

PRINT Your Name: _____

Quiz 21 — October 28, 2015

Remove everything from your desk except this page and a pencil or pen.

The solution will be posted soon after the quiz is given.

Circle your answer. **Show your work.** Your work must be correct and coherent.

Find $\int_1^\infty \frac{1}{(3x+1)^2} dx$.

Answer: The integral is improper because one of the end points is ∞ . We approximate the improper integral with proper integrals and take the limit:

$$\int_1^\infty \frac{1}{(3x+1)^2} dx = \lim_{b \rightarrow \infty} \int_1^b \frac{1}{(3x+1)^2} dx.$$

Let $u = 3x + 1$. It follows that $du = 3dx$. The integral is equal to

$$\lim_{b \rightarrow \infty} \frac{1}{3} \int_{x=1}^{x=b} \frac{1}{u^2} du = \lim_{b \rightarrow \infty} \left. \frac{1}{3} \frac{-1}{u} \right|_{x=1}^{x=b} = \lim_{b \rightarrow \infty} \left. \frac{1}{3} \frac{-1}{3x+1} \right|_{x=1}^{x=b} = \lim_{b \rightarrow \infty} \frac{1}{3} \left(\frac{-1}{3b+1} + \frac{1}{4} \right)$$

$$= \boxed{\frac{1}{12}}.$$