LSN # 11 Answers

Lesson 11 - The Substitution Rule II

Additional Problems

1. $\int \frac{dx}{5-3x}$

$-\frac{1}{3}\ln|5-3x|+C$

ANS

2. $\int \frac{3}{(2y+1)^5}dy$

$-\frac{3}{8(2y+1)^4}+C$

ANS

3. $\int \frac{x}{x^2+1}dx$

$\frac{1}{2}\ln|x^2+1|+C$

ANS

4. $\int e^{\cos t} \sin t dt$

$-e^{\cos(t)} + C$

ANS

5. $\int_1^2 \frac{e^{1/x}}{x^2} dx$

$e - \sqrt{e}$

ANS

6. $\int_0^1 x e^{-x^2} dx$

$\frac{1}{2} - \frac{1}{2e}$

ANS

7. Suppose a company has a marginal cost function $y = C(x) = x\sqrt{9+x^2}$, where x is the number of thousands of items produced and the cost C is in thousands of dollars. Graph the function $y = C(x)$ on your graphing calculator. If fixed costs are \$10,000, find the total cost of manufacturing the first 4000 items.

\$ 42,667

ANS

8. The rate at which a natural resource is extracted often increases at first until the easily accessible part of the resource is exhausted. Then the rate of extraction tends to decline. Suppose natural gas is being extracted from a new field at a rate of $A(t) = \frac{4t}{t^2+1}$ billions of cubic feet a year, where t is in years since the field was opened. If this field has an estimated 10 billion cubic feet of gas, how long will it take to exhaust this field at the given rate of extraction?

12.1414 years

ANS

9. Suppose oil is being extracted from a field at a rate given by $\frac{d}{dt}P(t) = 0.2e^{0.1t}$, where $P(t)$ is measured in millions of barrels and t is measured in years. At this rate how much oil will be extracted during the second 10-year period?

9.34155 million barrels

ANS

10. Suppose a new oil reserve has been discovered with an estimated 10 billion barrel capacity. Suppose production is given in billions of barrels and proceeds at a rate given by $\frac{d}{dt}P(t) = 1.5e^{0.1t}$, where t is measured in years. At this rate, how long will it take to exhaust this resource.

5.10826 years

ANS

11. Breathing is cyclic and a full respiratory cycle from the beginning of inhalation to the end of exhalation takes about 5 s. The maximum rate of air flow into the lungs is about 0.5 L/s. This explains, in part, why the function $f(t) = \frac{1}{2}\sin(2\pi t/5)$ has often been used to model the rate of air flow into the lungs. Use this model to find the volume of inhaled air in the lungs at any time t.

$$V(t) = -\frac{5}{4\pi}\cos\left(\frac{2\pi t}{5}\right) + \frac{5}{4\pi}$$

ANS.