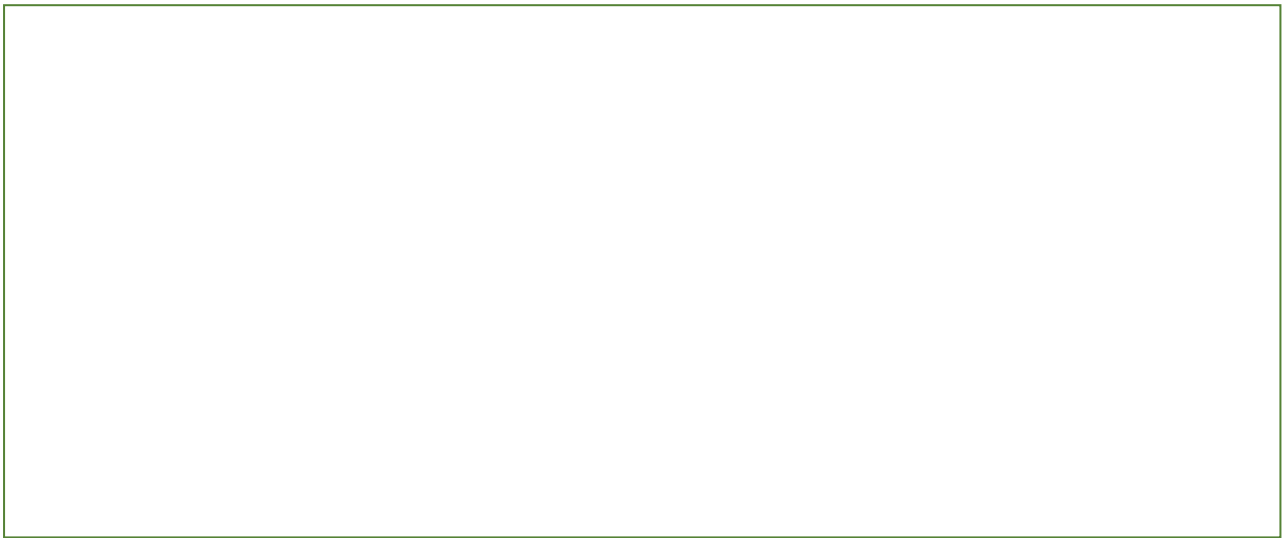


## Roots of Cubics

By the Fundamental Theorem of Algebra, a cubic equation  $ax^3 + bx^2 + cx + d = 0$  always has 3 (potentially repeated) roots,  $\alpha, \beta, \gamma$ . We saw in the previous chapters that these could be...

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### **Example**

**Find a cubic equation with roots 2, -1 and -3.**

**Example**

1.  $\alpha$ ,  $\beta$  and  $\gamma$  are the roots of the cubic equation  $2x^3 + 3x^2 - 4x + 2 = 0$ .  
Without solving the equation, find the values of:

(a)  $\alpha + \beta + \gamma$

(b)  $\alpha\beta + \beta\gamma + \gamma\alpha$

(c)  $\alpha\beta\gamma$

(d)  $\frac{1}{\alpha} + \frac{1}{\beta} + \frac{1}{\gamma}$

2. The roots of a cubic equation  $ax^3 + bx^2 + cx + d = 0$  are  $\alpha = 1 - 2i$ ,  $\beta = 1 + 2i$  and  $\gamma = 2$ . Find integers values for  $a, b, c$  and  $d$ .