5-4 (part 1)
Long division

1)

a) $(2x^2+7x+11) \div (x+2) = 2x+3 \text{ R } 5$

$$\begin{array}{r} 2x+3 \\ x+2 \overline{)\,2x^2+7x+11} \\ -2x^2-4x \\ \hline 3x+11 \\ -3x-6 \\ \hline \text{REMAINDER } 5 \end{array}$$

this means that $2x^2+7x+11 = (x+2)(2x+3)+5$

b) $(x^3+5x^2+11x+15) \div (x+3) = x^2+2x+5$

$$\begin{array}{r} x^2+2x+5 \\ x+3 \overline{)\,x^3+5x^2+11x+15} \\ -x^3-3x^2 \\ \hline 2x^2+11x+15 \\ -2x^2-6x \\ \hline 5x+15 \\ -5x-15 \\ \hline R\ 0 \end{array}$$

c) $(9x^3-15x^2+4x) \div (x-3) = 9x^2+12x+40 \text{ R } 120$

$$\begin{array}{r} 9x^2+12x+40 \\ x-3 \overline{)\,9x^3-15x^2+4x} \\ -9x^3+27x^2 \\ \hline 12x^2+4x \\ -12x^2+36x \\ \hline 40x \\ -40x+120 \\ \hline R\ [120] \end{array}$$

2) Is $(x+1)$ a factor of x^3+4x^2+x-6

$$
\begin{array}{r|l}
x+1 & x^2+3x-2 \\
\hline
x^3+4x^2+x-6 & \\
-x^3-x^2 & \\
\hline
3x^2+x-6 & \\
-3x^2-3x & \\
\hline
-2x-6 & \\
+2x+2 & \\
\hline
R\ (-4) &
\end{array}
$$

No, $(x+1)$ is <u>not</u> a factor of x^3+4x^2+x-6 because the remainder is -4 (and not 0)

5-4 (part 2)
synthetic division

1) a) $(x^3+3x^2-x-3) \div (x-1) =$ answer

zero → 1 (zero of $x-1$)

1	1	3	−1	−3	← coefficients
	↓	1	4	3	
	1	4	3	0	← Remainder
	↑	↑	↑		
	x^2	x	constant		

x^2+4x+3

b) $(x^3-7x^2-7x+20) \div (x+4) =$

−4	1	−7	−7	20
	↓	−4	44	−1
	1	−11	37	−128
	x^2	x	C	R

$x^2-11x+37$ R -128

c) $(x^3+27) \div (x+3) =$

−3	1	0	0	27
	↓	−3	9	−27
	1	−3	9	0
	x^2	x	C	R

x^2-3x+9

$(2x^3 - 7x^2 - 5x + 4) \div (x+1)$

2) -1 | 2 -7 -5 4

$\downarrow$ -2 9 -4

2 -9 4 0

R

slip

Now factor using "slip and slide" $2x^2 - 9x + 4$

$* x^2 - 9x + 8$ slide

$* (x - \frac{8}{2})(x - \frac{1}{2})$

$(x-4)(2x-1)$

therefore

$2x^3 - 7x^2 - 5x + 4$

$= (x+1)(x-4)(2x-1)$

3) $\frac{P(x)}{x+3} = x^2 - 7x + 10 \quad R\ -26$

multiply

$P(x) = (x+3)(x^2 - 7x + 10) - 26$

$x^3 - 7x^2 + 10x + 3x^2 - 21x + 30 - 26$

$\boxed{x^3 - 4x^2 - 11x + 4}$