Math 31 – Workshop #12

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1. Consider the integral $\displaystyle\int \frac{x^3}{9-4x^2}\,dx$.

   (a) Use regular substitution to compute this integral.

   (b) Use trig substitution to compute this integral.

   (c) In this case, which method do you think was easier?

2. (a) Find a pair of numbers to place in the numerators below so that the fractions are in simplest form and their sum is $\frac{11}{12}$.

$$\frac{\quad}{3} + \frac{\quad}{4} = \frac{11}{12}$$

   (b) Find a pair of numbers to place in the numerators below so that the fractions are in simplest form and their sum is $\frac{11}{12}$.

$$\frac{\quad}{6} + \frac{\quad}{4} = \frac{11}{12}$$

   (c) Find a pair of numbers to place in the numerators below so that their sum is $\frac{3}{x^2-1}$.

$$\frac{\quad}{x-1} + \frac{\quad}{x+1} = \frac{3}{x^2-1}$$

   (d) Use what you did in problem 2c to help you compute $\displaystyle\int \frac{3}{x^2-1}\,dx$.

3. Consider the rational expression $\dfrac{x^3-6x^2+2x+30}{x^2-x-6}$.

   (a) This rational expression is called improper because the degree on the bottom is not larger than the degree on the top. Perform long division so that we end up with a polynomial plus a rational expression that is proper.

$$\frac{x^3-6x^2+2x+30}{x^2-x-6} = \underbrace{\qquad\qquad}_{\text{polynomial}} + \frac{\quad}{x^2-x-6}$$

   (b) Find numbers to place in the numerators to make the equation below true.

$$\frac{\quad}{x-3} + \frac{\quad}{x+2} = \frac{3x}{x^2-x-6}$$

   (c) Fill in the blanks below.

$$\frac{x^3-6x^2+2x+30}{x^2-x-6} = \underbrace{\qquad\qquad}_{\text{polynomial}} + \frac{\quad}{x-3} + \frac{\quad}{x+2}$$

   (d) Compute $\displaystyle\int \frac{x^3-6x^2+2x+30}{x^2-x-6}\,dx$.

4. Compute $\displaystyle\int \frac{2x^3-x^2+4}{x^2+1}\,dx$.