4. [12 points] For each of the questions below, circle all of the available correct answers. Circle “NONE OF THESE” if none of the available choices are correct.

a. [3 points] Which of the following are antiderivatives of the function $2 \sin(x) \cos(x)$?

i. $\frac{1}{2} \cos^2(x) + \frac{1}{2} \sin^2(x)$

ii. $\sin^2(3) - \cos^2(x)$

iii. $\int_0^\pi 2 \sin(x) \cos(x) \, dx$

iv. $\sin^2(x)$

v. NONE OF THESE

b. [3 points] Which of the following integrals give the arc length of the curve $y = e^{2x}$ from $x = 0$ to $x = 2$?

i. $\int_0^2 \sqrt{1 + 4e^{2x}} \, dx$

ii. $\int_0^2 \sqrt{1 + e^{4x}} \, dx$

iii. $\frac{1}{2} \int_0^1 \sqrt{1 + 4e^{2s}} \, ds$

iv. $\int_0^2 \sqrt{1 + 4e^{4u}} \, du$

v. NONE OF THESE

c. [3 points] Which of the following are antiderivatives of the function $\frac{1}{\ln x}$?

i. $\ln(\ln(x)) + 4$

ii. $\int_2^e \frac{1}{\ln t} \, dt$

iii. $\int_1^{\ln x} \frac{e^t}{t} \, dt$

iv. $\int_2^x \frac{1}{\ln t} \, dt$

v. NONE OF THESE

d. [3 points] An object with variable mass is lifted up 30 meters at a constant rate. This process takes 10 seconds. Suppose that $m(t)$ is the mass of the object, in kilograms, $t$ seconds after the lifting begins. Let $g$ be the acceleration due to gravity in m/s$^2$. (So $g \approx 9.8$.) Which of the following expressions give the work, in joules, required to raise the object?

i. $3 \int_0^{10} g \cdot m(t) \, dt$

ii. $\int_0^{30} g \cdot m\left(\frac{x}{3}\right) \, dx$

iii. $\frac{1}{3} \int_0^{30} g \cdot m(x) \, dx$

iv. $\int_0^{10} g \cdot 3t \cdot m(t) \, dt$

v. NONE OF THESE