Recitation # 7: Exponential models and approaches to integration - Instructor Notes

Group work:

Problem 1 *Vitameatavegamin is a strange substance that comes in two forms. V-I decays at a linear rate, while V-II decays at an exponential rate. Both have the property that* 10 *ounces will decrease to* 7 *ounces in* 6 *hours. For each of V-I and V-II, answer the following:*

(a) *If we started with* 80 *ounces, how much will there be* 6 *hours later?*

(b) *How long will it take to decrease from* 15 *ounces to* 7.5 *ounces?*

Instructor Notes: The issue is to compare and contrast linear and exponential decay. To solve, it is implicit to find the slope (I) and k (II) first before proceeding (this may need a prompt).

Problem 2 *Evaluate*

$$\int \frac{5x^3 - 6x + 2}{x - 5}\, dx.$$

Instructor Notes: Each of problems #1 through #4 presents a different aspect that is covered in Section 7.1. This problem (# 1) requires long division.

Problem 3 *Evaluate*

$$\int \frac{5}{3^{2x} + 3^{-2x}}\, dx.$$

Instructor Notes: Students are likely to have forgotten $\dfrac{d}{dx}\left(C^x\right)$ for $C \neq e$.

Problem 4 *Evaluate the following integrals*

(a) $\displaystyle\int \frac{\cos x}{1+\sin x}\,dx$

(b) $\displaystyle\int \frac{1}{\sin x - 1}\,dx$

Instructor Notes: The two integrals in this problem look similar, but they require very different strategies in order to rewrite them as "basic" integrals.

Problem 5 *Evaluate the following integrals*

(a) $\displaystyle\int \frac{13}{\sqrt{12x - x^2 - 20}}\,dx$

(b) $\displaystyle\int \frac{13x^3}{\sqrt{12x^6 - x^8 - 20x^4}}\,dx$

(c) $\displaystyle\int \frac{13e^{4x}}{\sqrt{12e^{6x} - e^{8x} - 20e^{4x}}}\,dx$

Instructor Notes: Part (a) of this problem involves completing the square. Parts (b) and (c) both require you to factor out a common factor, as well as substitute, to get the same integral as in part (a). You may want to do part (a) as a whole class, and then split parts (b) and (c) between the groups. Then let them present the substitution which returns part (a).