# Assignment 1

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**question**
Using the factor theorem show that x-2 is a factor of $x^3 + x^2 - 4x - 4$.hence factorise the polynomial completely
**solution:**
By the factor theorem if $f(a) = 0$,then $x - a$ will be factor of f(x)
let the given polynomial be f(x)

$$f(x) = x^3 + x^2 - 4x - 4 \tag{1}$$
$$f(2) = 2^3 + 2^2 - 4 \times 2 - 4 \tag{2}$$
$$\implies f(2) = 0 \tag{3}$$

so,x-2 is a factor of f(x),now to factorise f(x)

$$\begin{array}{r l}
 & x^2 + 3x + 2 \\ \cline{2-2}
x - 2 \big) & x^3 \;\; + x^2 - 4x - 4 \\
 & - x^3 + 2x^2 \\ \cline{2-2}
 & 3x^2 - 4x \\
 & - 3x^2 + 6x \\ \cline{2-2}
 & 2x - 4 \\
 & - 2x + 4 \\ \cline{2-2}
 & 0
\end{array}$$

we get $x^2 + 3x + 2$ which is a quadratic expression so we can factorise it further by finding it's roots

$$x = \frac{-b \pm \sqrt{b^2 - 4 \times a \times c}}{2 \times a} \tag{4}$$

here,

$$b = 3 \tag{5}$$
$$a = 1 \tag{6}$$
$$c = 2 \tag{7}$$

so roots would be

$$x = \frac{-3 \pm \sqrt{3^2 - 4 \times 1 \times 2}}{2 \times 1} \tag{8}$$
$$x = -1and - 2 \tag{9}$$

so -1 and -2 are the roots

$$\implies \textbf{other two factors are } x + 1 \textbf{ and } x + 2 \tag{10}$$

$\therefore$ the final factors of f(x) are $x + 1$,$x + 2$ and $x - 2$

$$f(x) = (x + 1) \times (x - 2) \times (x + 2) \tag{11}$$