Determine whether the following improper integral converges or diverges (**show your work**). If it converges, determine its value.

$$\int_3^\infty 12e^{-2x}\,dx$$

$$= \lim_{b \to \infty} \int_3^b 12\,e^{-2x}\,dx$$

$$= 12 \lim_{b \to \infty} \left[\frac{e^{-2x}}{-2} \right]_3^b$$

$$= \frac{12}{-2} \lim_{b \to \infty} \left[e^{-2x} \right]_3^b$$

$$= -6 \lim_{b \to \infty} \left[e^{-2b} - e^{-6} \right]$$

$$= -6 \lim_{b \to \infty} \left[\frac{1}{e^{2b}}^{\,0} - \frac{1}{e^6} \right]$$

$$= -6 \cdot \left[0 - \frac{1}{e^6} \right]$$

$$= \frac{6}{e^6}.$$

The integral converges to $\dfrac{6}{e^6}$.