Name ______________________________ Period ________

Factoring

A working definition of factoring is: ______________________________.

The first step in any factoring problem is to ______________________________.

This means to use the ______________ ______________ in reverse.

EXAMPLES OF DISTRIBUTIVE PROPERTY

$6(x+7)=6x+42$

$7(2x+3)=14x+21$

$9(x-4)=9x-36$

$12(2x+1)=24x+12$

$5(3x-2y+4)=15x-10y+20$

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

EXAMPLES OF FACTORING

$6x+42=6(x+7)$

$14x+21=7(2x+3)$

$9x-36=9(x-4)$

$24x+12=12(2x+1)$

$15x-10y+20=5(3x-2y+4)$

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

When ______________ the common factor, look for a number or variable that ______________ into both (or all) terms. If there is more than one common factor, be sure to get the ______________ ______________ ______________.

Example 1 : **12x + 36**

Solution:

1. There are several numbers that divide evenly into both 12 and 36: ______________.
2. Take the largest common factor, which is ________.
3. Write down the 12, then__________ ______________: 12 (+).
4. In the parentheses you put the______________ ______________, x and 3, like this:

12x + 36 = 3(x + 3)

EXERCISES: **Factor completely.**

1. 3 | $3x + 15$
$= 3(\underline{x} + \underline{5})$

2. 8 | $8x + 24$
$= 8(\underline{x} + \underline{3})$

3. $7x - 28$
$= \_\_\_(\_\_\_ - \_\_\_)$

4. $5x - 25$
$= \_\_\_(\quad - \quad)$

5. $34x + 17y$
$= 17(\qquad)$

6. $14x + 28y$
$= \_\_\_(\qquad)$

7. $12x + 36y$
$= \_\_\_(\qquad)$

8. $15x + 60y$
$= \_\_\_(\qquad)$

9. $7x + 7$
$= \_\_\_(\quad + 1)$

10. $3x^2 + 3$
$= 3(\_\_\_ + \_\_\_)$

11. $42x^2 + 21$
$= 21(\qquad)$

12. $30x^2 + 15$
$= \_\_\_(\qquad)$

13. $5x^2 + 15x$
$= 5x(x + \quad)$

14. $7x^2 + 21x$
$= 7x(\qquad)$

15. $7x^2 + 14x$
$= \_\_\_(\qquad)$

16. $7x^2 - 14x$
$= \_\_\_(\qquad)$

17. $3x^2 + 12x$
$= \_\_\_\_\_\_$

18. $21x^2 + 30x$
$= \_\_\_\_\_\_$

19. $16x^2 - 18x$
$= \_\_\_(\qquad)$

20. $12x^2 - 30x$
$= \_\_\_(\qquad)$

21. $x^3 + 3x^2$
$= x^2(\qquad)$

22. $x^3 + 4x^2$
$= \_\_\_\_\_\_$

23. $x^3 + 4x$
$= \_\_\_\_\_\_$

24. $x^3 - 4x^2$
$= \_\_\_\_\_\_$

25. $4x^3 + 8x^2$

$= 4x^2($ $)$

26. $4x^3 + 8x$

$= 4x($ $)$

27. $12x^3 - 8x^2$

= ____________________

28. $16x^3 - 24x^2$

$= 8x^2($ $)$

29. $16x^3 + 32x^2$

= ____( )

30. $12x^3 + 18x^2$

= ____________________

31. $12x^3 - 18x^2$

= ____________________

32. $45x^3 + 30x^2$

= ____________________

33. $12x^2 + 12$

= ____________________

34. $24x^2 + 12$

= ____________________

35. $24x^2 + 12x$

= ____________________

36. $144x^2 + 12x$

= ____________________

37. $16x^2 + 48x^3$

$= 16x^2($ $)$

38. $16x^2 - 48x^3$

= ____________________

39. $24x^4 + 36x^3$

= ____________________

40. $24x^3 + 24x^2$

= ____________________

41. $24x^3 + 24x$

= ____________________

42. $24x^4 + 16x^2$

= ____________________

43. $6x + 9y - 12$

= 3(____ + ____ − ____)

44. $3x + 6y + 12z$

= ____( )

45. $9x + 18y + 9$

$= 9($ $)$

46. $30x + 20y + 10$

= 10(____ + ____ + ____)

47. $30x + 20y - 5$

= ____________________

48. $35x + 28y - 14z$

= ____________________

49. $30x^2 + 20xy - 10y^2$

= ____________________

50. $30x^3 + 20xy + 10x^2$

= ____________________

51. $12x^3 + 24x^2 + 24x$

= ____________________

52. $12x^3 - 24x^2 + 3x$

= ____________________

53. $19x^3 + 19x^2y + 38x^2$

= ______________________

54. $36x^3 + 24x^2y + 12x^2$

= ______________________

55. $16x^2 + 32x^3$

$= 16x^2($ $)$

56. $16x^3 + 32x^2$

= ______________________

57. $16x^2 - 12x^3$

= ______________________

58. $16x^3 - 12x^2$

= ______________________

59. $y^5 - 14y^3$

$= y^3($ $)$

60. $x^{10} + 5x^3$

$= x^3($ $)$

From exercises #55 – 60 above, observe the rule listed below!

RULE

When factoring powers, take out the *lowest* exponent (power) of the factor. Then *subtract* exponents.

61. $16x^2y^3 - 12x^3y^2$

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

62. $4x^3y^3 + 8x^2y^4$

$= 4x^2y^3($ $)$

63. $5x^3y^3 + 10x^2y$

= ______________________

64. $8x^5y^2 - 16x^4y^3$

= ______________________

65. $8x^5y^3 + 12x^3y^4$

= ______________________

66. $8x^3y^4 + 24x^2y^6$

= ______________________

When an expression contains negative terms, it is sometimes helpful to be able to factor **out the** negative or to factor out a "−1." If you factor out a "−1", this changes each sign inside the parentheses that follow, as in the following example.

EXAMPLE 2. Factor out a "−1" from the expression $-4x - 6y + 9$.

Solution: $-4x - 6y + 9 = -1(4x + 6y - 9)$ or

$= -(4x + 6y - 9)$ You can verify by the distributive property!

EXERCISES. In each of the following, factor completely, including the "negative."

67. $-x^2 - 4x + 6$

$= -1(\quad + \quad - \quad)$

or $-(\quad + \quad - \quad)$

68. $-x^2 + 5x - 1$

$= -1(\qquad)$

or $-(\qquad)$

69. $-x^2 + 3x + 7$

= ____________

70. $-6x^2 + 12$

$-6(\qquad)$

71. $-6x - 9y + 15$

$= -3(\qquad)$

72. $-8x + 20y - 24$

= ____________

73. $-x^2 - 4x$

$= -x(\qquad)$

74. $-x^2 - 7x$

= ____________

75. $-x^2 + 7x$

= ____________

76. $-4x + 12x^2$

$= -4x(1 -$ ______ $)$

77. $-8x - 12x^2$

= ____________

78. $-4x^2 - 4y^2$

= ____________

79. $-x^2 - 3x + 8xy$

= ____________

80. $-4x^2 - 16x + 16$

= ____________

81. $-8 + 8x - x^2$

= ____________

82. $-8 - 8x - 8x^2$

= ____________

83. $8 - 16x - 40x^2$

= ____________

84. $35 + 20x - 5x^2$

= ____________

In each of the following exercises, factor the common factors. As you do, observe how you move from the simple to the more complicated; from the concrete to the abstract.

85a) $yx + 7x$

$= x(\qquad)$

b) $ya + 7a$

$= a(\qquad)$

c) $y\$ + 7\$$

$= \$(\qquad)$

d) $y\,(\text{Junk}) + 7\,(\text{Junk})$

$= (\text{Junk})(\qquad)$

e) $y\,(x+4) + 7\,(x+4)$

$= (x+4)(\qquad)$

86a) $4xy + 3y$

= ______________

b) $4xa + 3a$

= ______________

c) $4x\$ + 3\$$

= ______________

d) $4x\,(\text{Junk}) + 3\,(\text{Junk})$

= ______________

e) $4x\,(y-7) + 3\,(y-7)$

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