Solving cubic equations

Example 4

Solve the equation $2x^3 - 4x^2 - 22x + 24 = 0$.

$\div 2 \Rightarrow x^3 - 2x^2 - 11x + 12 = 0$

① guess

$f(1) = (1)^3 - 2(1)^2 - 11(1) + 12 = 0$

$\Rightarrow x = 1$ is solution

$\Rightarrow (x-1)$ is factor

② Divide

$$
\begin{array}{r}
x^2 - x - 12 \\
x - 1 \overline{\big) x^3 - 2x^2 - 11x + 12} \\
\mp x^3 \pm x^2 \\
\hline
-x^2 - 11x \\
\pm x^2 \mp x \\
\hline
-12x + 12 \\
\pm 12x \mp 12 \\
\hline
\end{array}
$$

③ solve quadratic

$x^2 - x - 12 = 0 \Rightarrow (x+3)(x-4) = 0$

$\Rightarrow x = -3$ & $x = 4$

with calculator: $f(-3) = 0$, $f(1) = 0$, $f(4) = 0$