Q2:

Given: Arbitrary integers A0, A1, A2 and a polynomial $P(x) = A_0 + A_1 x^{100} + A_2 x^{200}$

Aim: Find an algorithm that squares P(x) with 5 large integer multiplications.

Solve:

Substitute y = x^{100}, then P(x)*P(x) will be

$$P(y) * P(y) = (A_0 + A_1 y + A_2 y^2) * (A_0 + A_1 y + A_2 y^2)$$

$P(y)^2$ = $P_0 + P_1 y + P_2 y^2 + P_3 y^3 + P_4 y^4$

In order tot find the P0,P1,P2,P3,P4 then we need five values of $P(y)^2$

Take y = <-2,-1,0,1,2> into the function $P(y)^2$, then the equation is

$$P_0 = anyGivenInteger \times anyGivenInteger$$

$$P_1 = AnyGivenInteger \times AnyGivenInteger \times y$$

$$P_2 = AnyGivenInteger \times AnyGivenInteger \times y \times y$$

$$P_3 = AnyGivenInteger \times AnyGivenInteger \times y \times y \times y$$

$$P_4 = AnyGivenInteger \times AnyGivenInteger \times y \times y \times y \times y$$

$P(-2)^2$ = $P_0 - 2P_1 + 4P_2 - 8P_3 + 16P_4;$,

$P(-1)^2$ = $P_0 - P_1 + P_2 - P_3 + P_4$,

$P(0)^2$ = P_0,

$P(1)^2$ = $P_0 + P_1 + P_2 + P_3 + P_4$,

$P(2)^2$ = $P_0 + 2P_1 + 4P_2 + 8P_3 + 16P_4$.

Only more than one of the power of y multiply each others can be counted as a large number multiplication. Because the y is large number, A0,A1,A2 are given as integer number. By the above then take the x in $P(x)^2$ = $P_0 + P_1 x^{100} + P_2 x^{200} + P_3 x^{300} + P_4 x^{400}$ .So there are 5 large integer multiplication.