18.

(a)

$$E[X] = \int_1^3 \frac{x^2}{4} dx = \frac{13}{6}$$

$$P(A) = 1 - P(X \leq 2) = 1 - \int_1^2 \frac{x}{4} dx = \frac{5}{8}$$

$$f_{X|A}(x) = \begin{cases} \frac{2x}{5} & 2 \leq x \leq 3 \\ 0 & otherwise \end{cases}$$

$$E[X|A] = \int_2^3 \frac{2x^2}{5} dx = \frac{38}{15}$$

(b)

$$E[Y] = E[X^2] = \int_1^3 \frac{x^3}{4} dx = 5$$

$$var(Y) = E[Y^2] - E[Y]^2 = \int_1^3 \frac{x^5}{4} dx - 25 = \frac{16}{3}$$

19.

(a)

由归一性：$\int_1^2 cx^{-2} dx = 1$，解得$c = 2$。

(b)

$$P(A) = 1 - P(X \leq 1.5) = 1 - \int_1^{1.5} \frac{2dx}{x^2} = \frac{1}{3}$$

$$f_{X|A}(x) = \begin{cases} \frac{6}{x^2} & 1.5 \leq x \leq 2 \\ 0 & otherwise \end{cases}$$

(c)

$$E[Y|A] = E[X^2|A] = \int_{1.5}^{2} 6dx = 3$$

$$var(Y|A) = E[Y^2|A] - E[Y|A]^2 = \frac{1}{4}$$