Understanding *u*-substitution and limits activity Solutions NAME:

Try both of the problems below on your own. Give yourself five minutes to complete each problem. At the end of this time, get the solutions page. If you were successful with the problems, explain each step in my solution (every little bit). If you were stumped by the problems, either explain each step in my solution (every little bit) or ask a specific question about each step that you cannot explain. Then try to answer the questions by talking to people around you. Write your answers next to your questions.

1. Evaluate the definite integral below. Use *u*-substitution. Specifically write down your definition of *u* and explain as you go.

$$\int_0^4 3x\left(3x^2+4\right)^4\,dx$$

$$\begin{aligned} Let\ \ u &= 3x^2+4 \\ du &= 6x\,dx \\ \frac{1}{2}du &= 3x\,dx \end{aligned}$$

$$\begin{aligned} \int_0^4 3x\left(3x^2+4\right)^4\,dx &= \frac{1}{2}\int_4^{52} u^4\,du \\ &= \frac{1}{2}\frac{1}{5}u^5\Big|_4^{52} \\ &= \frac{1}{10}\left(52^5-4^5\right) \\ &= 38,020,300.8 \end{aligned}$$

2. Evaluate the limit below. You can use the graph of $y=\frac{1}{2}+\frac{4}{x^2}-\frac{3}{(x-2)^3}+\frac{1}{3}$ as a check but try to think through it by asking yourself what happens to each term involved as *x* gets larger and larger.

$$\lim_{x\to\infty}\left(\frac{1}{2}+\frac{4}{x^2}-\frac{3}{(x-2)^3}+\frac{1}{3}\right)$$

$$\begin{aligned} &= \lim_{x\to\infty}\frac{1}{2}+\lim_{x\to\infty}\frac{4}{x^2}-\lim_{x\to\infty}\frac{3}{(x-2)^3}+\lim_{x\to\infty}\frac{1}{3} \\ &= \frac{1}{2}+0-0+\frac{1}{3} \quad = \quad \frac{3}{6}+\frac{2}{6} \quad = \quad \frac{5}{6} \quad \approx \quad .83 \end{aligned}$$