2018 AP® CALCULUS AB FREE-RESPONSE QUESTIONS

t (years)	2	3	5	7	10
$H(t)$ (meters)	1.5	2	6	11	15

4. The height of a tree at time t is given by a twice-differentiable function H, where $H(t)$ is measured in meters and t is measured in years. Selected values of $H(t)$ are given in the table above.

   (a) Use the data in the table to estimate $H'(6)$. Using correct units, interpret the meaning of $H'(6)$ in the context of the problem.

Symmetric difference

t (years)	2	3	5	7	10
$H(t)$ (meters)	1.5	2	6	11	15

4. The height of a tree at time t is given by a twice-differentiable function H, where $H(t)$ is measured in meters and t is measured in years. Selected values of $H(t)$ are given in the table above.

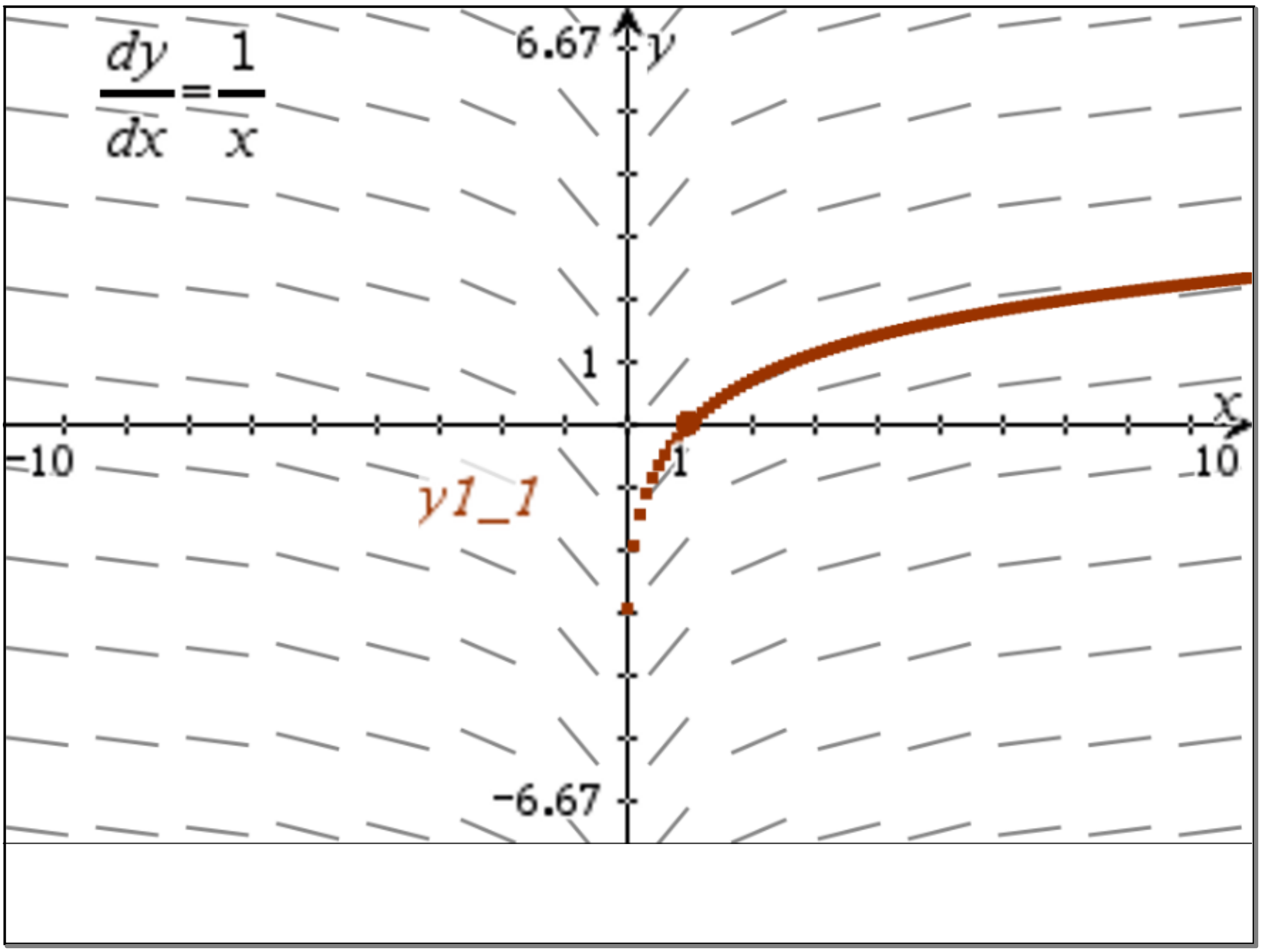
   (a) Use the data in the table to estimate $H'(6)$. Using correct units, interpret the meaning of $H'(6)$ in the context of the problem.

   (b) Explain why there must be at least one time t, for $2 < t < 10$, such that $H'(t) = 2$.

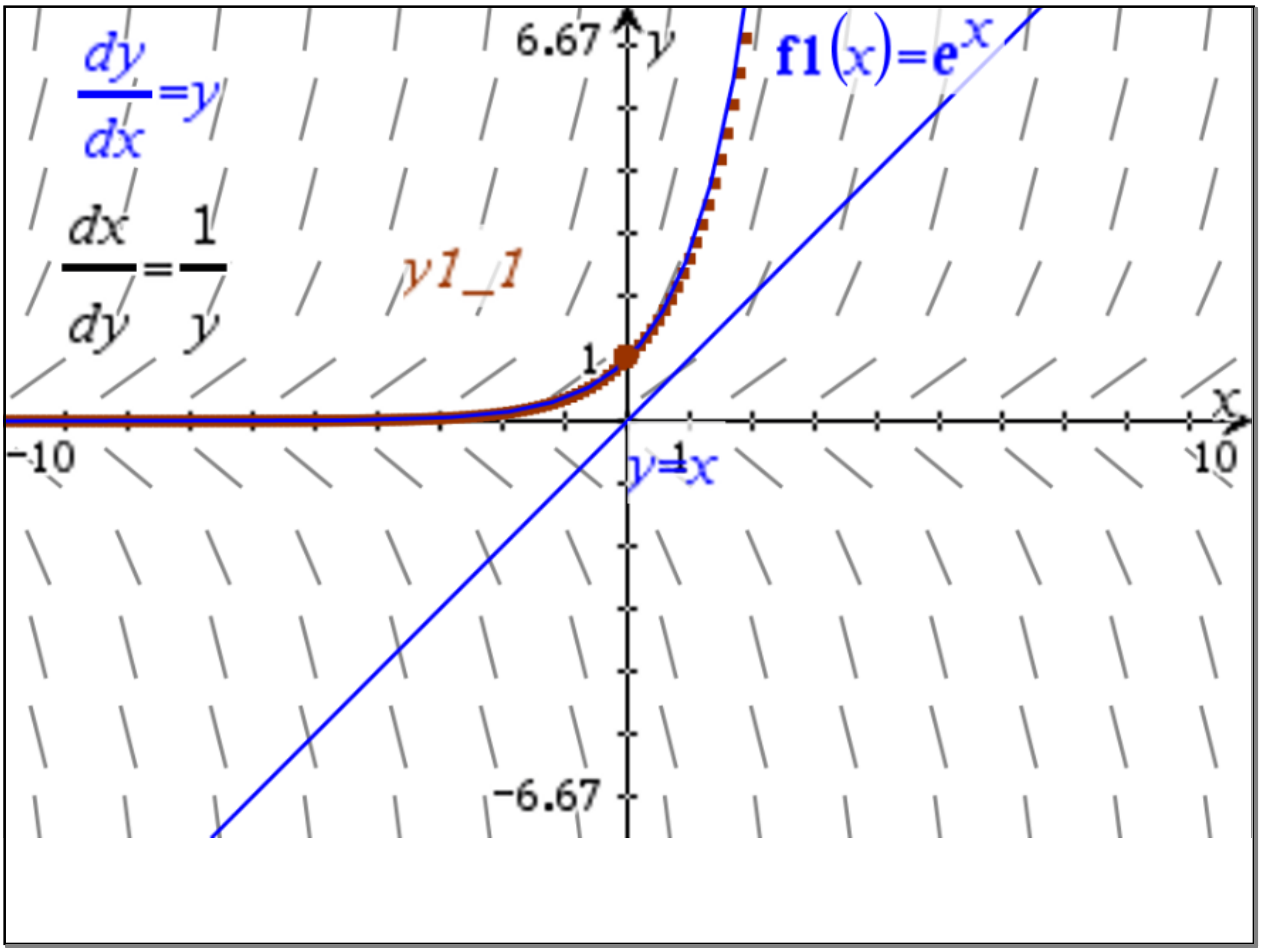
AP® CALCULUS AB/CALCULUS BC
2018 SCORING GUIDELINES

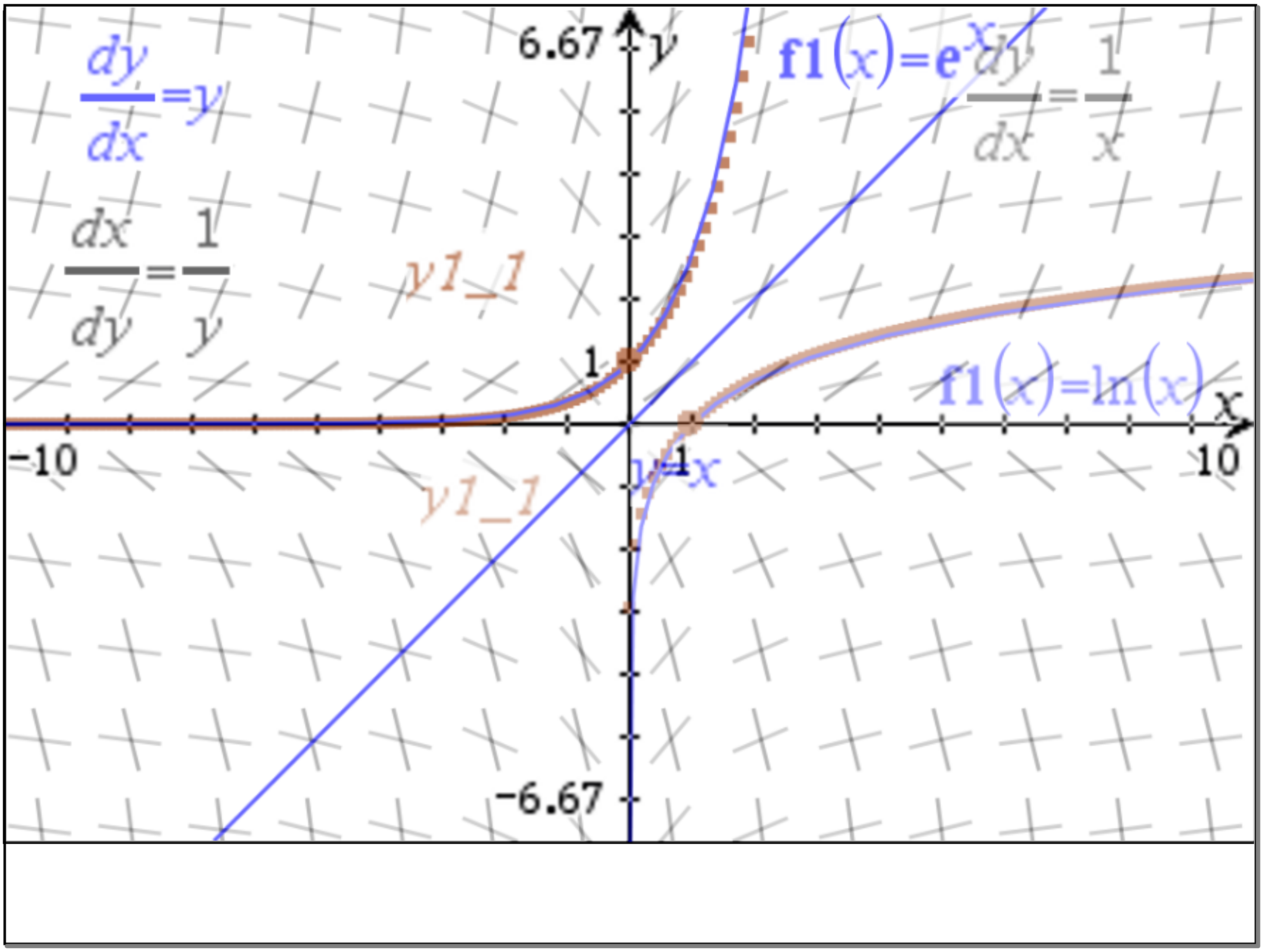
Question 4

(a) $H'(6) \approx \dfrac{H(7) - H(5)}{7 - 5} = \dfrac{11 - 6}{2} = \dfrac{5}{2}$ $H'(6)$ is the rate at which the height of the tree is changing, in meters per year, at time $t = 6$ years.	$2 : \begin{cases} 1 : \text{estimate} \\ 1 : \text{interpretation with units} \end{cases}$
(b) $\dfrac{H(5) - H(3)}{5 - 3} = \dfrac{6 - 2}{2} = 2$ Because H is differentiable on $3 \le t \le 5$, H is continuous on $3 \le t \le 5$. By the Mean Value Theorem, there exists a value c, $3 < c < 5$, such that $H'(c) = 2$.	$2 : \begin{cases} 1 : \dfrac{H(5) - H(3)}{5 - 3} \\ 1 : \text{conclusion using} \\ \quad\ \text{Mean Value Theorem} \end{cases}$


$\frac{dy}{dx}=\frac{1}{x}$
6.67
y
1
x
-10
1
10
y1_1
-6.67

September 11, 2018





$\frac{dy}{dx}=y$
$\frac{dx}{dy}=\frac{1}{y}$
6.67
y
f1(x)=e^x
$\frac{dy}{dx}=\frac{1}{x}$
y1_1
1
f1(x)=ln(x)
x
−10
1
y=x
10
y1_1
−6.67

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