Example (continued) Suppose $X$ is a Beta random variable with parameters $\alpha = 3, \beta = 8$. So we proved already that $X$ has CDF

$$F_X(a) = 1 - 360(1-a)^8\left(\frac{1}{8} - \frac{2}{9}(1-a) + \frac{1}{10}(1-a)^2\right)$$

Find the probability that $X \le \frac{1}{4}$, given that $X \le \frac{3}{8}$.

i.e. find $P(X \le \frac{1}{4} \mid X \le \frac{3}{8}) = \dfrac{P(X \le \frac{1}{4} \text{ and } X \le \frac{3}{8})}{P(X \le 3/8)} = \dfrac{P(X \le \frac{1}{4})}{P(X \le 3/8)}$

$$= \frac{F_X(1/4)}{F_X(3/8)} = \frac{0.4744\ldots}{0.788597\ldots} = 0.6013\ldots$$