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## 7.7. Advanced Algebra

### Dividing Polynomial Functions: Special Case

DATE: 2/5

*Target 6B. Perform operations on polynomial functions.*



Operation	Definition
<i>Sum</i>	$(f + g)(x) = f(x) + g(x)$
<i>Difference</i>	$(f - g)(x) = f(x) - g(x)$
<i>Product</i>	$(f \cdot g)(x) = f(x) \cdot g(x)$
<i>Quotient</i>	$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}, g(x) \neq 0$

At this point, we know how to add, subtract, and multiply polynomial functions. But how do we divide polynomial functions? There are different ways one can think about dividing polynomial functions. Today we look at dividing two polynomial functions by employing factoring.

*Given  $f(x) = x^2 + 3x - 4$  and  $g(x) = x - 1$ , find each function.*

Multiply:  $(x+2)(x+5)$

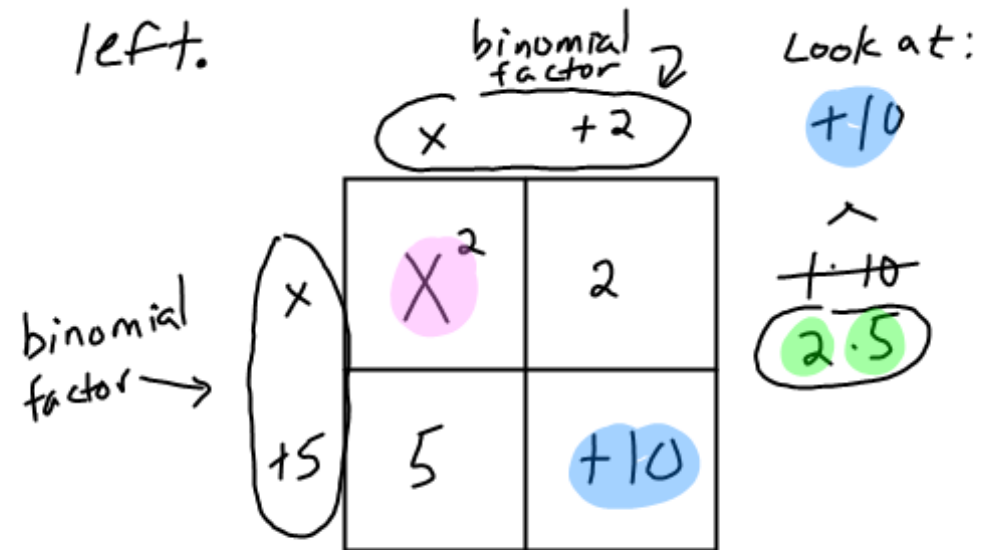
	$x$	$+2$
$x$	$x^2$	$2x$
$+5$	$5x$	$+10$

Ans:  $x^2 + 7x + 10$

How do we go backwards?

How do we go from  $x^2 + 7x + 10$  to  $(x+2)(x+5)$ ? We factor!

To factor the quadratic,  $x^2 + 7x + 10$ , start with a box like the one on the left.



- The  $x^2$  term always goes in top-left
- The constant term always goes in bottom right.
- The trick is to factor the constant term so that the two factors add up to  $+7$ , the coefficient of middle term:  $2+5=7$  ☺

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Given  $f(x) = x^2 + 3x - 4$  and  $g(x) = x - 1$ , find each function.

1.  $\left(\frac{f}{g}\right)(x)$  "f divided by g of x"

$$\frac{f(x)}{g(x)} = \frac{x^2 + 3x - 4}{x - 1} = \frac{(x+4)(x-1)}{(x-1)} = x+4 \leftarrow \text{Answer}$$

	x	-1	
x	x <sup>2</sup>	-1	
+4	+4	-4	

-4  
 $\hat{-1 \cdot 4}$   
~~-2 \cdot 2~~  
 $-1 + 4 = +3 \checkmark$

Given  $h(x) = x^2 - 6x + 8$  and  $k(x) = x - 2$ , find each function.

2.  $\left(\frac{k}{h}\right)(x)$  "k divided by h of x"

$$\frac{k(x)}{h(x)} = \frac{x^2 - 6x + 8}{x - 2} = \frac{(x-2)(x-4)}{(x-2)} = x-4 \leftarrow \text{Answer}$$

	x	-2	
x	x <sup>2</sup>	-2	
-4	-4	+8	

8  
 $\hat{-2 \cdot 4}$   
 $-2 + (-4) = -6 \checkmark$