$$PF = \frac{x^3+3x^2+6x+7}{x^2+3x+2} = x + \left(\frac{4x+7}{x^2+3x+2}\right)$$

$$\begin{array}{r|l}
 & \quad x \\
\hline
x^2+3x+2 & x^3+3x^2+6x+7 \\
 & x^3+3x^2+2x \\
\hline
 & 0 \quad\; 0 \quad\; 4x+7
\end{array}$$

$$\frac{17}{3} = 5 + \left(\frac{2}{3}\right) = 5\frac{2}{3}$$

$$F = \frac{4x^3 - 3x^2 + 5x - 7}{2x^2 - 9x + 3}$$

N, D

$\boxed{2x} + \boxed{\frac{15}{2}} \rightarrow Q$

$$\begin{array}{r|l}
 & 2x + \frac{15}{2} \\
\hline
2x^2 - 9x + 3 & 4x^3 - 3x^2 + 5x - 7 \\
 & \underline{4x^3 - 18x^2 + 6x} \\
 & \quad 0 + 15x^2 - x - 7 \\
 & \quad \underline{15x^2 - \frac{135x}{2} + \frac{45}{2}} \\
 & \quad 0 \quad \frac{133x}{2} - \frac{59}{2} \rightarrow R
\end{array}$$

$$Q + \frac{R}{Dir}$$

$$= 2x + \frac{15}{2} + \frac{\frac{133x}{2} - \frac{59}{2}}{2x^2 - 9x + 3}$$

$$\frac{503}{47} = 10 + \frac{33}{47}$$

Q, R, D

$$\begin{array}{r|l}
 & 10 \rightarrow Q \\
\hline
47 & 503 \\
 & \underline{47} \\
 & \ 33
\end{array}$$

$f\left(\frac{3}{4}+\frac{\sqrt{33}}{4}\right)=0$, therefore, $\left(x-\frac{3}{4}-\frac{\sqrt{33}}{4}\right)$ is a factor

$$F = \frac{-2x^3 + x^2 + 6x + 3}{D\,(-2x^2 + 3x + 3)} = Q + \frac{R}{D}$$

$-2x^2+3x+3$ is a factor as

$= (x+1) + \frac{\cancel{0}}{(\ )}$

$= \left(x-\frac{3}{4}+\frac{1}{4}\sqrt{33}\right)(x+1)$

$\left(x-\frac{3}{4}-\frac{1}{4}\sqrt{33}\right)$

$\left(x-\frac{3}{4}+\frac{1}{4}\sqrt{33}\right)$

$\left(x-\frac{3}{4}-\frac{1}{4}\sqrt{33}\right)$

$x=\frac{3}{4}-\frac{1}{4}\sqrt{33}$

$x=\frac{3}{4}+\frac{1}{4}\sqrt{33}$

$3^2-4(-2)3$

b^2-4ac

$$
\begin{array}{r|l}
 & \boxed{x} + \boxed{1} \quad Q \\
\hline
-2x^2+3x+3 & -2x^3+x^2+6x+3 \\
 & -2x^3+3x^2+3x \\
\hline
 & 0 \quad -2x^2+3x+3 \\
 & \quad -2x^2+3x+3 \\
\hline
 & \cancel{0+0+0} \\
 & \underline{\underline{0}} \quad R
\end{array}
$$

$= \underline{\underline{x+1}}$

Factorise: $-2x^2+3x+3$ (-6)

$a=-2$ $b=3$ $c=3$ ac

$(2x+1)(3-x)$

$6x-2x^2+3-x$

3, 6, 3

$$f(-1) = 0, \therefore (x+1) = 0$$

$$F = \frac{f(x)}{q(x)} = \frac{-2x^3 + x^2 + 6x + 3}{(x+1)} \quad \frac{N}{D}$$

$$= Q + \frac{R}{D}$$

$$= \underline{\underline{-2x^2 + 3x + 3}}$$

$$\frac{C}{Q} = L \qquad \frac{C}{L} = Q$$

$$\begin{array}{r|l} & \boxed{-2x^2} + \boxed{3x} + \boxed{3} \\ \hline x+1 & -2x^3 + x^2 + 6x + 3 \\ & -2x^3 - 2x^2 \\ \hline & \quad 3x^2 + 6x + 3 \\ & \quad 3x^2 + 3x \\ \hline & \qquad 3x + 3 \\ & \qquad 3x + 3 \\ \hline & \qquad \cancel{0 + 0} \Rightarrow \underline{0} \end{array}$$

$$\frac{16}{4} \Rightarrow R = 0$$

$$\frac{125}{25} \quad R = 0$$

$$x = -1$$
$$(+1) \quad (+)$$
$$(x+1) = 0$$

$$\boxed{\frac{f(x)}{Q(x)} \quad R \Rightarrow 0 \qquad Q(x) \text{ is a factor of } f(x)}$$

__Remainder theorem:__

If $(x+a)$ is a factor of $f(x)$

then $f(-a)$ will be zero.

$$(x+a)(x+b)(\cdot\ \cdot\ \cdot\ \cdot) = 0$$

$x+a=0$; $x = \underline{\underline{-a}}$

$$f\left(\frac{3}{4}\right) = 0$$

$\left(x - \frac{3}{4}\right)$ is a fact

$\frac{1}{4}\underline{\underline{(4x-3)}}$