1. Let $h(x) = x^3 - 12x^2 - 3x + 8$. Find $h(-2)$ without using a calculator.

$$\begin{array}{r|rrrr} -2 & 1 & -12 & -3 & 8 \\ & \downarrow & -2 & 28 & -50 \\ \hline & 1 & -14 & 25 & \boxed{-42} \end{array} \qquad h(-2) = -42$$

2. Consider the polynomial $P(x) = 2x^3 - x^2 - 15x + 18$

a. Show that $P(-3) = 0$.

$$P(-3) = 2(-3)^3 - (-3)^2 - 15(-3) + 18 = 2(-27) - (9) + 45 + 18$$
$$= -54 - 9 + 45 + 18 = 0$$

b. Use the fact that $P(-3) = 0$ along with synthetic division and knowledge of factoring trinomials to completely factor $2x^3 - x^2 - 15x + 18$.

$$\begin{array}{r|rrrr} -3 & 2 & -1 & -15 & 18 \\ & \downarrow & -6 & 21 & -18 \\ \hline & 2 & -7 & 6 & \boxed{0} \end{array}$$

$$2x^3 - x^2 - 15x + 18 = (x+3)(2x^2 - 7x + 6)$$
$$= (x+3)(2x-3)(x-2)$$

c. What are all the zeroes (including any imaginary ones) to $P(x)$?

$$x = -3,\ 3/2,\ 2$$

3. Consider the function $f(x) = x^3 + 8x^2 + 26x + 40$ which has $(x+4)$ as a linear factor. Find all the zeroes of $f(x)$ including any imaginary solutions

$$\begin{array}{r|rrrr} -4 & 1 & 8 & 26 & 40 \\ & \downarrow & -4 & -16 & -40 \\ \hline & 1 & 4 & 10 & \boxed{0} \end{array}$$

$$x^3 + 8x^2 + 26x + 40 = (x+4)(x^2 + 4x + 10)$$

Zeros: $x + 4 = 0$ $x = -4$

or   or

$x^2 + 4x + 10 = 0$ $x = \dfrac{-4 \pm \sqrt{16 - 4(1)(1}}{2}$

$= \dfrac{-4 \pm \sqrt{-24}}{2}$

$= \dfrac{-4 \pm i\sqrt{4}\sqrt{6}}{2}$

$x = -4,\ \dfrac{-4 \pm 2i\sqrt{6}}{2} = -2 \pm i\sqrt{6}$