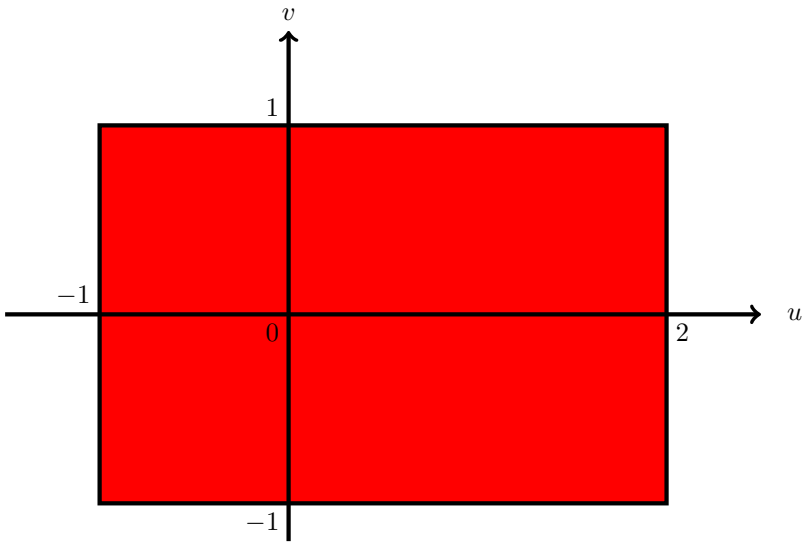
If X and Y are random variables whose joint probability density function is $f_{X,Y}(u,v) = 2e^{-(u+2v)}$ in the first quadrant, and zero elsewhere, then what is the probability the point (X,Y) lies in the red region shown below?



(a) $(1-e^{-2})^2$

(b) $1-e^{-2}$

(c) $(1-e^{-1})^2$

(d) $(1-e^{-1})(1-e^{-2})$

(e) $2(1-e^{-2})^2$

(f) $2(1-e^{-1})(1-e^{-2})$

(g) $1-e^{-3}$

(h) $e^{-1}-e^{-2}$

(i) $(e^{-1}-e^{-2})^2$

(j) $\frac{1}{2}(1-e^{-2})^2$

(k) $(e-e^{-2})(e-e^{-1})$

(l) None of these