d) If $X^2 \equiv b \pmod p$ has no sol. $X^2 \equiv b \pmod{p^e}$ for $e \geq 2$, since any such sol $X^2 \equiv b \pmod{p^e}$ could always be a reduced modulo p. And if it has two sol, then it implies that it will have two sol, $X^2 \equiv b \pmod{p^e}$ for each $e \geq 1$, the sol, are matched one-to-one.

8 $2^{(p-1)/2} \pmod p$

$p = 3$	$2^1 = 2 \equiv 2$	$2^{(p-1)/2}$ is congruent to 1 or $(p-1) \bmod p$
$p = 5$	$2^2 = 4 \equiv 4$	
$p = 7$	$2^3 = 8 \equiv 1$	
$p = 11$	$2^5 = 32 \equiv 10$	
$p = 13$	$2^6 = 64 \equiv 12$	
$p = 17$	$2^8 = 256 \equiv 1$	
$p = 19$	$2^9 = 512 \equiv 18$	

Let $a = 2^{(p-1)/2}$. Then $a^2 \equiv 2^{p-1} \equiv 1 \pmod p$

$\therefore a \equiv \pm 1 \pmod p$, note that $p \mid (a^2 - 1)$, so $p \mid (a+1)(a-1)$
So, since p is a prime, it divides one of $a-1$ or $a+1$,
which mean $a \equiv \pm 1 \pmod p$