

2a) We will start by proving the contrapositive, and statement becomes:

$$\neg P: X > 8 \text{ and } X < 12 \text{ then } X^2 - 20X + 96 < 0$$

Let's look at the first case:

$$1) X < 12:$$

$$X^2 - 20X + 96 < 12^2 - 20 \cdot 12 + 96$$

$$X^2 - 20X + 96 < 144 - 240 + 96$$

$$X^2 - 20X + 96 < 0$$

$\therefore$  When  $X$  is  $< 12$  the statement holds

$$2) X \geq 8: \in \text{minimum upper bound}$$

$$X^2 - 20X + 96 \geq 8^2 - 20 \cdot 8 + 96 \text{ then}$$

$$X^2 - 20X + 96 \geq 64 - 160 + 96$$

$$X^2 - 20X + 96 \geq 0$$

$\therefore$  every value  $X \leq 8$  <sup>or  $\geq 12$</sup>  will be greater than 0,  $\therefore$  when  $X > 8$  the statement holds

$\therefore$  Since the conclusion is true in both cases, the contrapositive is true  
Ans Since the contrapositive is true so is the original statement

$$b) \text{ If } X \leq 8 \text{ or } X \geq 12 \text{ then } X^2 - 20X + 96 \geq 0$$

c) it is true!