t	0	25	30	45	65	80
$W(t)$	2	10	13	30	60	81

BC1: Workers at a local office building are expected to be at work by 9AM ($t = 60$) each day. Let the twice differentiable function $y = W(t)$ be the amount of workers in the building at time t, in minutes, satisfying the logistic differential equation $\frac{dy}{dt} = \frac{1}{15}y\left(1 - \frac{y}{100}\right)$ where $W(0) = 2$. Selected values of $W(t)$ are given in the table where $\mathrm{t} = 0$ is 8AM.

(a) Find $W'(65)$ and $W''(65)$. Using correct units, interpret the meaning of $W''(65)$ in context of this problem.

(b) Evaluate $\int_0^\infty W'(3t + 25)dt$. Show the work that leads to your answer.

(c) Use a left Riemann sum with three subintervals indicated by the data in the table to approximate the value of $\frac{1}{45}\int_0^{45} W(t)dt$. Using correct units, explain the meaning of $\frac{1}{45}\int_0^{45} W(t)dt$ in the context of the problem.

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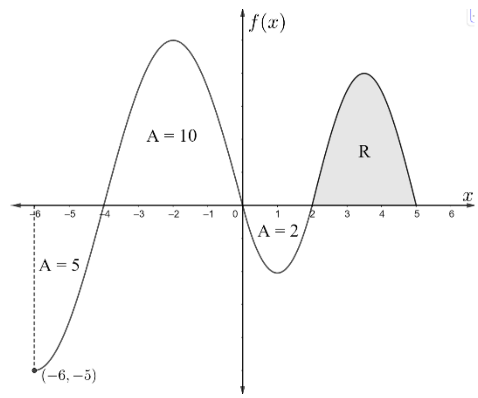
(d) Use Euler's method with two steps of equal size starting at $t = 45$ minutes to approximate the number of workers inside the office building by 9:25AM ($t = 85$ minutes).

(e) Is there a time c, such that $25 < c < 45$, when $W'(c) = 1$. Justify your answer.

(f) Let $P_2(t)$ be the second degree Taylor polynomial for $W(t)$ centered at $t = 65$. Find $P_2(t)$ and use it to approximate the number of workers inside the office building at 9:25AM ($t = 85$).



BC2: The function f is twice differentiable for $x \geq -6$. A portion of the graph of f is given in the figure above. The areas formed by the bounded regions between the graph of f and the x axis are labeled in the figure. Let the twice differentiable function g be defined by $g(x) = \int_2^x f(t)dt$.

(a) Find $\lim_{x \to -2} \frac{g(2x) - 4x}{e^{x^2-4} + x - 1}$.

(b) Find the absolute maximum of g on the interval $[-6,2]$. Justify your answer.

(c) Evaluate $\int_{-3}^{1} xf'(2x)dx$.

(d) The region R is the base of a solid whose cross sections perpedicular to the x axis are squares. Write, but do not evaluate, an integral expression that gives the volume of the solid.

(e) For $x \geq 5$, the function f is not explicitly given, but $f'(x) = -4\left(\frac{1}{2}\right)^{x-5}$. If $a_n = f'(n)$, find $\sum_{n=5}^{\infty} a_n$ or show that the series diverges.