Proof: $\sqrt{x + 2\sqrt{x-1}} + \sqrt{x - 2\sqrt{x-1}} = 2$

let $u = \sqrt{x-1} \Rightarrow u \geq 0$

$\sqrt{u^2+1+2u} + \sqrt{u^2+1-2u} = 2$

$u+1 + |u-1| = 2$ note: the $|u-1|$ is there since though $u \geq 0$, $u-1$ is not always positive, but principal square roots are positive and $(u-1)^2 = |u-1|^2$ for all u, so we put $|u-1|$

$\boxed{u+1 + |u-1| = 2}$

case 1, $u \geq 1$

$u+1 + u-1 = 2$

$2u = 2$

$u = 1$

case 2, $u < 1$

$u+1 - (u-1) = 2$

$1 - (-1) = 2 \quad 2=2$

$u = [0, 1)$ since $u \geq 0$ as stated above and the case is $u < 1$

~~So $u=1 \Rightarrow \sqrt{x-1} = 1 \Rightarrow x=2$~~

~~$u = [0,1) \Rightarrow \sqrt{x-1} = 0 \quad x=1$~~

~~$\sqrt{x-1} = 1 \quad x=2$~~ ~~so $x = [1,2]$~~

to prove this $\sqrt{x-1} = u$

$\Rightarrow x = u^2+1$

so $u=1$ or $u \in [0,1) \Rightarrow \boxed{u \in [0,1]}$ so $0 \leq u \leq 1$

so $x \in [0^2+1, 1^2+1] = [1,2]$ since the function $f(u) = u^2+1$ is increasing.

$\boxed{\text{So } x = [1,2] \text{ or rather All real } x \text{ s.t. } 1 \leq x \leq 2}$