**1**. [9 points] Some values of the function $g(x)$ and its derivative are given in the table below. Suppose that both $g(x)$ and $g'(x)$ are continuous.

| $x$ | 1 | 3 | 5 | 7 | 9 |
|---|---|---|---|---|---|
| $g(x)$ | 3 | 1 | 4 | 2 | 5 |
| $g'(x)$ | $-2$ | 0 | 3 | $-1$ | 4 |

Using the information given above, find the following. Be sure to **show all of your work.** Your answers should not involve the letter $g$, but you **do not need to simplify them.**

**a**. [3 points] Suppose $F(x) = \displaystyle\int_1^{x^2} g(t)\,dt$. Find $F'(3)$.

*Solution:* By the Second Fundamental Theorem of Calculus, combined with the Chain Rule,

$$F'(x) = 2xg(x^2)$$

so

$$F'(3) = 2 \cdot 3 \cdot g(9) = 30.$$

**Answer:** 30

**b**. [3 points] Find $\displaystyle\lim_{x\to 1} \frac{3\ln(x) + g(x) - 3}{x - 1}$.

*Solution:* We use L'Hospital's rule to find the limit.

$$\begin{aligned}\lim_{x\to 1} \frac{3\ln(x) + g(x) - 3}{x - 1} &\overset{\text{LH}}{=} \lim_{x\to 1} \frac{3}{x} + g'(x) \\ &= 3 + g'(1) \\ &= 1\end{aligned}$$

**Answer:** 1

**c**. [3 points] Use MID(2) to find the approximate value of $\displaystyle\int_1^9 \frac{g(x)}{1+x^3}\,dx$. Write out all the terms in your sum and do not attempt to simplify.

*Solution:* Note that the midpoints we use are 3 and 7. Then our MID(2) approximation is

$$4 \cdot \frac{g(3)}{1+3^3} + 4 \cdot \frac{g(7)}{1+7^3}.$$

**Answer:** $\dfrac{4}{1+3^3} + \dfrac{8}{1+7^3}$