Answer on Question #77372 - Chemistry - General Chemistry

Question:

1) Find the result of the following integrals.

a) ∫▒〖(2+y)^2 dy〗

b) ∫▒(x²+x+1)/√x dx

2) Find the arc curve, y=x^4/8+1/〖4x〗^2 from x=1 to x=2.

3) Find the results of the following integrals by using substitution rule.

a) ∫_0^1▒〖xe〗^(-x²) dx

b) ∫_0^1▒〖(e^z+1)/(e^z+z) dz〗

c) ∫▒〖dx/(ax+b)(a≠0)〗

Solution:

1) From our knowledge of derivatives, we can immediately write down a number of antiderivatives.

Here is a list of those most often used:

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C, \quad \text{if } n \neq -1$$

$$\int x^{-1}\,dx = \ln|x| + C$$

$$\int e^x\,dx = e^x + C$$

$$\int \sin x\,dx = -\cos x + C$$

2)

$$D(x) = \sqrt{(\Delta x)^2 + (\Delta y)^2}$$

$$s = D(x) = \sum \sqrt{(\Delta x)^2 + \frac{(\Delta y)^2}{(\Delta x)^2} \cdot (\Delta x)^2}$$

$$= \sum \sqrt{1 + \left(\frac{\Delta y}{\Delta x}\right)^2} (\Delta x)$$

$$= \int_a^b \sqrt{1 + \left(\frac{dy}{dx}\right)^2}\,dx$$

$$\frac{dy}{dx} = \frac{x^3}{2} + \frac{x}{2} = \frac{1}{2}(x^3 + x)$$

$$\left(\frac{dy}{dx}\right)^2 = \frac{1}{4}(x^3 + x)^2 = \frac{1}{4}(x^6 + 2x^4 + x^2)$$

$$= \int_1^2 \sqrt{1 + \left(\frac{dy}{dx}\right)^2} dx$$

$$= \int_1^2 \sqrt{1 + \frac{x^6 + 2x^4 + x^2}{4}} dx$$

$$= \int_1^2 \sqrt{\frac{4 + x^6 + 2x^4 + x^2}{4}} dx$$

$$= \frac{1}{2}\int_1^2 \sqrt{x^6 + 2x^4 + x^2 + 4} dx$$

$$= \frac{1}{2}\int_1^2 \sqrt{(x^3 + x)^2 + 4} dx$$

Answer: 2.84