Suffolk Public Schools

Factoring Trinomials : $ax^2 + bx + c$

Lesson 8-6

Lesson 8-6 Factoring Trinomials: $ax^2 + bx + c$

Factoring $ax^2 + bx + c$: To factor quadratic trinomials of the form $ax^2 + bx + c$,

A. Find the product of "a" and "c"
B. Rewrite the problem, dropping the "a" coefficient and replacing "c" with the product of "a" and "c"
C. Find two numbers whose product is "c" and whose sum is "b"
D. Write the two factors.
E. Divide each of the constants by the original "a"
F. If the fraction can be simplified, do so, if not, move the denominator to become the new coefficient of the variable in that particular factor.

A. $5x^2 + 27x + 10$

$5x^2 + 27x + 10 =$ $x^2 + 27x + 50$ (multiply 5•10. Drop the 5 from the x^2 and replace the 10 with your answer.)

$=$ $(x + 25)(x + 2)$ (find factors of 50 that add up to 27.) Write out the two factors)

$=$ $\left(x + \frac{25}{5}\right)\left(x + \frac{2}{5}\right)$ (Divide each constant term by 5 (the original "a")

$=$ $(x + 5)(5x + 2)$ (Simplify, if possible. If not move the "denominator" so that it becomes the coefficient of the x term.)

Check by multiplying the two factors.

	5x	2
x	$5x^2$	2x
5	25x	10

$5x^2 + 27x + 10$

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B. $24x^2 - 22x + 3$

$24x^2 - 22x + 3 = x^2 - 22x + 72$

$= (x + 4)(x + 18)$

$= (x + \frac{4}{24})(x + \frac{18}{24})$

$= (x + \frac{1}{6})(x + \frac{3}{4})$

$= (6x + 1)(4x + 3)$

Factors of +72	Sum of Factors
1, 72	73
2, 36	38
3, 24	27
4, 18	22

Simplify fractions

F O I L

check: $24x^2 + 18x + 4x + 3$

$24x^2 + 22x + 3$

Factoring $ax^2 + bx + c$, When A, B, and C Have a Common Factor

C. $4x^2 + 24x + 32 = 4 \cdot (x^2 + 6x + 8)$ Factor out the common factor

$= 4(x + 2)(x + 4)$

Factors of 8	Sum of Factors
1, 8	9
2, 4	6

DON'T FORGET TO BRING DOWN YOUR COMMON FACTOR!!!!!

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TRY THESE ON YOUR OWN:

Practice:

1. $3x^2 + 26x + 35 =$ _____

   = _____

   = _____

   = _____

Factors of	Sum of Factors

2. $3x^2 - 17x + 10 =$ _____

   = _____

   = _____

   = _____

Factors of	Sum of Factors

3. $2x^2 + 14x + 20 =$ ____•(_____)

   = _____

   = _____

   = _____

Factors of	Sum of Factors

4. $6x^2 + 15x - 9 =$ ____•(_____)

   = _____

   = _____

   = _____

Factors of	Sum of Factors

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Hot Words A polynomial that cannot be written as a product of two polynomials with integral coefficients (integer) is called a prime polynomial.

D. $3x^2 + 7x - 5$ $x^2 + 7x - 15$

Factors of −15	Sum of Factors
−1, 15	14
−3, 5	2

There are no factors whose sum is 7. Therefore,

$3x^2 + 7x - 5$ is a prime polynomial.

E. $3x^2 - 5x + 3$

$x^2 - 5x + 9$

Factors of 9	Sum of Factors
−1, −9	−10
−3, −3	−6

Prime polynomial
(no factors of 9 add up to −5)

Solving Equations By Factoring

F. $18c^2 - 19c - 8 = 3c^2 - 5c$

$-3c^2 + 5c \quad -3c^2 + 5c$

$15c^2 - 14c - 8 = 0$ Rewrite so one side equals 0.

$c^2 - 14c - 120 = 0$

$(c + 6)(c - 20) = 0$

$(c + \frac{6}{15})(c - \frac{20}{15}) = 0$

$(c + \frac{2}{5})(c - \frac{4}{3}) = 0$

Factors of −120	Sum of Factors
1, −120	−119
2, −60	−58
3, −40	−37
4, −30	−26
5, −24	−19
6, −20	−14

$(5c + 2) = 0$ OR $(3c - 4) = 0$

$-2 \quad -2$ $+4 \quad +4$

$\frac{5c}{5} = \frac{-2}{5}$ $\frac{3c}{3} = \frac{4}{3}$

$c = -\frac{2}{5}$ $c = \frac{4}{3}$

The solution set is $\{-\frac{2}{5}, \frac{4}{3}\}$

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TRY THESE ON YOUR OWN:

Practice:

Factors of 14	Sum of Factors
-1, -14	-15
-2, -7	-9

5. $2a^2 - 11a + 7$

$a^2 - 11a + 14$

Prime Polynomial

Factors of 60	Sum of Factors
1, 60	61
2, 30	32
3, 20	23
4, 15	19

6. Solve $12x^2 + 19x + 5 = 0$

$x^2 + 19x + 60 = 0$

$(x+4)(x+15) = 0$

$\frac{12}{12}$ $\frac{12}{12}$

$(x+\frac{1}{3})(x+\frac{5}{4}) = 0$

$3x + 1 = 0$ OR $4x + 5 = 0$

$-1 \quad -1$ $\quad -5 \quad -5$

$\frac{3x}{3} = \frac{-1}{3}$ $\quad \frac{4x}{4} = \frac{-5}{4}$

$x = -\frac{1}{3}$ $\quad x = -\frac{5}{4}$

The solution set is $\{-\frac{1}{3}, -\frac{5}{4}\}$.

Factors of	Sum of Factors
-1, 120	119
-2, 60	58
-3, 40	37
-4, 30	27
-5, 24	19
-6, 20	14
-8, 15	7

7. Solve $6a^2 + 7a - 20 = 0$

$a^2 + 7a - 120 = 0$

$(a-8)(a+15) = 0$

$\frac{6}{6}$ $\frac{6}{6}$

$(a-\frac{4}{3})(a+\frac{5}{2}) = 0$

$3a - 4 = 0$ OR $2a + 5 = 0$

$+4 \quad +4$ $\quad -5 \quad -5$

$\frac{3a}{3} = \frac{4}{3}$ $\quad \frac{2a}{2} = \frac{-5}{2}$

$a = \frac{4}{3}$ $\quad a = -\frac{5}{2}$

The solution set is $\{\frac{4}{3}, -\frac{5}{2}\}$.