equation with the initial condition $f(0) = 1$. Use Euler's method, starting at $x = 0$ with two steps of equal size, to approximate $f(-0.4)$. Show the work that leads to your answer.
- (d) Find $\frac{d^2y}{dx^2}$ in terms of x and y . Determine whether the approximation found in part (c) is less than or greater than $f(-0.4)$. Explain your reasoning.

2008 AP[®] CALCULUS BC FREE-RESPONSE QUESTIONS

6. Consider the logistic differential equation $\frac{dy}{dt} = \frac{y}{8}(6 - y)$. Let $y = f(t)$ be the particular solution to the differential equation with $f(0) = 8$.

- (a) A slope field for this differential equation is given below. Sketch possible solution curves through the points $(3, 2)$ and $(0, 8)$.

(Note: Use the axes provided in the exam booklet.)



- (b) Use Euler's method, starting at $t = 0$ with two steps of equal size, to approximate $f(1)$.
- (c) Write the second-degree Taylor polynomial for f about $t = 0$, and use it to approximate $f(1)$.
- (d) What is the range of f for $t \geq 0$?
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2009 AP[®] CALCULUS BC FREE-RESPONSE QUESTIONS

CALCULUS BC
SECTION II, Part B
Time—45 minutes
Number of problems—3

No calculator is allowed for these problems.

4. Consider the differential equation $\frac{dy}{dx} = 6x^2 - x^2y$. Let $y = f(x)$ be a particular solution to this differential equation with the initial condition $f(-1) = 2$.
- (a) Use Euler's method with two steps of equal size, starting at $x = -1$, to approximate $f(0)$. Show the work that leads to your answer.
- (b) At the point $(-1, 2)$, the value of $\frac{d^2y}{dx^2}$ is -12 . Find the second-degree Taylor polynomial for f about $x = -1$.
- (c) Find the particular solution $y = f(x)$ to the given differential equation with the initial condition $f(-1) = 2$.

2010 AP[®] CALCULUS BC FREE-RESPONSE QUESTIONS

5. Consider the differential equation $\frac{dy}{dx} = 1 - y$. Let $y = f(x)$ be the particular solution to this differential equation with the initial condition $f(1) = 0$. For this particular solution, $f(x) < 1$ for all values of x .
- (a) Use Euler's method, starting at $x = 1$ with two steps of equal size, to approximate $f(0)$. Show the work that leads to your answer.
- (b) Find $\lim_{x \rightarrow 1} \frac{f(x)}{x^3 - 1}$. Show the work that leads to your answer.
- (c) Find the particular solution $y = f(x)$ to the differential equation $\frac{dy}{dx} = 1 - y$ with the initial condition $f(1) = 0$.
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