;Algebra 1: FOIL Method

\presentation [foil.jpg][p]In algebra a special process of multiplying two binomials together makes the acronym FOIL for First, Outer, Inner, Last. The FOIL Method makes it easier to combine like terms after multiplying two binomials.[FOIL][p]Knowledge of the FOIL Method will especially be helpful for determining the factors[factoring] of a trinomial[trinomial] and finding the points of a linear equation in latter lessons.

\concept The FOIL Method[FOIL] is used in multiplying binomials[binomials] to make combining like terms[liketerms] easier.
\or Using the FOIL Method[FOIL] helps to simplify the resulting polynomial[polynomial].
\or FOIL[foil] stands for the order of how the terms[term] of two binomials[binomial] are multiplied together: First, Outer, Inner, Last.
\not The HILO Method is used when multiplying binomials.
\not The FOIL Method[FOIL] is an unnecessary process since simplifying any distribution[distribution] arrives at the same answer.

\test Describe the FOIL Method.
\correct The FOIL Method is used in multiplying binomials to make combining like terms easier.
\or Using the FOIL Method helps to simplify the resulting polynomial.
\or FOIL stands for the order of how the terms of two binomials are multiplied together: First, Outer, Inner, Last.

\not The FOIL Method is when mathematicians place aluminum foil on their heads to help their brains solve complex problems.
\not The FOIL Method is an unnecessary process since simplifying any distribution arrives at the same answer.

\info distribution [p]The distributive property states that for any natural numbers a, b, and c, a(b + c) = ab + ac or ac + ab; and for any natural numbers a, b, c, and d, (a + b)(c + d) = ac + bc + ad + bd or ac + ad + bc + bd. The order does not alter the solution. (2 + 3)(6 + 8) = 12 +18 + 16 + 24 or 12 +16 +18 +24; either way it equals 60.
\info liketerms [p]Like terms have the same (or no) variable to the same power. In the polynomial[polynomial] $a^2 + 2a + 6 + 3a$, 2a and 3a are 'like terms'. [p] When two binomials[binomial], each with a like term, are multiplied together, the resulting polynomial[polynomial] will have two like terms which can be combined to result in either a trinomial[trinomial] like $a^2 + 5a + 6$ or a binomial[binomial] like $a^2 - 9$.
\info foil [p] One distribution[distribution] of (a + 2)(a + 3) is $a^2 + 2a + 6 + 3a$. The FOIL method assures that like terms[like terms] will be grouped together in the middle for easier simplification (combining terms and/or reducing to lowest terms). This is achieved by multiplying the [b]F[/b]irst terms of each binomial factor FIRST, then the two [b]O[/b]utermost, the two [b]I[/b]nnermost terms, and then the [b]L[/b]ast remaining terms. By using the FOIL method (First, Outer, Inner, Last) on our example, we arrive at $a^2 + 3a + 2a + 6$, so we can more easily combine the like

terms and simplify it to $a^2 + 5a + 6$. [p]When multiplying binomials, a subtraction operand becomes a negative coefficient.

$$(x-3)(x+5) = x^2 + 5x + (-3)x + (-3)(5)$$

$$= x^2 + 5x - 3x - 15$$

$$= x^2 + 2x - 15$$

[n]

$$(y-6)(y-7) = y^2 + (-7)y + (-6)y + (-7)(-6)$$

$$= y^2 - 7y - 6y - 42$$

$$= y^2 - 13y - 42$$

\info factoring [p]The factors of 10 are 2 and 5 since 2 X 5 = 10. The factors of $x^2 + 2x - 3$ are $(x-1)$ and $(x+3)$ since $(x-1)(x+3) = x^2 + 2x - 3$. The process of determining the factors of a polynomial is called factoring.

\info monomial [p] A monomial (‘one name’ in Latin) is a mathematical expression containing one term, such as 108 or 2a or -3y or x^3.

\info binomial [p]A binomial (‘two name’ in Latin) is a mathematical expression containing two terms, such as 27 - 13 or 2a + 5b or 6 - 3y or $3y^2 - 27$. [p]Special patterns result when a binomial is multiplied by itself.

$$(a+b)(a+b) = a^2 + 2ab + b^2$$ and

$$(a-b)(a-b) = a^2 - 2ab + b^2$$

[p]The middle terms add up to zero leaving the difference of two squares in the following situation:

$$(a-b)(a+b) = a^2 + ab - ab - b^2 = a^2 - b^2$$

\info trinomial [p] A trinomial (‘three name’ in Latin) is a mathematical expression containing three terms, such as 10 + 2 + 8 or 3a + 6b - 4c or 5x - 3y +12 or $x^3 - 3y^2 - 5$.

\info term [p] A term is a single mathematical expression, also called a monomial[monomial], such as 18 or 5c.

\info polynomial [p] A polynomial (‘many name’ in Latin) is a mathematical expression containing more than one term[term], such as 12 + 8 or 3a + 6b - 4c + 7d or xy + 5xy + 6 or $x^2 + 3x - 3$.

[p]Polynomials are written in descending order from highest power to the lowest power; thus $x^2 + 5x^3 + x^4 + 3x - 3$ would be written as $x^4 + 5x^3 + x^2 + 3x - 3$.

[p]and
$$\begin{aligned}(5+t)(8+t) &= 40 + 5t + 8t + t^2\\ &= t^2 + 13t + 40\end{aligned}$$

[p]Polynomials usually begin with a positive term of highest power, even if that means factoring out a negative one.

$$(7-s)(8+s) = 56 + 7s - 8s - s^2 = 56 - s - s^2$$

$$= -s^2 - s + 56 = (-1)(s^2 + s - 56)$$

\question->foil According to the FOIL Method, what are the Last terms in (z - 2)(z + 7)?

\correct (-2)(7)

\or -2 and 7
\not (-2)(z)
\not (7)(z)
\not 7 and z

\question->foil According to the FOIL Method, what are the Outer terms in (b + 4)(b - 10)?
\correct (-10)(b)
\or -10 and b
\not (4)(-10)
\not (4)(b)
\not 4 and -10

\question-> According to the FOIL Method, what are the Inner terms in (v - 3)(v - 2)?
\correct (-3)(v)
\or -3 and v
\not -3 and -2
\not (-3)(-2)
\not -2 and v

\question->foil What are the results of using the FOIL method on $(a-1)(a-3)$?
\correct $a^2 - 4a + 3$
\or $a^2 - 3a - a + 3$
\or $a^2 - 3a - 1a + 3$
\not $a^2 + 3$
\not $a^2 - 2a + 3$

\question->binomial Multiply the binomial[binomial] y + 2 by itself and simplify.

\correct $y^2 + 4y + 4$

\correct $(y+2)(y+2) = y^2 + 4y + 4$

\not $(y+2)(y+2) = y^2 + 2y + 4$

\not $y^2 + 4$

\fact->y+3y+3 $(y+3)(y+3) = y^2 + 6y + 9$

\or $(y+3)^2 = y^2 + 6y + 9$

\not $(y+3)^2 = y^2 + 9y + 9$

\not $(y+3)^2 = y^2 + 9$

\info y+3y+3

$(y+3)^2 = (y+3)(y+3) = y^2 + 3y + 3y + 9 = y^2 + 6y + 9$

\fact->a-5a-5 $(a-5)^2 = a^2 - 10a + 25$

\or $(a-5)(a-5) = a^2 - 10a + 25$

\not $(a-5)^2 = a^2 - 5a - 25$

\not->binomial $(a-5)^2 = a^2 + 25$

\info a-5a-5

$(a-5)^2 = (a-5)(a-5) = a^2 - 5a - 5a - 25 = a^2 - 10a + 25$

\question->b-8b-8 What are the results of using the FOIL method on $(b-8)(b-8)$?

\correct $(b-8)(b-8) = b^2 - 16b + 64$

\or $(b-8)^2 = b^2 - 16b + 64$

\not $(b-8)(b-8) = b^2 - 64b + 16$

\not $(b-8)^2 = b^2 - 8b + 16$

\info b-8b-8

$(b-8)^2 = (b-8)(b-8) = b^2 - 8b - 8b + 64 = b^2 - 16b + 64$

\question->x-4x+5 What are the results of using the FOIL method on $(x-4)(x+5)$?

\correct $(x-4)(x+5) = x^2 + x - 20$

\or $(x-4)(x+5) = x^2 + 1x - 20$

\not->xcoef $(x-4)(x+5) = x^2 - 20x - 20$

\not->-coef $(x-4)(x+5) = x^2 + 9x - 20$

\info xcoef You’ve multiplied the coefficients of the middle terms.

\info -coef You’ve subtracted the coefficients of the middle terms.

\info x-4x+5

$(x-4)(x+5) = x^2 + 5x - 4x - 20 = x^2 + 1x - 20 = x^2 + x -$

\fact->c-9c+6 $(c-9)(c+6) = c^2 - 3c - 54$

\or $(c-9)(c+6) = c^2 + 6c - 9c - 54$

\not $(c-9)(c+6) = c^2 - 15c - 15$

\not->-coef $(c-9)(c+6) = c^2 + 15c - 54$

\info c-9c+6

$(c-9)(c+6) = c^2 + 6c - 9c - 54 = c^2 - 3c - 54$

\fact->5+v8-v $(5+v)(8-v)=-v^2+3v+40$

\or $(5+v)(8-v)=40+3v-v^2$

\or

$(5+v)(8-v)=-v^2+3v+40=(-1)(v^2-3v-40)$

\not $(5+v)(8-v)=v^2+3v+40$

\not $(5+v)(8-v)=-40+13v+v^2$

$(5+v)(8-v)=40-5v+8v-v^2$

\info->5+v8-v $=40+3v-v^2=-v^2+3v+40$

$=(-1)(v^2-3v-40)$

[p]Polynomials usually begin with a positive term of highest power, even if that means factoring out a negative one.

\fact->a-22a+11 $(a-22)(a+11)=a^2-11a-242$

\or $(a-22)(a+11)=a^2-22a+11a-242$

\not->-coef $(a-22)(a+11)=a^2-33a-242$

\not $(a-22)(a+11)=a^2-11a-33$

\info->a-22a+11

$(a-22)(a+11)=a^2-22a+11a-242$

$=a^2-11a-242$

\fact->12-r9-r

$$(12-r)(9-r)=108-21r+r^2=r^2-21r+108$$

\or $(12-r)(9-r)=r^2-21r+108$

\not->-coef $(12-r)(9-r)=r^2-3r+108$

\not $(12-r)(9-r)=r^2-21r+81$

\info->12-r9-r

$$(12-r)(9-r)=108-12r-9r=108-21r+r^2=r^2-21r$$

fact->y+3y-3 $(y+3)(y-3)=y^2-9$

\or $(y+3)(y-3)=y^2-3y+3y-9=y^2-9$

\not->-coef $(y+3)(y-3)=y^2-6y-9$

\not $(y+3)(y-3)=y^2+9$

\info->y+3y-3

$$(y+3)(y-3)=y^2-3y+3y-9=y^2+0-9=y^2-9$$

\fact->x-4x+4

$$(x-4)(x+4)=x^2+4x-4x-16=x^2-16$$

\or $(x-4)(x+4)=x^2-16$

\not

$$(x-4)(x+4)=x^2-4x-4x-16=x^2-8x-16$$

\not->coef

$$(x-4)(x+4)=x^2+4x-(-4)x-16=x^2+8x-16$$

\dialog

\challenge->foil What is the result of the first step in the FOIL process of multiplying $(y-2)(y+10)$?

\response y^2
\challenge->foil What is the result of the second step in the FOIL process of multiplying $(y-2)(y+10)$?
\response 10y
\challenge->foil What is the result of the third step in the FOIL process of multiplying $(y-2)(y+10)$?
\response -2y
\challenge->foil What is the result of the last step in the FOIL process of multiplying $(y-2)(y+10)$?
\response -20
\conclusion Correct, the FOIL process of multiplying $(y-2)(y+10)$ results in $y^2+8y-20$.

\dialog
\challenge->foil What is the result of the first step in the FOIL process of multiplying $(x-7)(x+3)$?
\response x^2
\challenge->foil What is the result of the second step in the FOIL process of multiplying (x - 7)(x + 3) ?
\response 3x
\challenge->foil What is the result of the third step in the FOIL process of multiplying (x - 7)(x + 3) ?
\response -7x
\challenge->foil What is the result of the last step in the FOIL process of multiplying (x - 7)(x + 3) ?
\response -21
\conclusion Correct, the FOIL process of multiplying (x - 7)(x + 3) results in $x^2-4x-21$.

\dialog
\challenge->foil What is the result of the first step in the FOIL process of multiplying (4 - w)(6 + w) ?
\response 24
\challenge->foil What is the result of the second step in the FOIL process of multiplying (4 - w)(6 + w)?
\response 4w
\challenge->foil What is the result of the third step in the FOIL process of multiplying (4 - w)(6 + w)?
\response -6w
\challenge->foil What is the result of the last step in the FOIL process of multiplying (4 - w)(6 + w)?
\response w^2
\conclusion Correct, the FOIL process of multiplying (4 - w)(6 + w) results in $24 + 4w - 6w - w^2$.
\challenge->polynomial How would you write $24 + 4w - 6w - w^2$ as a proper positive polynomial?
\response $(-1)w^2 + 2w - 24$
\conclusion Though $-w^2 - 2w + 24$ is correct, a negative one needs to be factored out to avoid a negative variable at the beginning of a polynomial.

\dialog
\challenge->foil What is the result of the first step in the FOIL process of multiplying (x +4)(x +2) ?
\response x^2
\challenge->foil What is the result of the second step in the FOIL process of multiplying (x +4)(x +2)?

\response 2x
\challenge->foil What is the result of the third step in the FOIL process of multiplying (x +4)(x +2)?
\response 4x
\challenge->foil What is the result of the last step in the FOIL process of multiplying (x +4)(x +2)?
\response 8
\conclusion Correct, the FOIL process of multiplying (x +4)(x + 2) results in $x^2 + 6x + 8$.

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