

# 53 Factoring Polynomials HW due 11/3/14

# 1-6, 39-42 Solutions

[Note: Two Methods Shown; Only Need to do one!]

1)  $x^3 - 5x^2 - 9x + 45$

Factor by Grouping:

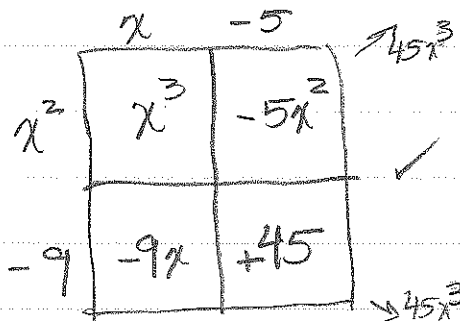
$$(x^3 - 5x^2) + (-9x + 45)$$

$$x^2(x-5) + -9(x-5)$$

$$(x-5)(x^2-9) \leftarrow \text{DOTS!}$$

$$(x-5)(x+3)(x-3) \leftarrow$$

Factor by Area Model:



$$(x-5)(x^2-9)$$

$$(x-5)(x+3)(x-3)$$

2)  $x^3 - 2x^2 - 4x + 8$

Factor by Grouping:

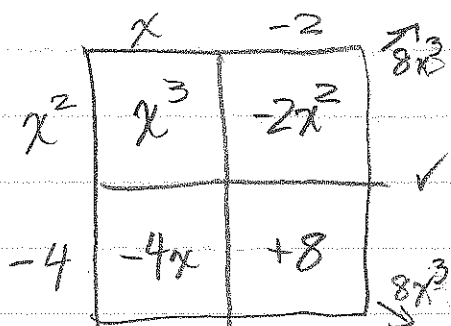
$$(x^3 - 2x^2) + (-4x + 8)$$

$$x^2(x-2) + -4(x-2)$$

$$(x-2)(x^2-4) \leftarrow \text{DOTS!}$$

$$(x-2)(x+2)(x-2) \leftarrow$$

Factor by Area Model:



$$(x-2)(x^2-4)$$

$$(x-2)(x+2)(x-2)$$

$$3) \quad x^3 + 2x^2 + 7x + 14$$

Factor by Grouping:

$$(x^3 + 2x^2) + (7x + 14)$$

$$x^2(x+2) + 7(x+2)$$

$$(x+2)(x^2+7)$$

↑

Sum of squares  
does not factor  
with integer  
terms;  
stop here! ☹

Factor by Area Model:

	$x$	$+2$	
$x^2$	$x^3$	$2x^2$	$\nearrow 14x^3$
$+7$	$7x$	$14$	$\searrow 14x^3$

✓

$$(x+2)(x^2+7)$$

$$4) \quad 3x^3 - 12x^2 + 2x - 8$$

Factor by Grouping:

$$(3x^3 - 12x^2) + (2x - 8)$$

$$3x^2(x-4) + 2(x-4)$$

$$(x-4)(3x^2+2)$$

Factor by Area Model:

	$x$	$-4$	
$3x^2$	$3x^3$	$-12x^2$	$\nearrow -24x^3$
$+2$	$2x$	$-8$	$\searrow -24x^3$

✓

$$(x-4)(3x^2+2)$$

$$5) \quad 5x^3 + 5x^2 + x + 1$$

Factor by Grouping:

$$(5x^3 + 5x^2) + (x + 1)$$

$$5x^2(x + 1) + 1(x + 1)$$

$$(x + 1)(5x^2 + 1)$$

Factor by Area Model:

	$x$	$+1$	$\nearrow 5x^3$
$5x^2$	$5x^3$	$5x^2$	$\checkmark$
$+1$	$x$	$1$	$\searrow 5x^3$

$(x+1)(5x^2+1)$

$$6) \quad 2x^3 - 12x^2 + 5x - 30$$

Factor by Grouping:

$$(2x^3 - 12x^2) + (5x - 30)$$

$$2x^2(x - 6) + 5(x - 6)$$

$$(x - 6)(2x^2 + 5)$$

Factor by Area Model:

	$x$	$-6$	$\nearrow -60x^3$
$2x^2$	$2x^3$	$-12x^2$	$\checkmark$
$5$	$5x$	$-30$	$\searrow -60x^3$

$(x-6)(2x^2+5)$

39)  $x^3 + 512$  → Rewrite as Sum of Cubes  
because  $8^3 = 512$

$x^3 + 8^3$  → use factoring pattern:  
 $a = x, b = 8$

$(x+8)(x^2 - 8x + 8^2)$  → simplify

$(x+8)(x^2 - 8x + 64)$

40)  $27x^3 - 1$  → Rewrite as Difference of  
cubes because  $3^3 = 27$   
and  $1^3 = 1$

$(3x)^3 - 1^3$  → use factoring pattern:  
 $a = 3x, b = 1$

$(3x-1)((3x)^2 + 1(3x) + 1^2)$  → simplify

$(3x-1)(9x^2 + 3x + 1)$

$$6^3 = 3^3 \cdot 2^3$$

41)  $27x^3 - 216$  → Rewrite as difference of cubes because

$$(3x)^3 - 6^3 \quad \begin{matrix} 3^3 = 27 \text{ and } 6^3 = 216 \\ \rightarrow \text{Use factoring pattern:} \\ a = 3x, b = 6 \end{matrix}$$

$$(3x - 6)(3x^2 + 6(3x) + 6^2) \rightarrow \text{simplify}$$

$$(3x - 6)(9x^2 + 18x + 36) \leftarrow \text{Notice there is a common factor of } 3 \text{ in the linear factor and } 9 \text{ in the quadratic factor.}$$

$$3(x-2) \cdot 9(x^2+2x+4) = 27(x-2)(x^2+2x+4)$$

-OR-

Factor out the GCF:

$$27(x^3 - 8) \quad \text{THEN}$$

$$27(x-2)(x^2+2x+4)$$

42)  $8x^3 - 27$  → Rewrite as a

difference of cubes

because  $2^3 = 8$  and  $3^3 = 27$

$$(2x)^3 - 3^3$$

→ Use factoring pattern:

$$a = 2x, b = 3$$

$$(2x - 3)(2x^2 + 3(2x) + 3^2) \rightarrow \text{simplify}$$

$$(2x - 3)(4x^2 + 6x + 9)$$