3.6 Factoring Polynomials

A The Remainder Theorem If a polynomial $P(x)$ is divided by $x-b$ then the remainder is $r=P(b)$. Proof:	Ex 1. Determine the remainder when $P(x)=2x^3-4x^2+3x-6$ is divided by a) $x-2$ b) $x+1$
Ex 2. When $P(x)=x^3-kx^2+17x+6$ is divided by $x-3$, the remainder is 12. Find the value of k.	Ex 3. When a polynomial $P(x)=3x^3+cx^2+dx-7$ is divided by $x-2$, the remainder is -3. When $P(x)$ is divided by $x+1$, the remainder is -18. What are the values of c and d?
B The Remainder Theorem (II) If a polynomial $P(x)$ is divided by $ax-b$ then the remainder is $r=P(b/a)$. Proof:	Ex 4. Determine the remainder when $P(x)=2x^3+3x^2-7x-3$ is divided by $2x+5$.

C The Factor Theorem A polynomial $P(x)$ has $x-b$ as a *factor* if and only if $P(b)=0$. Note. In this case b is a *zero* of the polynomial function $P(x)$.	Ex 5. Determine whether a) $x+2$ is a factor of $P(x)=x^3+5x^2+2x-8$ b) x^2-1 is a factor of $P(x)=2x^4-3x^3-x^2+3x-1$
D Integral Zero Theorem If $x=b$ is an *integral zero* of the polynomial $P(x)$ with *integral coefficients*, then b is a *factor* (divisor) of the *constant term* a_0 of the polynomial. c) $P(x)=x^4-2x^3-x^2+4x-2$	Ex 6. Factor completely. a) $P(x)=x^4-x^3-7x^2+x+6$ b) $P(x)=2x^3+3x^2-3x-2$
E Rational Zero Theorem If $x=b/a$ is an *rational zero* of the polynomial $P(x)$ with *integral coefficients*, then b is a *factor* (divisor) of the *constant term* a_0 and a is a *factor* (divisor) of the *leading term* a_n.	Ex 7. Factor completely. $P(x)=12x^4-4x^3-11x^2+x+2$

Reading: Nelson Textbook, Pages 171-176
Homework: Nelson Textbook, Page 176: #1, 2, 5, 6ab, 7af, 9, 10, 12, 13, 16