Q1 At some point $x^2 >> \epsilon$

Q2 $$\frac{d^2\psi}{dx^2} = x^2\left(A e^{-x^2/2} + B e^{x^2/2}\right) = x^2\psi \quad ✓$$

+ a part that is negligible in the current large x limit.

Q3 It's not normalizable

Q4 $$\frac{d\psi}{dx} = \frac{dh}{dx} e^{-x^2/2} - x h e^{-x^2/2}$$

$$\frac{d^2\psi}{dx^2} = \frac{d^2h}{dx^2} e^{-x^2/2} - 2x\frac{dh}{dx} e^{-x^2/2} - h e^{-x^2/2} + x^2 h e^{-x^2/2}$$

Since

$$\frac{d^2\psi}{dx^2} + (\epsilon - x^2)\psi = 0$$

squiggles cancel
divide of $e^{-x^2/2}$

$$\frac{d^2h}{dx^2} - 2x\frac{\partial h}{\partial x} + (\epsilon - 1)h = 0 \quad ✓$$

Q5 K comes down, subtract one from the power then multiply on another x

Q6 because the $k=0$ + $k=1$ contributions to the sum are 0 based on what's out front $(k)(k-1)$

Q7 $$(k+2)(k+1)a_{k+2} = 2k a_k - (\epsilon - 1) a_k$$

$$a_{k+2} = \frac{2k - (\epsilon - 1)}{(k+1)(k+2)} a_k$$

Q8 Because it was a 2nd order Eqn,

Q9 Plug into the recursion numerator

$2k - (\overbrace{2n+1}^{\epsilon} - 1) = 2k - 2n$ so when $k=n$, $a_{k+2} = 0$. Then we plug 0 back in to get a_{k+4} and that will be 0 and so on.

Q10 $a_2 = \frac{0-0}{(1)(2)} a_0$ so all even a_k are 0

Q11 $a_2 = \frac{0-4}{1 \cdot 2} a_0 \Rightarrow a_2 = -2$

$$\psi_2 = (a_0 x^0 + a_1 x^2) e^{-x^2/2}$$

$$= a_0 (1 - 2x^2) e^{-x^2/2}$$