

## Division of Polynomials

$$\frac{x^2 + 5x - 6}{x - 2}$$

x	$x^2$	
-2		

Set up the boxes putting the divisor on the outside and the first term in the upper, left corner.

	$x$	
x	$x^2$	
-2	$-2x$	

Then, the key is asking the appropriate questions.

“What can we multiply by  $x$  to equal  $x^2$  ?”

“What is  $x$  times  $-2$ ?”

	$x$	
x	$x^2$	$7x$
-2	$-2x$	

*(A red oval circles the  $7x$  and  $-2x$  boxes, with an arrow pointing to  $5x$  above it.)*

This becomes the toughest part...

Remember that the diagonal needs to add up to  $5x$ .

“What can I add to  $-2x$  to equal  $5x$ ?”  $7x$

	$x$	$7$
x	$x^2$	$7x$
-2	$-2x$	$-14$

*(A red arrow points from the  $-14$  box to  $-6$  to the right.)*

Then continue..

“What can we multiply by  $x$  to get  $7x$ ?”  $7$

Then multiply  $7$  by  $-2$  to get the last box – and compare it to the quadratic.

To get to  $-6$  from  $-14$  you'd have to add  $8$ . So  $+8$  is our remainder.

$$\frac{x^2 + 5x - 6}{x - 2} = x + 7 + \frac{8}{x - 2}$$

$$\begin{array}{r}
 x^2 - x + 3 \\
 \hline
 x^2 + 3x - 5 \overline{) x^4 + 2x^3 - 5x^2 + 2x + 3} \\
 \underline{x^4 + 3x^3 - 5x^2} \phantom{+ 2x + 3} \\
 -x^3 + 0x^2 + 2x \phantom{+ 3} \\
 \underline{-x^3 - 3x^2 + 5x} \phantom{+ 3} \\
 3x^2 - 3x + 3 \\
 \underline{3x^2 + 9x - 15} \\
 -12x + 18
 \end{array}$$

	$x^2$	$-x$	$3$
$x^2$	$x^4$	$-1x^3$	$3x^2$
$3x$	$3x^3$	$-3x^2$	$9x$
$-5$	$-5x^2$	$5x$	$-15$

$9x + 5x = 14x$  need  $2x$  so we' subtract  $12x$   
 Remainder =  $-12x$

$-15$  but we need  $+3$  so we'd need to add  $18$   
 Remainder =  $+18$

Solution:  $x^2 - x + 3 + \frac{-12x + 18}{x^2 - x + 3}$