

$$1! + 3! = 4$$

۱- از ۱ به بعد، رقم یکان صفر است

$$2! + 4! = 26 \quad 7 \times 26 = 182 \quad \boxed{2} \text{ یکان است}$$

$$\sqrt[4]{(1+\sqrt{7})^3} = \sqrt[4]{\frac{1+3\sqrt{7}}{\sqrt{7+7}}} = \boxed{\sqrt[4]{2}} \quad \text{۲- الف}$$

$$\frac{\sqrt{2}+\sqrt{5}}{\sqrt{2}(\sqrt{5}+\sqrt{2})} \rightarrow \frac{\sqrt{3}-\sqrt{5}-\sqrt{3}+\sqrt{5}}{2} = \frac{\sqrt{4-2\sqrt{5}}-\sqrt{4+2\sqrt{5}}}{2}$$

$$\frac{\sqrt{5}-1-\sqrt{5}-1}{2} = \frac{2}{2} = \boxed{-1} \checkmark$$

$$\begin{aligned} & (\sqrt{\sqrt{3}+1} + \sqrt{\sqrt{3}-1}) (\sqrt{\sqrt{3}+\sqrt{2}}) \\ & (\sqrt{\sqrt{3}-\sqrt{2}}) (\sqrt{\sqrt{3}+\sqrt{2}}) \quad \text{۴- الف} \end{aligned}$$

$$\text{۱) } + \sqrt{3+\sqrt{4}-(\sqrt{3}+\sqrt{2})}$$

$$\left(\sqrt{\underbrace{3+\sqrt{4}}_a + \underbrace{\sqrt{3}+\sqrt{2}}_b} + \sqrt{3+\sqrt{4}-\sqrt{3}-\sqrt{2}} \right)^2$$

$$a+b+a-b+2\sqrt{a^2-b^2} = 2(3\sqrt{4}) + 2\sqrt{a^2-b^2}$$

$$2\sqrt{(3+\sqrt{4})^2 - (\sqrt{3}+\sqrt{2})^2} = 2\sqrt{9+4+4\sqrt{4}-3-2-2\sqrt{6}}$$

$$= 2\sqrt{10+4\sqrt{4}} = 2\sqrt{(\sqrt{4}+2)^2} = 2(\sqrt{4}+2)$$

$$2(3+\sqrt{4}) + 2(\sqrt{4}+2) = 10 + 4\sqrt{4} \rightarrow \text{چون توان ۲ داریم}$$

$$\Rightarrow \sqrt{10+4\sqrt{4}} = \sqrt{(2+\sqrt{4})^2} = 2+\sqrt{4} \rightarrow \text{منهای دو طرف}$$

$$\Rightarrow \sqrt{4} + 2 - 2 = \boxed{\sqrt{4}} \checkmark$$

$$\sqrt[12]{2^1} \times \sqrt[12]{2^3} \times \sqrt[12]{2^2} = 2^{\frac{1+3+2}{12}} = 2^{\frac{6}{12}} = 2^{\frac{1}{2}} = \sqrt{2} \quad \text{ج}$$

$$\frac{2\sqrt{2} + 3\sqrt{3}(\omega + \sqrt{4})}{\omega - \sqrt{4}(\omega + \sqrt{4})} = \frac{10\sqrt{2} + 2\sqrt{12} + 10\sqrt{3} + 3\sqrt{12}}{19} \quad \text{۳- الف}$$

$$\frac{19(\sqrt{2} + \sqrt{3})}{19} = \sqrt{2} + \sqrt{3} \leftarrow$$

$$\frac{2(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)} = \frac{2\sqrt{3}+2}{2} = \sqrt{3}+1$$

$$\sqrt{2} + \sqrt{3} - \sqrt{3} - 1 = \boxed{\sqrt{2} - 1}$$

$$\frac{3\sqrt{3}-1}{\sqrt{3}+1} + \frac{1}{2-\sqrt{3}}$$

$$\downarrow$$

$$\frac{(3\sqrt{3}-1)(2-\sqrt{3})}{13} = \frac{13\sqrt{3}-13}{13} = \sqrt{3}-1$$

$$2 + \sqrt{3} + \sqrt{3} - 1 = \boxed{2\sqrt{3}+1} \checkmark$$

$$\frac{1}{2-\sqrt{3}} = 2+\sqrt{3}$$

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NOTEBOOK

$$\frac{3^x (1+3+9+27+11+123)}{2^x \left(\frac{1}{8} + \frac{1}{2} + 1 + 2 + 4 + 1\right)} = \frac{3^x \times 368}{2^x \times 10, 70} = 2^2$$

$$368 \times 3^x = 2^x \times 10, 70 \times 2^2 = 2^x \times 119$$

$$\frac{3^x}{2^x} = \frac{119}{368} = \frac{9}{8} \rightarrow \boxed{x=2}$$

$$(\sqrt{59-2} + \sqrt{59+2} - 2\sqrt{2})^2 (\sqrt{59-2} + \sqrt{59+2} + 2\sqrt{2})^2$$

$$(\sqrt{59-2} + \sqrt{59+2} - 2\sqrt{2})^2 = (\sqrt{59-2} + \sqrt{59+2} + 2\sqrt{2} - 2\sqrt{2})^2$$

$$= (2\sqrt{59-2} - 2\sqrt{2})^2 = 2^2 + 1 - 1\sqrt{12}$$

$$= 32 - 1\sqrt{12} = 32 - 19\sqrt{3} = 19(2 - \sqrt{3}) \rightarrow \boxed{z=19} \checkmark$$

$$\left(\sqrt{11-4\sqrt{3}} + \frac{1}{\sqrt{11-4\sqrt{3}}} + 2 - 2\right)^2 = \left(2 - \sqrt{3} + \frac{1}{2-\sqrt{3}}\right)^2$$

$$11 - 4\sqrt{3} + \frac{1}{11-4\sqrt{3}} + 2 = 9 - 4\sqrt{3} + \frac{1}{11-4\sqrt{3}} = 19 = 2^z$$

$$\boxed{z=19} \checkmark$$

$$\frac{11+4\sqrt{3}}{1}$$

$$\sqrt[10]{x} \times x^{\frac{2}{5}} = \sqrt[10]{x^2} \times x^{\frac{2}{5}} = x^{\frac{2}{10} + \frac{2}{5}} = x^{\frac{2}{5}} = x^{\frac{2}{5}} = A^{-1}$$

$$x \times x^{\frac{1}{2}} = x^{\frac{3}{2}} \quad (x^{\frac{3}{2}})^{-\frac{1}{3}} = x^{-\frac{1}{2}} = \frac{1}{\sqrt{x}} \checkmark$$

$$\sqrt[3]{a} = a^{\frac{1}{3}} = x \vee a^{\frac{1}{3}} \quad x \vee = a^{\frac{1}{3} - \frac{1}{3}} = a^{-\frac{1}{3}} = x \vee = \frac{1}{a^{\frac{1}{3}}}$$

$$\frac{1}{a} = \sqrt[3]{x} \rightarrow \sqrt[3]{x} - 3 = 3\sqrt[3]{x} - 3 \rightarrow \frac{(3\sqrt[3]{x} - 3)(\sqrt[3]{x} - 1)}{(\sqrt[3]{x} + 1)(\sqrt[3]{x} - 1)}$$

$$= \frac{12 - 9\sqrt[3]{x}}{x} = \boxed{9 - 3\sqrt[3]{x}} \checkmark$$

$$\sqrt{x+a} = u$$

$$\sqrt{x-a} = v \quad u^2 - v^2 = (u+v)(u-v)$$

$$x+a - x-a = (\sqrt{x+a} + \sqrt{x-a})(\sqrt{x+a} - \sqrt{x-a})$$

$$\sqrt{x+a} + \sqrt{x-a} = \frac{a+a}{x} = \frac{a}{x} + 1 \Rightarrow \frac{a}{x} + 1 - 1 = \frac{a}{x}$$