2)

Roots given by 1st method are

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a},\ x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

Roots given by 2nd method are

$$x_1 = \frac{2c}{-b - \sqrt{b^2 - 4ac}} x_2 = \frac{2c}{-b + \sqrt{b^2 - 4ac}}$$

When $|b|$ is large compared to geometric mean of a and c (i.e. $|b|$ >>> $\sqrt{ac}$), $b^2 - ac$ is very close to b^2. So, $\sqrt{b^2 - ac}$ is very close to $|b|$.

If $b \geq 0$, then $|b| = b$. Then,for large $|b|$, $-b + \sqrt{b^2 - 4ac} \approx -b + |b| = -b + b = 0$. So, $-b + \sqrt{b^2 - 4ac}$ is very small and numerical errors occur due to limited double precision represenation of b and $\sqrt{b^2 - 4ac}$. So, in this case, we adopt roots which term $-b + \sqrt{b^2 - 4ac}$.

If $b < 0$, then $|b| = -b$. Then,for large $|b|$, $-b - \sqrt{b^2 - 4ac} \approx -b - |b| = -b + b = 0$. So, $-b - \sqrt{b^2 - 4ac}$ is very small and numerical errors occur due to limited double precision represenation of b and $\sqrt{b^2 - 4ac}$. So, in this case, we adopt roots which term $-b - \sqrt{b^2 - 4ac}$.

So, this leads us to our composite method.

Roots given by composite method are

$$x_1 = \frac{2c}{-b - \sqrt{b^2 - 4ac}},\ x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}\ if\ b \geq 0$$

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a},\ x_2 = \frac{2c}{-b + \sqrt{b^2 - 4ac}}\ if\ b < 0$$