$\boxed{4}$ (a) 1. Compute QR of $\tilde{H}_n = M_n R_n \rightsquigarrow O(n^2)$ as $\tilde{H}_n$ hessenberg

2x2 to 2xn $\rightsquigarrow$ 6n flops $\rightsquigarrow$ total n row $\therefore O(n^2)$.

2. Compute $M_n^T(\|b\| e_1) \rightsquigarrow O(n^2)$

3. Solve $R_n y = M_n^T(\|b\|e_1) \rightsquigarrow O(n^2)$

2x2
$$\begin{matrix} o & o & o \\ o & v & o \end{matrix}$$

(b) Note that $\tilde{H}_n = \left[\begin{array}{c|c} \tilde{H}_{n-1} & x \\ \hline 0 & x \end{array}\right] \rightsquigarrow R_n = \left[\begin{array}{c|c} R_{n-1} & \\ \hline 0 & \end{array}\right]$

we only need to calculate this

2x2 to 2x1 $\rightsquigarrow$ 6 flops $\rightsquigarrow$ total n rows $\therefore O(n)$

For 2, so does $M_n = [M_{n-1} \mid q_n]$
so we need to compute $q_n^T \cdot \|b\| e_1$ only.
Lastly, we can just add $-\frac{r_{kn}}{r_{k1}} \cdot y_k$ to the components of previous y

$\therefore O(n)$ ■

$\boxed{5}$ Let $x_0 = x$ be an initial guess that he/she wishes to start with.
Then, from the problem $Ax_* = b$, $A(x_* - x) = b - Ax$.
So, if we set $x' = (x_* - x)$, $b' = b - Ax$, thus again it can be viewed as the new problem $Ax' = b'$ with initial guess $x'_0 = 0$, $r'_0 = b'$. (So we can use Algorithm 35.1 normally)
Apply algorithm to $Ax' = b'$. We can get x_n's by $x_n' + x$ each step ■