# Math SL EXPLORATION LAB 11

Working with Composite Functions.

In this assignment, you will be be introduced to taking integrals using the method of substitution and will see it's connection to the method of differentiating using the Chain Rule .

1. SKILL REVIEW: Use the Chain Rule to differentiate the following composite functions:

   a. (i) $y = (2x^2 + 6x + 5)^5$ (ii) $y = \sqrt[3]{2x^3 + x + 1}$ (iii) $y = \frac{1}{(x^3 + x - 1)^2}$

   b. (i) $y = \sin(x^2) + \sin^2(x)$ (ii) $y = \tan(2x) + \frac{1}{\sin(x)}$ (iii) $y = \sin(\sqrt{x})$

   c. (i) $y = e^{2x+1}$ (ii) $y = 2e^{4-3x}$ (iii) $y = 2e^{4-3x^2}$ (iv) $y = \sqrt{e^x}$

   d. (i) $y = \ln(x^2 + 1)$ (ii) $y = \ln(\sin(x) + x)$ (iii) $y = \ln(e^x - e^{-x})$

2. NEW SKILL: Examples: Integration by Substitution:

   a. EXAMPLES:

1) $\int -15x^4(-3x^5 - 1)^5\,dx;\ u = -3x^5 - 1$

2) $\int -16x^3(-4x^4 - 1)^{-5}\,dx;\ u = -4x^4 - 1$

3) $\int -\frac{8x^3}{(-2x^4 + 5)^5}\,dx;\ u = -2x^4 + 5$

4) $\int (5x^4 + 5)^{\frac{2}{3}} \cdot 20x^3\,dx;\ u = 5x^4 + 5$

   b. PRACTICE:

5) $\int \frac{(5 + \ln x)^5}{x}\,dx;\ u = 5 + \ln x$

6) $\int 4\sec 4x \cdot \tan 4x \cdot \sec^4 4x\,dx;\ u = \sec 4x$

7) $\int 36x^3(3x^4 + 3)^5\,dx;\ u = 3x^4 + 3$

8) $\int x(4x - 1)^4\,dx;\ u = 4x - 1$

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c. EXAMPLES:

9) $\int -9x^2(-3x^3+1)^3\,dx$

10) $\int 12x^3(3x^4+4)^4\,dx$

11) $\int -12x^2(-4x^3+2)^{-3}\,dx$

12) $\int (3x^5-3)^{\frac{3}{5}}\cdot 15x^4\,dx$

d. PRACTICE:

13) $\int (-2x^4-4)^4\cdot -32x^3\,dx$

14) $\int (e^{4x}-4)^{\frac{1}{5}}\cdot 8e^{4x}\,dx$

15) $\int x(4x+5)^3\,dx$

16) $\int 5x\sqrt{2x+3}\,dx$

3. NEW SKILL: Practice: Integration by Substitution:

http://www.teaching.martahidegkuti.com/shared/lnotes/6_calculus/integral/substitution/substitutionb.pdf

Oxford Exercise 9F, p302, Q1 - 12