

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  $\text{m/s}^2$ . (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