Ginorio_Assignment_13

MGinorio

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Question 1

Use integration by substitution to solve the integral below.

$$\int 4e^{-7x} dx$$

Answer

$$u = -7x$$
$$\frac{du}{dx} = -7$$
$$du = -7dx$$
$$dx = \frac{du}{-7}$$
$$\int 4e^{u} \frac{du}{-7}$$
$$-\frac{4}{7} \int e^{u} du$$
$$= -\frac{4}{7} \times e^{u}$$
$$Substitute\ u = -7x$$
$$= -\frac{4}{7} e^{-7x} + C$$

Question 2

Biologists are treating a pond contaminated with bacteria. The level of contamination is changing at a rate of $\frac{dN}{dt} = -\frac{3150}{t^4} - 220$ bacteria per cubic centimeter per day, where t is the number of days since treatment began. Find a function $N(t)$ to estimate the level of contamination if the level after 1 day was 6530 bacteria per cubic centimeter.

Answer

$$\frac{dN}{dt} = -\frac{3150}{t^4} - 220$$
$$\frac{dN}{dt} = -3150t^{-4} - 220$$

$$dN = (-3150t^{-4} - 220)dt$$
$$N = \int (-3150t^{-4} - 220)dt$$
$$N = \int -3150t^{-4} - \int 220dt$$
$$N(t) = \frac{1050}{t^3} - 220t + C$$

Now, given that the level of contamination after 1 day was 6530 bacteria per cubic centimeter:

$$N(1) = 6530$$

$$N(1) = 6530 = \frac{1050}{1} - 220 + C$$
$$C = 5700 \ for \ N(1)$$

Substitute C back into $N(t)$

$$N(t) = \frac{1050}{t^3} - 220t + 5700$$

Question 3

Find the total area of the red rectangles in the figure, where the equation of the line is $f(x) = 2x - 9$.

Answer

Based on the image, the leftmost rectangle starts at 4.5 and the rightmost rectangle ends at 8.5

$$\int_{4.5}^{8.5} 2x - 9dx$$
$$= (x^2 - 9x)\Big|_{4.5}^{8.5}$$
$$= (8.5^2 - 9(8.5)) - (4.5^2 - 9(4.5))$$
$$Area = 16$$

Question 4

Find the area of the region bounded by the graphs of the given equations.

$$y = x^2 - 2x - 2, \ y = x + 2$$

Answer

Pending

Question 5

Question 6

Use integration by parts to solve the integral below.

$$\int \ln(9x) \cdot x^6 dx$$

Answer

Start with formula:

$$\int f(x)g'(x) = f(x)g(x) - \int f'(x)g(x)$$

By parts

$$f(x) = \ln(9x)$$
$$f'(x) = \frac{1}{x}dx$$
$$g'(x) = x^6 dx$$
$$g(x) = \frac{x^7}{7}$$

Now substitute into the formula

$$\ln(9x)\frac{x^7}{7} - \int \frac{x^7}{7}\frac{1}{x}dx$$
$$\ln(9x)\frac{x^7}{7} - \frac{x^7}{49} + C$$