

3. The cubic equation

$$ax^3 + bx^2 - 19x - b = 0$$

where  $a$  and  $b$  are constants, has roots  $\alpha$ ,  $\beta$  and  $\gamma$

The cubic equation

$$w^3 - 9w^2 - 97w + c = 0$$

where  $c$  is a constant, has roots  $(4\alpha - 1)$ ,  $(4\beta - 1)$  and  $(4\gamma - 1)$

Without solving either cubic equation, determine the value of  $a$ , the value of  $b$  and the value of  $c$ .