$$ax^6 + bx^5 + 5x^4 + 2x^3 - x^2 - x + c = (x^3 + 2x^2 + x)\, Q(x)$$

$$p(x) = ax^6 + bx^5 + 5x^4 + 2x^3 - x^2 - x + c = x(x+1)^2 Q(x)$$

$$p(0) = 0 = c$$

$$p(-1) = 0 = a - b + 5 - 2 - 1 + 1 \rightarrow \boxed{a - b = -3}$$

$$p'(x) = 6ax^5 + 5bx^4 + 20x^3 + 6x^2 - 2x - 1$$

$$p'(-1) = 0 = -6a + 5b - 20 + 6 + 2 - 1 \rightarrow \boxed{-6a + 5b = 13}$$

$$a = 2, \quad b = 5, \quad c = 0$$

$$p(x) = 2x^6 + 5x^5 + 5x^4 + 2x^3 - x^2 - x$$

$$
\begin{array}{r}
2x^3 + x^2 + x - 1 \\
\hline
2x^6 + 5x^5 + 5x^4 + 2x^3 - x^2 - x \, \big| \, x^3 + 2x^2 + x \\
2x^6 + 4x^5 + 2x^4 \\
\hline
x^5 + 3x^4 + 2x^3 - x^2 - x \\
x^5 + 2x^4 + x^3 \\
\hline
x^4 + x^3 - x^2 - x \\
x^4 + 2x^3 + x^2 \\
\hline
-x^3 - 2x^2 - x \\
-x^3 - 2x^2 - x \\
\hline
\end{array}
$$

$$2x^3 + x^2 + x + 1 \qquad x = \tfrac{1}{2}$$

$$
\begin{array}{r}
2x^2 + 2x + 2 \\
\hline
2x^3 + x^2 + x - 1 \, \big| \, x - \tfrac{1}{2} \\
2x^3 - x^2 \\
\hline
2x^2 + x - 1 \\
2x^2 - x \\
\hline
2x - 1 \\
2x - 1 \\
\hline
\end{array}
$$

$$\frac{-1 \pm \sqrt{3}i}{2} = \frac{-1 \pm \sqrt{1 - 4}}{2} \qquad 2(x^2 + x + 1) = 0$$