1. Use $\chi^2$ cdf(lower, upper, degrees). Max occurs at $x = n - 2$, where $n =$ degrees.
   (i) $P(12 \leq \chi^2(19) \leq 25) = 0.725$  
   (ii) $P(\chi^2(17) \leq 20) = 0.726$  
   (iii) $P(\chi^2(22) \geq 20) = 0.583$

2. (i) 90% of the $\chi^2(19)$ distribution is from 10.12 to 30.14
   (ii) 95% of the $\chi^2(17)$ distribution is from 7.564 to 30.19
   (iii) 98% of the $\chi^2(22)$ distribution is from 9.542 to 40.29

3. (a) For $n = 30$ and $S = 0.76$, we use the 95% chi-square scores from the $\chi^2(29)$ curve
   which are $L = 16.05$ and $R = 45.72$. Then, $\sqrt{\frac{(n - 1) \times S^2}{R}} \leq \sigma \leq \sqrt{\frac{(n - 1) \times S^2}{L}}$, so we have
   a 95% confidence interval of $\sqrt{\frac{29 \times 0.76^2}{45.72}} \leq \sigma \leq \sqrt{\frac{29 \times 0.76^2}{16.05}}$, or $0.6053 \leq \sigma \leq 1.0216$.

(b) For $n = 24$ and $S = 0.80$, we use the 98% chi-square scores from the $\chi^2(23)$ curve
   which are $L = 10.2$ and $R = 41.64$. Then, $\sqrt{\frac{(n - 1) \times S^2}{R}} \leq \sigma \leq \sqrt{\frac{(n - 1) \times S^2}{L}}$, so we have
   a 95% confidence interval of $\sqrt{\frac{23 \times 0.8^2}{41.64}} \leq \sigma \leq \sqrt{\frac{23 \times 0.8^2}{10.2}}$, or $0.59456 \leq \sigma \leq 1.2013$. 