

Karatsuba multiplication algorithm :

$$X = X_2 * 10^N + X_1 \quad \text{len}(X_2) = \text{len}(X_1)$$

$$Y = Y_2 * 10^N + Y_1 \quad \text{len}(Y_2) = \text{len}(Y_1)$$

$$A = X_2 * Y_2$$

$$B = X_1 * Y_1$$

$$Z = X * Y = A * 10^{2N} + (X_2 * Y_1 + X_1 * Y_2) * 10^N + B$$

$$C = (X_2 + X_1) * (Y_2 + Y_1)$$

$$Z = X * Y = A * 10^{2N} + (C - B - A) * 10^N + B$$