Sum up your name: Key

AP Calculus AB: Riemann Sums Review

t (hours)	0	2	5	7	8
$E(t)$ (hundreds of entries)	0	4	13	21	23

2. A zoo sponsored a one-day contest to name a new baby elephant. Zoo visitors deposited entries in a special box between noon ($t = 0$) and 8 P.M. ($t = 8$). The number of entries in the box t hours after noon is modeled by a differentiable function E for $0 \le t \le 8$. Values of $E(t)$, in hundreds of entries, at various times t are shown in the table above.

(a) Use the data in the table to approximate the rate, in hundreds of entries per hour, at which entries were being deposited at time $t = 6$. Show the computations that lead to your answer.

(b) Use a trapezoidal sum with the four subintervals given by the table to approximate the value of $\frac{1}{8}\int_0^8 E(t)\,dt$.

Using correct units, explain the meaning of $\frac{1}{8}\int_0^8 E(t)\,dt$ in terms of the number of entries.

a) $\frac{f(b)-f(a)}{b-a} = \frac{f(7)-f(5)}{7-5} = \frac{21-13}{2} = \frac{8}{2} = \boxed{4 \frac{\text{hundred entries}}{\text{hr}}}$

b) $\frac{1}{8}\left(\frac{2(0+4)}{2} + \frac{3(4+13)}{2} + \frac{2(13+21)}{2} + \frac{1(23+21)}{2}\right) = 10.688 \frac{\text{hundreds of entries}}{\text{hr}}$

This is the avg rate at which entries are being put into the box per hour from hrs 0-8.

x	2	3	5	8	13
$f(x)$	1	4	–2	3	6

5. Let f be a function that is twice differentiable for all real numbers. The table above gives values of f for selected points in the closed interval $2 \le x \le 13$.

(a) Estimate $f'(4)$. Show the work that leads to your answer.

$f'(4) = \frac{f(5)-f(3)}{5-3} = \frac{-2-4}{2} = \frac{-6}{2} = -3$

(c) Use a left Riemann sum with subintervals indicated by the data in the table to approximate $\int_2^{13} f(x)\,dx$.

Show the work that leads to your answer.

(d) Suppose $f'(5) = 3$ (inc) and $f''(x) < 0$ (CD) for all x in the closed interval $5 \le x \le 8$. Use the line tangent to the graph of f at $x = 5$ to show that $f(7) \le 4$.

c) $1(1)+2(4)+3(-2)+5(3) = 18$

d) $y - y_1 = m(x - x_1)$

$y-(-2) = 3(x-5)$

$y+2 = 3x-15$

$y = 3x-17$

$y = 3(7)-17 = 4$

this is the tangent line it will over approx all values since the f(x) is concave down

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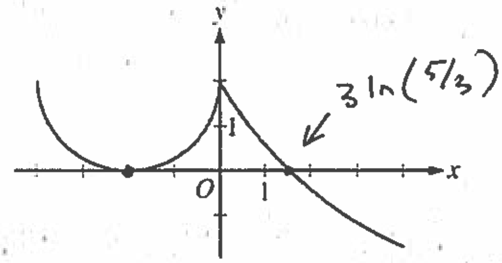

Graph of f'

6. The derivative of a function f is defined by $f'(x) = \begin{cases} g(x) & \text{for } -4 \le x \le 0 \\ 5e^{-x/3} - 3 & \text{for } \ 0 < x \le 4 \end{cases}$.

The graph of the continuous function f', shown in the figure above, has x-intercepts at $x = -2$ and $x = 3\ln\left(\frac{5}{3}\right)$. The graph of g on $-4 \le x \le 0$ is a semicircle, and $\boxed{f(0) = 5.}$

(a) For $-4 < x < 4$, find all values of x at which the graph of f has a point of inflection. Justify your answer.

(b) Write the equation of the normal line for f(x) at x=0 Perpendicular$\left(\frac{-1}{m}\right)$

(c) For $-4 \le x \le 4$, find the value of x at which f has an absolute maximum. Justify your answer.

a) POI means $f''=0$ the f'' is seen by looking at the slope of f' on this graph.
This graph has a slope of zero at $x=-2$ and an undefined slope at $x=0$. They are both POI because the slope changes from inc to dec or dec to inc meaning the concavity is changing.

b) $y - y_1 = m(x - x_1)$
$y - 5 = \frac{-1}{2}(x - 0)$
$y - 5 = \frac{-1}{2}x$
$\boxed{y = \frac{-1}{2}x + 5}$

c) This is a graph of f'. Therefore f' is always positive, meaning increasing slopes until $x = 3\ln(5/3)$, that means $x = 3\ln(5/3)$ must be the absolute max. since $f(x)$ begins to decrease after that x-value.