WELCOME To
Math 207

Jan 13-6:55 AM

Algebra 1
Algebra 2 (Intermediate)
College Algebra
Trigonometry

Jan 13-7:28 AM

Factoring

What is factoring?

To re-write as a product

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Why factor?

$$x^2 - 10x + 21 = 0$$
$$(x-3)(x-7) = 0$$

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Zero-product rule

Suppose we multiply some numbers and the result is zero.

Then ① One of the factors is zero and

② The value of all other factors is irrelevant.

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$(x-3)(x-7)=0$

Either $x-3=0$ or $x-7=0$

$x=3$ $x=7$

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The opposite of $2x-3$ is $-2x+3$.

$2x-3$ and $2x+3$ are <u>conjugates</u>.

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add conjugates:

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

subtract:

$$(2x+3)-(2x-3)=6$$

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multiply: $(2x+3)(2x-3)$

$$=4x^2-\cancel{6x}+\cancel{6x}-9$$

$$=4x^2-9$$

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

Difference of squares theorem:

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

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$$(a+b+7c)^2-15^2=$$

$$(a+b+7c+15)(a+b+7c-15)$$

<u>perfect square</u>: 1, 4, 9, 16
25, 36, ...

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<u>complete square</u>:

$(2a-1)^2$

$(x-5)^2$

$(a+b+7c)^2$

A sum or difference, squared

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$x^2-10x+21$ $\quad (x-5)^2=x^2-10x+25$

$\underbrace{x^2-10x+25}-25+21$

$(x-5)^2-4$

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

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

$(x-3)(x-7)$

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Practice:

x^2-4x+3 $\quad (x-1)(x-3)$

$x^2+8x+15$ $\quad (x+3)(x+5)$

$x^2-6x+13$ $\quad$ can not be factored

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$x^2-6x+13$ $\quad (x-3)^2=x^2-6x+9$

$x^2-6x+9-9+13$

$(x-3)^2+4$

Sum of squares can NEVER be factored!

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Part 2

$2x^2+12x-32$

$2(x^2+6x-16)$

$2(x^2+6x+9-9-16)$

$2((x+3)^2-25)$

$2\ (x+3+5)(x+3-5)$

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

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x^2-5x+4

$\underbrace{x^2-5x+\frac{25}{4}}-\frac{25}{4}+\frac{4\cdot 4}{1\cdot 4}$

$\left(x-\frac{5}{2}\right)^2-\frac{25}{4}+\frac{16}{4}$

$\left(x-\frac{5}{2}\right)^2-\frac{9}{4}$

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$\left(x-\frac{5}{2}\right)^2-\left(\frac{3}{2}\right)^2$

$\left(x-\frac{5}{2}+\frac{3}{2}\right)\left(x-\frac{5}{2}-\frac{3}{2}\right)$

$\left(x-\frac{2}{2}\right)\left(x-\frac{8}{2}\right)$

$(x-1)(x-4)$

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$$x^2 - 8x + 11 \qquad (x-4)^2 = x^2 - 8x + 16$$

$$\underbrace{x^2 - 8x + 16} - 16 + 11$$

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

$$(x-4)^2 - (\sqrt{5})^2$$

$$(x - 4 + \sqrt{5})(x - 4 - \sqrt{5})$$

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$$ax^2 + bx + c = 0$$

$\vdots$

quadratic formula

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Def: $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 2^6$

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Rules of exponents

1. $a^n \cdot a^m = a^{n+m}$
2. $\dfrac{a^n}{a^m} = a^{n-m}$

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3. $(a^n)^m = a^{nm}$
4. $(ab)^n = a^n b^n$
5. $\left(\dfrac{a}{b}\right)^n = \dfrac{a^n}{b^n}$

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2. $\dfrac{a^n}{a^m} = a^{n-m}$

$$2^0 = 2^{5-5} = \frac{2^5}{2^5} = 1$$

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⑥ If $a \neq 0$, then

$a^0 = 1$

0^0 is undefined

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$2^{-3} = \frac{1}{2^3}$

$\frac{\cancel{2}\cdot\cancel{2}}{\cancel{2}\cdot\cancel{2}\cdot 2\cdot 2\cdot 2} = \frac{2^2}{2^5} = 2^{2-5} = 2^{-3}$

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⑦ $a^{-n} = \frac{1}{a^n}$ if $a \neq 0$

0^{-n} is not defined

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$5^{\frac{1}{2}} = ?$ $5^{\frac{1}{3}} = ?$ $5^{\frac{1}{7}} = ?$

$5^{\frac{1}{2}} = x$

$\left(5^{\frac{1}{2}}\right)^2 = x^2$

$5 = x^2$

$5^{\frac{1}{2}} = \sqrt{5}$

(Both square to 5)

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$5^{\frac{1}{3}} = y$

$\left(5^{\frac{1}{3}}\right)^3 = y^3$

$5 = y^3 \Rightarrow y = \sqrt[3]{5}$

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⑧ $a^{\frac{1}{n}} = \sqrt[n]{a}$

$8^{\frac{2}{3}} = 8^{\frac{1}{3}\cdot 2} = \left(8^{\frac{1}{3}}\right)^2$

$= \left(\sqrt[3]{8}\right)^2 = 4$

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(9)

$$a^{\frac{n}{m}} = \begin{cases} \left(\sqrt[m]{a}\right)^n \\ \sqrt[m]{a^n} \end{cases} \quad a>0$$

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$$(-8)^{\frac{4}{6}}$$

why should this not be defined?

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Rules of logarithms

$\log_2 8 = 3$ because $2^3 = 8$

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$\log_a b = c$ because

$a^c = b$

$a^{\log_a b} = b$

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(1) $\log_a (a^b) = b$

(2) $a^{\log_a c} = c$

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