4. [12 points] For each of the questions below, circle <u>all</u> 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. $\displaystyle\int_0^\pi 2\sin(x)\cos(x)\,dx$ 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. $\displaystyle\int_0^2 \sqrt{1 + 4e^{2x}}\,dx$ ii. $\displaystyle\int_0^2 \sqrt{1 + e^{4x}}\,dx$

    iii. $\displaystyle\frac{1}{2}\int_0^1 \sqrt{1 + 4e^{2s}}\,ds$ iv. $\displaystyle\int_0^2 \sqrt{1 + 4e^{4u}}\,du$ v. NONE OF THESE

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

    i. $\ln(\ln(x)) + 4$ ii. $\displaystyle\int_2^e \frac{1}{\ln t}\,dt$

    iii. $\displaystyle\int_1^{\ln x} \frac{e^t}{t}\,dt$ iv. $\displaystyle\int_2^x \frac{1}{\ln t}\,dt$ 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/s². (So $g \approx 9.8$.) Which of the following expressions give the work, in joules, required to raise the object?

    i. $3\displaystyle\int_0^{10} g \cdot m(t)\,dt$ ii. $\displaystyle\int_0^{30} g \cdot m\left(\frac{x}{3}\right)\,dx$

    iii. $\displaystyle\frac{1}{3}\int_0^{30} g \cdot m(x)\,dx$ iv. $\displaystyle\int_0^{10} g \cdot 3t \cdot m(t)\,dt$ v. NONE OF THESE