(1) Consider $D = (-2s)^2 - 4 \cdot 1 \cdot 4s =$

$= 4s^2 - 16s = 4s(s-4)$. The equation has no solutions if and only if $D < 0$. Hence, $4s(s-4) < 0$, that's $0 < s < 4$

(2) Note that $x_1^2 + x_2^2 = (x_1 + x_2)^2 - 2x_1x_2$.

By Vieta's formulas, $x_1 + x_2 = a$, $x_1x_2 = a - 1$

Hence, $x_1^2 + x_2^2 = a^2 - 2(a-1) = a^2 - 2a + 2 = (a-1)^2 + 1$

This expression takes min. value iff $a - 1 = 0$

$\Leftrightarrow \boxed{a = 1}$

(3) Re-write it in the equivalent form: $36st \leq \left(\frac{4s + 9t}{2}\right)^2$