2^{nd} exercise: Part-A:

1) ΔABD is right at B. (given)

So, to find AB^2 apply pythagorean theorem.

$hyp^2 = leg_1^2 + leg_2^2$

$AD^2 = AB^2 + BD^2$

then, $AB^2 = AD^2 - BD^2$

Thus, $\boxed{AB^2 = (2x-1)^2 - (x+4)^2}$

2) $E(x) = (2x-1)^2 - (x+4)^2$

$= 4x^2 - 4x + 1 - x^2 - 8x - 16$

$E(x) = 3x^2 - 12x - 15.$

where $a = 3$, $b = -12$ & $c = -15$

3a) $(x+4)(3x-24) = 3x^2 - 12x - 96.$

b) $AB = 9$ (given) & $AB^2 = E(x)$ (proved) so $AB^2 = 9^2$.

then, $3x^2 - 12x - 15 = 81.$

so, $3x^2 - 12x - 96 = 0$

then, $(x+4)(3x-24) = 0$ (proved)

hence $x = -4$ or $x = \frac{24}{3} = 8.$ but $x > 2$ (cond)

Thus, $x = -4$ rej & $x = 8$ is accepted

4) $B\hat{A}O = 30°$ (given)

$A\hat{B}O = 90°$ (given)

then ΔABO is semi equilateral at B.

So $AB = \frac{\sqrt{3}}{2} \times hyp$ (side facing $60°$)

$AB = \frac{\sqrt{3}}{2} \times AO$

$\sqrt{3x^2-12x-15} = \frac{\sqrt{3}}{2} AO$

$AO = \frac{2\sqrt{3x^2-12x-15}}{\sqrt{3}}$

rationalize the denominator

$\boxed{AO = \frac{2\sqrt{3}\sqrt{3x^2-12x-15}}{3}}$ cm,

$BO = \frac{1}{2} hyp$ (side facing $30°$)

$BO = \frac{1}{2} AO$

$BO = \frac{\sqrt{3}\sqrt{3x^2-12x-15}}{3}$ cm