① $f_x(x) = \int_0^2 xy\,dy = \frac{xy^2}{2}\Big|_0^2 = 2x$ $f_y(y) = \int_0^1 xy\,dx = \frac{x^2 y}{2}\Big|_0^1 = \frac{y}{2}$

Is $f(x,y) = f_x(x)\cdot f_y(y)$? $(2x)(\frac{y}{2}) = xy$ ✓ YES ∴ X & Y are Independent

② a) X = # components tested until 3 functioning ones are found

$X \sim NB(0.3, 3)$

EQ3 $f(x) = \binom{x-1}{3-1} 0.3^3 (0.7)^{x-3}$ $P(X=8) = \binom{7}{2} .3^3 .7^5$

$= \frac{7!}{2!5!} .3^3 .7^5 = 21(.0045) = \boxed{.095}$

b) $E(x) = \frac{r}{p} = \frac{3}{.3} = \boxed{10 \text{ components}}$

③ (a) X = time to transmit a text message

$X \sim N(1.1, \sqrt{0.07}) \rightarrow X \sim N(1.1, 0.2646)$

$P(X>1.4) = P(Z > \frac{1.4-1.1}{0.2646}) = P(Z > 1.134) = 1 - \Phi(1.134)$

$= 1 - 0.8708 = \boxed{0.1292}$

(b) Y = # of texts with transmission time > 1.4 seconds, in the next 5 texts sent

$Y \sim Bin(0.1292, 5)$ $f(y) = EQ1$

$P(Y=2) = \binom{5}{2}(0.1292)^2(1-0.1292)^{5-3} = \frac{5!}{2!3!}(0.0167)(0.6603)$

$= \boxed{0.11}$

④ (a) $\mu_{R_o} = 8$ cm $\mu_{R_i} = \frac{7.1+6.8}{2} = 6.95$ cm

$\mu_J = \frac{\pi(8^4 - 6.95^4)}{2} = 2769.1 \text{ cm}^4$

(b) $V(R_o) = .1^2 = 0.01$ $V(R_i) = \frac{.3^2}{12} = 0.0075$

$V(J) = \left(\frac{\partial g}{\partial R_o}\right)^2 V(R_o) + \left(\frac{\partial g}{\partial R_i}\right)^2 V(R_i) = \left(2\pi(\mu_{R_o})^3\right)^2(0.01) + \left(-2\pi(\mu_{R_i})^3\right)^2(0.0075)$

$= 103{,}491 + 33{,}368.6 = 136{,}858.9 \text{ cm}^8$

$\sigma_J = \sqrt{V(J)} = 369.95 \simeq \boxed{370 \text{ cm}^4}$