Q1

$$\det \begin{vmatrix} x^2 & x & 2 \\ 2 & 1 & 1 \\ 0 & 0 & -5 \end{vmatrix} = (-5) \begin{vmatrix} x^2 & x \\ 2 & 1 \end{vmatrix} = (-5)(x^2 - 2x)$$

$$\det A = 0 \iff (-5)(x^2 - 2x) = 0$$
$$\iff x(x-2) = 0$$
$$\iff \begin{bmatrix} x = 0 \\ x = 2 \end{bmatrix}$$

$x = 0:$
$$\det \begin{vmatrix} 0 & 0 & 2 \\ 2 & 1 & 1 \\ 0 & 0 & -5 \end{vmatrix} = -5 \begin{vmatrix} 0 & 0 \\ 2 & 1 \end{vmatrix} = 0 \checkmark$$

$x = 2$
$$\det \begin{vmatrix} 4 & 2 & 2 \\ 2 & 1 & 1 \\ 0 & 0 & -5 \end{vmatrix} = (-5) \begin{vmatrix} 4 & 2 \\ 2 & 1 \end{vmatrix} = 0 \checkmark$$

$\therefore$ $\boxed{x = 0 \quad \text{OR} \quad x = 2}$

Q2

(a) $\det(3A) = 3^3 \det(A) = 27 \times 10 = \boxed{270}$

(b) $\det(2A^{-1}) = 2^3 \det(A^{-1}) = 2^3 \times \dfrac{1}{\det A} = 8 \times \dfrac{1}{10} = \boxed{\dfrac{4}{5}}$

(c)

$$\det \begin{vmatrix} a & g & d \\ b & h & e \\ c & i & f \end{vmatrix} = \begin{vmatrix} a & b & c \\ g & h & i \\ d & e & f \end{vmatrix} = - \begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = \boxed{-10}$$

$\underbrace{}_{A} \qquad \underbrace{}_{A^T}$