Name:_____ Date:_____

Class/Home worksheet: Alg2H

Factoring (book chapter 5, page 519 and beyond)

Factoring is the reverse of multiplying.

Factoring an expression means to write it as an equivalent expression that is a product.

Common factor:

$3x^2 + 12 =$

$3 \cdot x^2 + 3 \cdot 4 =$

$3 \cdot (x^2 + 4)$

Common factor:

$7x^3 + 14x^2 =$

$7x^2(x + 2)$

Common factor:

$5x^3 - 20x^3 =$

$5x^3(1 - 4)$

Common factor:

$12x^2y - 20x^3y =$

$4x^2y(3 - 5x)$

Common factor:

$10a^4 + 15a^2 - 25a =$

$5a(2a^3 + 3a - 5)$

$5a(2a^3 + 2a - 5a - 5)$

$5a($ stays as is!)

Common factor:

$9x^3y^2 - 6x^2y^3 + 3x^3y^3 =$

$3x^2y^2(3x - 2y + xy)$

Take a common factor if possible.
It will simplify things!

Problems denoted with ** mark are taken from Exeter Phillips Academy (NH) math curriculum.

Difference of Squares (P. 221)

$$A^2 - B^2 = (A + B) \cdot (A - B)$$

Factor:

$$x^2 - 25 =$$

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

Factor:

$$9x^2 - 16y^2 =$$

$(3x+4y)(3x-4y)$

Factor:

$$\frac{1}{25} - x^2 =$$

$\left(\frac{1}{5} - x\right)\left(\frac{1}{5} + x\right)$

Factor (challenge):

$$x^{16} - 1 =$$

$(x^4-1)(x^4+1) =$

$= (x^2-1)(x^2+1)(x^4+1) = (x+1)(x-1)(x^2+1)(x^4+1)$

Perfect Squares (P. 220)

$$A^2 + 2AB + B^2 = (A + B)^2$$

$$A^2 - 2AB + B^2 = (A - B)^2$$

Factor:

$$x^2 + 10x + 25 =$$

$(x+5)^2$

Factor:

$$x^2 - 14x + 49 =$$

$(x-7)^2$

Factor (hint: rearrange) :

$$16y^2 + 49 + 56y =$$

$16y^2 + 56y + 49 =$

$= (4y+7)^2$

Factor:

$$72xy + 16x^2 + 81y^2 =$$

$16x^2 + 72xy + 81y^2 =$

$= (4x+9y)^2$

Factoring trinomials MATH style

(The common method in Kehillah school!)

Assume a trinomial of the form

$$aX^2 + bX + c$$

Create the following table following the directions below it:

M	A	T	H
$a \cdot c \cdot X^2$	$b \cdot X$	Try the various factors of $a \cdot c$ that sum up to b	☺

1. Put under M (Multiply) the product $a \cdot c \cdot X^2$
2. Put under A (Add) the value of $b \cdot X$
3. Under T (Tries), put the various factor-pairs of the result in M, and try to see if their sum adds up to A.
4. When you find an appropriate pair, mark a smiley face in H (Happy) !
5. Rewrite the trinomial, by writing the middle term as the sum of two terms, and factor by grouping appropriate terms.

Examples:

I. $3x^2 + 8x + 4$

M	A	T	H
$12x^2$	$8x$	3, 4 6, 2	✓

$3x^2 + 6x + 2x + 4$

$= 3x(x+2) + 2(x+2) = \boxed{(3x+2)(x+2)}$

II. $2x^2 + x - 15$

M	A	T	H
$-30x^2$	$1 \cdot x$	$-6, 5$ $6x, -5x$	✓

$2x^2+6x-5x-15 = 2x(x+3)-5(x+3) = \boxed{(2x-5)(x+3)}$

If I take: $2x^2-5x+6x-15 = x(2x-5)+3(2x-5) = (x+3)(2x-5)$ ✓

III. $x^2 - 2x - 24$

M	A	T	H
$-24 \cdot x^2$	$-2x$	$-12, 2$ $6, -4$ $-6, 4$	✓

$x^2-6x+4x-24 = x(x-6)+4(x-6) = \boxed{(x+4)(x-6)}$

Let's try in the case of binomial (though we know the answer already!)

IV. $4x^2 - 9 = 4x^2 + 0x - 9$

M	A	T	H
$-36x^2$	0	$6, -6$	✓

$4x^2+6x-6x-9 = 2x(2x+3)-3(2x+3) = \boxed{(2x-3)(2x+3)}$

V. $-2x^2 - x + 6$

M	A	T	H
$-12x^2$	$-x$	$-6, 2$ $-4, 3$	✓

$-2x^2-4x+3x+6 = -2x(x+2)+3(x+2) = \boxed{(3-2x)(x+2)}$

From the book, Page 223

(30) $12a^2 + 36a + 27 =$

$3(4a^2+12a+9) =$

$3(2a+3)^2$

(38) $9x^2 - 25 =$

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

(46) (tricky: Don't stop in the middle)

$4xy^4 - 4xz^4 =$

$4x(y^4-z^4) =$

$4x(y^2-z^2)(y^2+z^2) =$

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

Factor:

$x^2 + 9x + 20 =$

M	A	T
$20x^2$	$9x$	4, 5

$x^2+4x+5x+20 =$

$= x(x+4)+5(x+4) = (x+5)(x+4)$

Factor:

$4x^2 - 3 + 4x =$ $4x^2+4x-3$

M	A	T
$-12x^2$	$4x$	$-6, 2$

$= 4x^2+2x-6x-3 =$

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

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

Factor:

$6x^2 + 17x + 7 =$

M	A	T
$42x^2$	$17x$	7, 6 14, 3

$6x^2+3x+14x+7 =$

$3x(2x+1)+7(2x+1) =$

$(3x+7)(2x+1)$

Two more items for factoring: Grouping and Cubes

Checking: $6x^2+14x+3x+7 =$

$= 2x(3x+7)+1(3x+7) = (2x+1)(3x+7)$