3> In right $\triangle PQD$ of hypotenuse [QD] apply Pythagorean Theorem

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

$QD^2 = PD^2 + PQ^2$

$QD^2 = (4x-16)^2 + (3x-12)^2$

$= 16(x-4)^2 + 9(x-4)^2$

$QD^2 = 25(x-4)^2$ $\quad x > 4$

$\boxed{QD = 5(x-4)}$ cm

$PH \times QD = PD \times PQ$ (height - Hypotenuse relation in a right $\triangle$ or write the area in 2 different ways.

So $\frac{PH \times QD}{2} = \frac{PD \times PQ}{2}$

$\frac{PH[5(x-4)]}{2} = 6(x-4)^2$

$PH = \frac{12(x-4)^2}{5(x-4)}$ $\quad x > 4$

Thus $\boxed{PH = \frac{12(x-4)}{5}}$ cm. $\quad 1\frac{1}{4}$ pts

4> $A(x) = 6(x-4)^2$

$A(x) = 54$

So $6(x-4)^2 = 54$

$(x-4)^2 = 9$

$(x-4-3)(x-4+3) = 0$

$(x-7)(x-1) = 0$

$x = 7$ or $x = 1$

1 pt

but $x > 4$

Hence, $x = 7$ is accepted & $x = 1$ is rejected

but $PD = 4x - 16$

$= 4(7) - 16$

$\boxed{PD = 12 \text{ cm}}$.