

Surds and Indices

$$\textcircled{1} x = \sqrt{a + \sqrt{a + \sqrt{a + \dots \infty}}} \Rightarrow x = \frac{\sqrt{4a+1} + 1}{2}$$

$$\textcircled{2} y = \sqrt{a - \sqrt{a - \sqrt{a - \dots \infty}}} \Rightarrow y = \frac{\sqrt{4a+1} - 1}{2}$$

$$\textcircled{i} x + y = \sqrt{4a+1}$$

$$\textcircled{ii} x - y = 1$$

$$\textcircled{iii} x \times y = a$$

$$x = \sqrt{7 + \sqrt{7 + \sqrt{7} \dots}} \dots \infty$$

$$y = \sqrt{7 - \sqrt{7 - \sqrt{7} \dots}} \dots \infty$$

$$\textcircled{i} \quad x = \frac{\sqrt{4 \times 7 + 1} + 1}{2} = \frac{\sqrt{29} + 1}{2}$$

$$\textcircled{ii} \quad y = \frac{\sqrt{4 \times 7 + 1} - 1}{2} = \frac{\sqrt{29} - 1}{2}$$

$$\textcircled{iii} \quad x + y =$$

$$\textcircled{iv} \quad x - y =$$

$$\textcircled{v} \quad x \times y =$$

$$\textcircled{iii} \quad x + y = \sqrt{4a + 1} = \sqrt{29}$$

$$\textcircled{iv} \quad x - y = 1$$

$$\textcircled{v} \quad x \times y = a = 7$$

$$\# x = \sqrt{5 + 2\sqrt{5 + 2\sqrt{5 + \dots \infty}}}$$

$$x = \frac{\sqrt{4a + b^2} + b}{2}$$

$$x = \frac{\sqrt{4 \times 5 + 2^2} + 2}{2} = \frac{\sqrt{24 + 4}}{2} = \frac{2\sqrt{6} + 2}{2} = \cancel{2}(\sqrt{6} + 1) = \sqrt{6} + 1$$

$$\# y = \sqrt{\underset{a}{7} - 3\sqrt{\underset{b}{7} - 3\sqrt{7} - 3\sqrt{7} \dots \infty}} \Rightarrow y = \frac{\sqrt{4a + b^2} - b}{2} = \frac{\sqrt{4 \times 7 + 3^2} - 3}{2} = \frac{\sqrt{37} - 3}{2}$$

$$\textcircled{i} x = \frac{\sqrt{4a+1} + 1}{2}$$

$$\textcircled{ii} y = \frac{\sqrt{4a+1} - 1}{2}$$

$$\# x = \sqrt{a + \sqrt{a - \sqrt{a + \sqrt{a - \sqrt{a + \sqrt{a}}}}}} \dots \infty \Rightarrow x = \frac{\sqrt{4a-3} + 1}{2}$$

$$x = \sqrt{5 + \sqrt{5 - \sqrt{5 + \sqrt{5 - \sqrt{5}}}}} \dots \infty$$

$$x = \frac{\sqrt{20-3} + 1}{2} = \frac{\sqrt{17} + 1}{2}$$

$$\# y = \sqrt{a - \sqrt{a + \sqrt{a - \sqrt{a + \sqrt{a - \sqrt{a}}}}} \dots \infty \quad y = \frac{\sqrt{4a-3} - 1}{2}$$

$$y = \sqrt{7 - \sqrt{7 + \sqrt{7 - \sqrt{7}}}} \dots \infty$$

$$y = \frac{\sqrt{4 \times 7 - 3} - 1}{2} = \frac{4}{2} = \underline{\underline{2 \text{ ANS.}}}$$

$$\# x = \sqrt{a+b} \sqrt{a-b} \sqrt{a+b} \sqrt{a} \dots \infty \quad x = \frac{\sqrt{4a-3b^2} + b}{2} = \frac{\sqrt{28-12} + 2}{2}$$

$$x = \sqrt{7+2} \sqrt{7-2} \sqrt{7+2} \sqrt{7} \dots \infty \quad = \frac{\sqrt{16} + 2}{2} = \frac{4+2}{2} = 3^2$$

$$\# y = \sqrt{a-b} \sqrt{a+b} \sqrt{a-b} \sqrt{a} \dots \infty \quad y = \frac{\sqrt{4a-3b^2} - b}{2}$$

$$y = \sqrt{5-2} \sqrt{5+2} \sqrt{5-2} \sqrt{5} \dots \infty$$

$$y = \frac{\sqrt{4 \times 5 - 3 \times 2^2} - 2}{2} = \frac{\sqrt{8} - 2}{2} = \frac{2\sqrt{2} - 2}{2} = \cancel{2} \frac{(\sqrt{2} - 1)}{\cancel{2}} = \sqrt{2} - 1$$

$$\# x = \sqrt{a \sqrt{a \sqrt{a \sqrt{a} \dots \infty}}$$

$$x = a$$

$$\# \textcircled{1} x = \sqrt{7 \sqrt{7 \sqrt{7 \sqrt{7} \dots \infty}}$$

$$x = 7$$

$$\textcircled{2} y = \sqrt{16 \sqrt{16 \sqrt{16} \dots \infty}}$$

$$\textcircled{a} 16$$

$$\textcircled{c} 4$$

$$\textcircled{b} 2$$

$$\textcircled{d} \text{none of these}$$

$$\# x = \sqrt{a \sqrt{a \sqrt{a \dots \sqrt{a}}}} \quad n \text{ वा } 2$$

$$x = (a)^{\frac{2^n - 1}{2^n}}$$

$$\# x = \sqrt{7 \sqrt{7 \sqrt{7 \sqrt{7 \sqrt{7}}}}}$$

$$x = 7^{\frac{31}{32}}$$

$$2^5 = 32$$

$$2^6 = 64$$

$$\# x = \sqrt{3 \sqrt{3 \sqrt{3 \sqrt{3 \sqrt{3 \sqrt{3}}}}}}$$

$$x = 3^{\frac{63}{64}}$$

$$2^3 = 8$$

$$p = \sqrt{\sqrt{\sqrt{5}}}$$

$$p = 5^{\frac{7}{8}}$$

$$\sqrt[3]{5} = 5^{\frac{1}{3}}$$

$$\sqrt[3]{5 \times \sqrt[3]{5}}$$

$$\# y = \sqrt[3]{5 \sqrt[3]{5 \sqrt[3]{5}}} \checkmark$$

$$5^{\frac{1}{3}} \times 5^{\frac{1}{9}} \times 5^{\frac{1}{27}}$$

$$(5)^{\frac{1}{3} + \frac{1}{9} + \frac{1}{27}} = \frac{9 + 3 + 1}{27} = \frac{13}{27}$$

$$\sqrt[5]{\frac{13}{27}}$$

$$a^m \times a^n = a^{m+n}$$

$$\# \sqrt[3]{5 \sqrt[3]{5 \sqrt[3]{5}}} = 5 \frac{1+3+9}{3^0+3^1+3^2} = 5 \frac{13}{27}$$

$$\# \sqrt[3]{7 \sqrt[3]{7 \sqrt[3]{7 \sqrt[3]{7}}}} = (7) \frac{3^0+3^1+3^2+3^3}{3^4}$$

$$\# \sqrt[4]{3 \sqrt[4]{3 \sqrt[4]{3}}} = (3) \frac{4^0+4^1+4^2}{4^3} = 3 \frac{21}{64}$$

$$= 7 \frac{40}{81}$$

$$\# \sqrt[7]{13 \sqrt[7]{13 \sqrt[7]{13}}} = (13) \frac{7^0+7^1+7^2}{7^3} = 13 \frac{57}{343}$$

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

$$\sqrt{3} \sqrt{3}$$

$$3^{\frac{1}{2}} \times 3^{\frac{1}{4}}$$

$$3^{\frac{1}{2} + \frac{1}{4}}$$

$$3^{\frac{2+1}{4}} = 3^{\frac{3}{4}}$$

$$\sqrt[4]{3} \sqrt[4]{3} \sqrt[4]{3}$$

$$3^{\frac{1}{4}} \times 3^{\frac{1}{4}} \times 3^{\frac{1}{8}}$$

$$3^{\frac{4+2+1}{8}} = 3^{\frac{7}{8}}$$