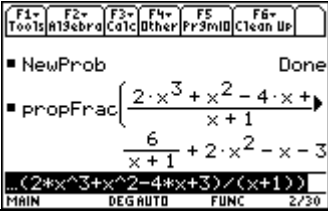
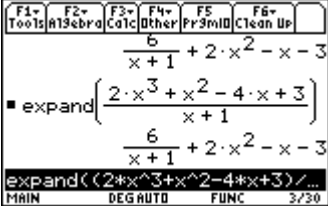


**MATHEMATICAL METHODS CAS**  
**UNIT ONE**

**POLYNOMIAL DIVISION**

You must use “by hand” skills as well as CAS in these examples.

TEXT Reference: Essential Mathematical Methods 1 & 2, 4<sup>th</sup> pg 115 Ex 6B

<p>We will use CAS to do polynomial division of the type:</p> $\frac{2x^3 + x^2 - 4x + 3}{x + 1}$	<p><b><u>METHOD ONE</u></b></p> <p>F6 #2 NewProb</p> <p>F2 #7 PropFrac((2x^3+.....</p> 
<p><b><u>METHOD TWO</u></b></p> <p>Use the <b>Expand</b> key</p>	<p>F2 #3</p> <p>Expand((2x^3+....</p> 

**What is the remainder of this division? Discuss.**

Give examples to support your findings. Use your “by hand” techniques to verify the CAS result.

## INVESTIGATION OF POLYNOMIAL DIVISION

Let  $P(x) = x^3 + 3x^2 + 2x + 1$ .

Find  $P(1)$ .

Calculate the following  $\frac{x^3 + 3x^2 + 2x + 1}{x - 1}$ .

Take note of the remainder.

**Define  $P(x) = x^3 + 3x^2 + 2x + 1$**

*Define can be found in F4*

**P(1)**

**PropFrac(P(x)/(x-1))**



Is there a relationship between  $P(1)$ , the linear factor  $(x - 1)$  and the polynomial division?

Investigate for other values of  $x$

Eg:

(i) Let  $x = 2, -2$  and find  $P(x)$ .

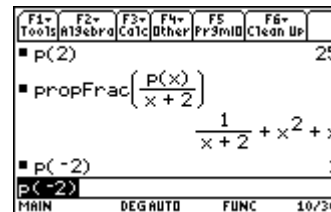
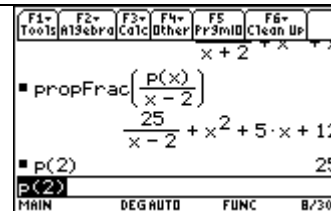
Determine  $\frac{P(x)}{(x+2)}$  and  $\frac{P(x)}{(x-2)}$ .

(ii) Let  $x = -1, 1$  and find  $P(x)$ .

Determine  $\frac{P(x)}{(x+1)}$  and  $\frac{P(x)}{(x-1)}$

(iii) Let  $x = 3, -3$  and find  $P(x)$ .

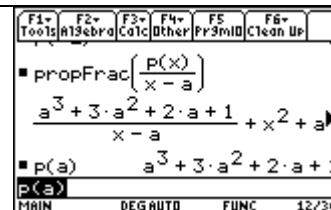
Determine  $\frac{P(x)}{(x+3)}$ ,  $\frac{P(x)}{(x-3)}$ .



What have you found out?

Can we generalise this for all linear divisors??

Use your CAS to determine what the remainder is when  $P(x)$  is divided by  $(x-a)$



Can the remainder of a polynomial division be determined without using the process of division? Discuss.

Can the remainder be determined if a polynomial  $P(x)$  is divided by  $(x-a)$ ?

What is the remainder if  $P(x)$  is divided by  $(ax-b)$ ? Use your CAS to support your findings.

**The Remainder Theorem** State, in your own words, what the Remainder Theorem says.

Calculate  $\frac{x^3 - 4x^2 + x + 6}{x+1}$ .

Is there a remainder?

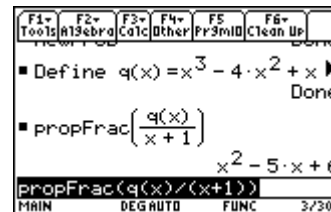
What are the factors of  $x^3 - 4x^2 + x + 6$ ?

F6 #2

**NewProb**

**Define  $Q(x) = x^3 - 4x^2 + x + 6$**

**PropFrac( $(x^3 - 4x^2 + x + 6)/(x+1)$ )**



Hence

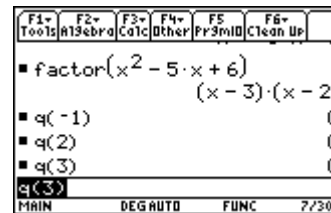
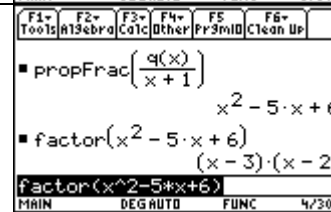
$$Q(x) = (x+1)(x^2 - 5x + 6)$$

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

What would you expect the value of  $Q(-1)$  to be?

What would you expect the value of  $Q(2)$  to be?

What would you expect the value of  $Q(3)$  to be?



**The Factor Theorem.** Give your own definition of the Factor Theorem.