$x^a x^b = x^{a+b}$ ←

$2^3 \cdot 2^2 = \underbrace{2\times2\times2}_{3} \times \underbrace{2\times2}_{2} = 2^5$ ①

$(x^a)^b = a^{ab}$

$(2^3)^2 = (2\times2\times2)\times(2\times2\times2) = 2^6$

$\sqrt{2} \times \sqrt{2} = 2$

$\sqrt{2} = 2^a$

$2^a \times 2^a = 2$

$2^{2a} = 2^1$

$2a = 1$

$a = \frac{1}{2}$

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

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

$\sqrt{x} = x^{1/2}$.

$\sqrt[3]{x} = x^{a}$.

$\sqrt[3]{x} \cdot \sqrt[3]{x} \cdot \sqrt[3]{x} = x^{1}$.

$(x^{a})^{3} = x^{3a} = x^{1}$

$3a = 1$

$a = \frac{1}{3}$

$\sqrt[n]{x} = x^{1/n}$

n-th root

$$x^{2/3} = (x^2)^{1/3} = (x^{1/3})^2$$

$$x^{2/3} = \sqrt[3]{x^2} = (\sqrt[3]{x})^2$$

$$x^{-1}\, x^{1} = x^{-1+1} = x^{0} = 1$$

$$x^{-1}\, x = 1 \qquad \boxed{x^{-1} = \frac{1}{x}}$$

$$x^a x^b = x^{a+b}$$

$$(x^a)^b = x^{ab}$$

$$x^{-a} = \frac{1}{x^a}$$

$$\sqrt[n]{x} = x^{1/n}$$

$$\frac{-2}{1} \times \frac{1}{5} = \frac{-2}{5}$$

Example

Q1 $\dfrac{1}{\sqrt[5]{x^{-2}}}$

$\dfrac{1}{(x^{-2})^{1/5}}$

$\dfrac{1}{x^{-2/5}}$

$$\frac{1}{x^{-2/5}}$$

$$\boxed{x^{2/5}}$$

$$x^{-a} = \frac{1}{x^{a}}$$

$$x^{a} = \frac{1}{x^{-a}}$$

Q2 $(\sqrt{xy^{1}})^{-3}$

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$$\left(\sqrt{xy}\right)^{-3}$$

$$\sqrt{z} = z^{1/2}$$ (6)

$$\left((xy)^{1/2}\right)^{-3} = (xy)^{-3/2}$$

$$\frac{1}{2} \times -\frac{3}{1} = \frac{1}{(xy)^{3/2}}$$

$$= \frac{1}{x^{3/2}\, y^{3/2}}$$

Joseph Maher

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$\sqrt{x}\ x^3\ x^4$

$x^{1/2}\ x^3\ x^4$

$\frac{1}{2} + \underbrace{3+4}_{7}$

$\frac{1}{2} + \frac{7 \times 2}{1 \times 2} = \frac{1}{2} + \frac{14}{2} = \frac{15}{2}$

$\sqrt{x}\ x^3\ x^4$

$\sqrt{x}\,y \neq \sqrt{xy}$

$\sqrt{x}\ \sqrt{xy}$

$x^{15/2}$

$15/2$.

x ⟶ ≠ ⟶ $x \hat{} 15/2$.

$\frac{x^{15}}{2}$.

$= \longrightarrow x \hat{} (15/2)$

$x^{15/2}$

computer – order of operations.

P ← ( )
E — exp
M x
D /
^ +
S –

Q6 (9)

$$\frac{\sqrt{x^3}}{\sqrt[3]{x^2}} = \frac{(x^3)^{1/2}}{(x^2)^{1/3}}$$

$\frac{3}{1} \times \frac{1}{2} = \frac{3}{2}$

$\frac{2}{1} \times \frac{1}{3} = \frac{2}{3}$

$$= \frac{x^{3/2}}{x^{2/3}} = x^{3/2} \; x^{-2/3}$$

$\frac{3\times3}{3\times2} - \frac{2}{3\times2} \times 2$

$\frac{9}{6} - \frac{4}{6}$

$$= x^{5/6}$$

Q8

$$\frac{\sqrt[3]{x^2}\; y^3}{\sqrt{y^2}\; x^5} = \frac{\sqrt[3]{x^2}}{x^5} \cdot \frac{y^2}{\sqrt{y^2}}$$

$$= \frac{(x^2)^{1/3}}{x^5} \cdot \frac{y^2}{(y^2)^{1/2}} = \frac{x^{2/3}\; y^2}{x^5\; y^1}$$

$$= \frac{y^2\, y^{-1}}{x^5\, x^{-2/3}} = \frac{y}{x^{13/3}}$$

$\frac{3\times 5}{3} - \frac{2}{3}$

$\frac{15-2}{3}$

Warning $(y^2)^{1/2} = y$

$y = -2$.

$((-2)^2)^{1/2}$

$(4)^{1/2} = 2 \neq -2$

be careful with negative numbers

$$x^{a/b} = (x^a)^{1/b} = (x^{1/b})^a$$

$$\sqrt{(-2)^2} \qquad \left(\sqrt{-2}\right)^2$$

$$\| \qquad \uparrow \text{ doesn't work.}$$

$$\sqrt{4}$$

$$\|$$

$$2$$

warning: be careful with negative numbers.

usual assumption: $\sqrt{x}$

x is positive

$$x^{a/b} = (x^a)^{1/b} = (x^{1/b})^a$$

$$\sqrt{(-2)^2} = \sqrt{4} = 2$$

$$(\sqrt{-2})^2$$

↑ doesn't work.

warning: be careful with negative numbers.

usual assumption: $\sqrt{x}$ x is positive

Q6 $t + (t^2 - 4) - t(t+3)$

15

$t + t^2 - 4 - t^2 - 3t$

0

$-2t - 4$

2 × 2 = 4.

16

Q11 $(x+1)(x-2)$

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

$x^2 - 2x + x - 2$

$x^2 - x - 2$

	x	-2
x	x^2	$-2x$
$+1$	x	-2

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6. km

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

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

$$x^3 + x^2 - 2x - x^2 - x + 2$$

$$0$$

$$x^3 - 3x + 2$$

	x^2	$+x$	-2
x	x^3	x^2	$-2x$
-1	$-x^2$	$-x$	$+2$

Q12

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

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

$$x^2+x-x-1+x^3-3x^2$$

$$0$$

$$x^3-2x^2-1$$

Q17 $\frac{1}{x+5} - \frac{x}{x+3}$

common denominator (20)

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

$\frac{1}{(x+5)} \times \frac{(x+3)}{(x+3)} - \frac{x \times (x+5)}{(x+3) \times (x+5)}$

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

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

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$$\frac{x+3-x^2-5x}{(x+3)(x+5)} = \boxed{\frac{-x^2-4x+3}{(x+3)(x+5)}}$$

$$= \boxed{\frac{-x^2-4x+3}{x^2+8x+15}}$$

$$\frac{-b \pm \sqrt{b^2-4ac}}{2a}$$

$$\frac{4 \pm \sqrt{16+12}}{-2}$$

$$\frac{4 \pm \sqrt{28}}{-2} \qquad -2 \pm \frac{\sqrt{28}}{2}$$

Warning

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$$-x^2-4x+(3/x^2)+8x+15.$$

PEMDAS

Computer sees.

$$(-x^2-4x+3)/(x^2+8x+15)$$

Q14

$$\frac{u+1}{1} + \frac{u}{u+1}$$

Common denominator

$u+1$

$$\frac{(u+1)\times(u+1)}{1\times(u+1)} + \frac{u}{u+1} \longleftarrow \frac{\times(u+1)}{\times(u+1)} \quad \frac{1(u+1)}{}$$

$$\frac{u^2+u+u+1}{u+1} + \frac{u}{u+1} = \frac{u^2+3u+1}{u+1}$$

$$\frac{(u+1)\times(u+1)}{(u+1)\times 1}$$

$$\frac{(u+1)\times 1}{(u+1)\times u-1} + \frac{1 \quad \times(u-1)}{(u+1)\times(u-1)}$$

common denominator

$$(u-1)(u+1)$$

$$\frac{(u+1)\times 1}{(u+1)\times(u-1)} + \frac{1}{(u+1)(u-1)}$$

common denominator

$$(u+1)(u-1)$$