3. [12 points] In this problem we study the integral $I = \displaystyle\int_1^{1.5} \ln x \, dx$.

a. [2 points] Write a left Riemann sum with 5 subdivisions that approximates I, showing all the terms in your sum. **Circle** your sum and leave all the terms in **exact** form.

b. [2 points] Use the midpoint rule with 5 subdivisions to approximate I, showing all the terms in your sum. **Circle** your sum and leave all the terms in **exact** form.

c. [4 points] (i) Use the u-substitution $u = x - 1$ to find an integral J, which is equal to I. **Circle** your answer.

(ii) Give $P_3(u)$, the 3rd degree Taylor polynomial around $u = 0$ for the integrand of the integral J. **Circle** your answer.

(iii) Substitute $P_3(u)$ for the integrand of J and compute the resulting integral by hand. **Circle** your answer.

3. (continued)

d. [4 points] Finally find the exact value of $I = \int_1^{1.5} \ln x \, dx$ using integration by parts. Give your answer in **exact** form and show your work. **Circle** your answer.

4. [5 points]

The function $g(x)$ satisfies the differential equation $y' = ay^2 - x$. The table on the right gives some information about $g(x)$.

x	$g(x)$	$g'(x)$
1	1	2

a. [2 points] Find a.

b. [3 points] Approximate $g(1.2)$ using Euler's method with $\Delta x = 0.1$.