

PEMBAHASAN BENTUK PANGKAT DAN AKAR KELAS X

1. C

$$8^{-\frac{1}{3}} = \frac{1}{8^{\frac{1}{3}}} = \frac{1}{\sqrt[3]{8}} = \frac{1}{2}$$

2. C

$$7^{\frac{8}{6}} = 7^{\frac{6}{6} + \frac{2}{6}} = 7^{\frac{6}{6}} \times 7^{\frac{2}{6}} = 7^1 \times 7^{\frac{1}{3}} = 7 \times \sqrt[3]{7} = 7\sqrt[3]{7}$$

3. B

$$\begin{aligned} \frac{1}{1+x^{p-q}} + \frac{1}{1+x^{q-p}} &= \frac{1}{1+\frac{x^p}{x^q}} + \frac{1}{1+\frac{x^q}{x^p}} = \frac{1}{\frac{x^q+x^p}{x^q}} + \frac{1}{\frac{x^p+x^q}{x^p}} = \frac{1}{\frac{x^q+x^p}{x^q}} + \frac{1}{\frac{x^q+x^p}{x^p}} \\ &= \frac{x^q}{x^q+x^p} + \frac{x^p}{x^q+x^p} = \frac{x^q+x^p}{x^q+x^p} = 1 \end{aligned}$$

4. A

$$\frac{(x+y)^{3a+1}}{(x+y)^{2a+5}} = (x+y)^{3a+1-(2a+5)} = (x+y)^{3a+1-2a-5} = (x+y)^{a-4}$$

5. B

$$\begin{aligned} \left(\frac{a^2b}{c^2}\right)^3 \times \frac{b^4}{ac^3} &= \left(\frac{a^{2 \times 3} b^3}{c^{2 \times 3}}\right) \times \frac{b^4}{ac^3} = \frac{a^6}{a} \times \frac{b^3 \times b^4}{1} \times \frac{1}{c^6 \times c^3} \\ &= a^{6-1} \times b^{3+4} \times \frac{1}{c^{6+3}} = \frac{a^5 b^7}{c^9} \end{aligned}$$

6. B

$$\begin{aligned} (3^x + 3^{-x})^2 &= 6^2 \\ (3^x)^2 + 2(3^x)(3^{-x}) + (3^{-x})^2 &= 36 \\ (3^2)^x + 2 + (3^2)^{-x} &= 36 \\ 9^x + 2 + 9^{-x} &= 36 \\ 9^x + 9^{-x} &= 36 - 2 \\ 9^x + 9^{-x} &= 34 \end{aligned}$$

7. D

$$\begin{aligned}
 \left(\frac{3}{3^{x-2}}\right)^2 &= \sqrt[3]{\frac{1}{9}} \Leftrightarrow \frac{(3)^2}{(3^{x-2})^2} = \left(\frac{1}{9}\right)^{\frac{1}{3}} \Leftrightarrow \frac{9}{3^{2x-4}} = \left(\frac{1}{3^2}\right)^{\frac{1}{3}} \Leftrightarrow \frac{3^2}{3^{2x-4}} = \frac{1}{3^{\frac{2}{3}}} \Leftrightarrow 3^{2-(2x-4)} = 3^{-\frac{2}{3}} \\
 &\Leftrightarrow 3^{2-2x+4} = 3^{-\frac{2}{3}} \Leftrightarrow 3^{6-2x} = 3^{-\frac{2}{3}} \\
 6-2x &= -\frac{2}{3} \\
 -2x &= -\frac{2}{3} - 6 \\
 -2x &= \frac{-2-18}{3} \\
 -2x &= \frac{-20}{3} \\
 x &= \frac{-20}{-6} \\
 x &= 3\frac{1}{3}
 \end{aligned}$$

8. D

$$\frac{\sqrt[3]{\left(\frac{1}{8^3}\right)^9}}{\left(\sqrt[3]{2}\right)^6} = \frac{\left(\left(\frac{1}{8^3}\right)^9\right)^{\frac{1}{3}}}{\left(\frac{1}{2^3}\right)^6} = \frac{8^{\frac{9}{3}}}{2^{\frac{6}{3}}} = \frac{8}{2^2} = \frac{8}{4} = 2$$

9. B

$$\begin{aligned}
 \sqrt[3]{2\sqrt{\frac{27}{8}}} &= \sqrt[3]{2\sqrt{\frac{27}{8}}} = \sqrt[3]{\left(\frac{27}{8}\right)^{\frac{1}{2}}} = \left(\left(\frac{27}{8}\right)^{\frac{1}{2}}\right)^{\frac{1}{3}} = \left(\frac{27}{8}\right)^{\frac{1}{2} \times \frac{1}{3}} = \left(\frac{27}{8}\right)^{\frac{1}{3} \times \frac{1}{2}} \\
 &= \left(\left(\frac{27}{8}\right)^{\frac{1}{3}}\right)^{\frac{1}{2}} = \left(\sqrt[3]{\frac{27}{8}}\right)^{\frac{1}{2}} = \left(\frac{3}{2}\right)^{\frac{1}{2}} = \frac{\sqrt{3}}{\sqrt{2}} \\
 \frac{\sqrt{3}}{\sqrt{2}} &= \frac{\sqrt{3}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{6}}{\sqrt{4}} = \frac{\sqrt{6}}{2} = \frac{1}{2}\sqrt{6}
 \end{aligned}$$

10. A

$$\begin{aligned}
\left(a^{\frac{1}{2}} - a^{-\frac{1}{2}}\right)^2 \left(a^{\frac{1}{2}} + a^{-\frac{1}{2}}\right)^2 &= \left[\left(a^{\frac{1}{2}} - a^{-\frac{1}{2}}\right)\left(a^{\frac{1}{2}} + a^{-\frac{1}{2}}\right)\right]^2 = \left[\left(a^{\frac{1}{2}}\right)^2 - \left(a^{-\frac{1}{2}}\right)^2\right]^2 \\
&= \left(a^1 - a^{-1}\right)^2 = \left(a - \frac{1}{a}\right)^2 = (a)^2 - 2(a)\left(\frac{1}{a}\right) + \left(\frac{1}{a}\right)^2 \\
&= a^2 - 2 + \frac{1}{a^2} = \frac{a^4 - 2a^2 + 1}{a^2} \\
&= \frac{1}{a^2} (a^2 - 1)^2
\end{aligned}$$

11. B

$$\begin{aligned}
p^2 - 2 &= (1 + \sqrt{3})^2 - 2 = \left[(1^2) + 2(1)(\sqrt{3}) + (\sqrt{3})^2\right] - 2 \\
&= (1 + 2\sqrt{3} + 3) - 2 \\
&= 4 + 2\sqrt{3} - 2 = 2 + 2\sqrt{3} = 2(1 + \sqrt{3}) = 2p
\end{aligned}$$

12. B

$$\begin{aligned}
f(x)f(y) &= f(x+y) \\
a^x \cdot a^y &= a^{x+y} \\
a^{x+y} &= a^{x+y}
\end{aligned}$$

13. A

$$(-z^5 u^5)^3 = (-z^5 u^5) \times (-z^5 u^5) \times (-z^5 u^5) = -z^{15} u^{15}$$

14. C

$$\left(\frac{x^2}{y^3}\right)^6 : \left(\frac{y^6}{x^{-4}}\right)^{-3} = \left(\frac{x^{12}}{y^{18}}\right) : \left(\frac{y^{-18}}{x^{12}}\right) = \left(\frac{x^{12}}{y^{18}}\right) \times \left(\frac{x^{12}}{y^{-18}}\right) = \frac{x^{12+12}}{y^{18-18}} = \frac{x^{24}}{y^0} = x^{24}$$

15. E

$$\frac{\sqrt{0,0036}}{0,3} = \frac{\sqrt{\frac{36}{10000}}}{\frac{3}{10}} = \frac{\frac{6}{100}}{\frac{3}{10}} = \frac{6}{100} \times \frac{10}{3} = \frac{2}{10} = 0,2$$

16. D

$$8^{2x-1} = \sqrt{4^{2x+3}}$$

$$(2^3)^{2x-1} = (4^{2x+3})^{\frac{1}{2}}$$

$$2^{3(2x-1)} = 4^{\frac{1}{2}(2x+3)}$$

$$2^{6x-3} = (2^2)^{\frac{1}{2}(2x+3)}$$

$$2^{6x-3} = (2)^{1(2x+3)}$$

$$2^{6x-3} = 2^{2x+3}$$

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

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

$$4x=6$$

$$x = \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$$

17. E

$$\begin{aligned} \sqrt{3\sqrt{9\sqrt{27}}} &= 3^{\frac{x}{y}} \Leftrightarrow \sqrt{3\sqrt{9 \times (27)^{\frac{1}{2}}}} = 3^{\frac{x}{y}} \Leftrightarrow \sqrt{3 \times \left(3^2 \times (3^3)^{\frac{1}{2}}\right)^{\frac{1}{2}}} = 3^{\frac{x}{y}} \\ &\Leftrightarrow \left(3 \times \left(3^2 \times (3^3)^{\frac{1}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}} = 3^{\frac{x}{y}} \Leftrightarrow \left(3 \times \left(3^2 \times 3^{\frac{3}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}} = 3^{\frac{x}{y}} \\ &\Leftrightarrow \left(3 \times \left(3^{2+\frac{3}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}} = 3^{\frac{x}{y}} \Leftrightarrow \left(3 \times \left(3^{\frac{7}{2}}\right)^{\frac{1}{2}}\right)^{\frac{1}{2}} = 3^{\frac{x}{y}} \Leftrightarrow \left(3 \times 3^{\frac{7}{4}}\right)^{\frac{1}{2}} = 3^{\frac{x}{y}} \\ &\Leftrightarrow \left(3^{1+\frac{7}{4}}\right)^{\frac{1}{2}} = 3^{\frac{x}{y}} \Leftrightarrow \left(3^{\frac{11}{4}}\right)^{\frac{1}{2}} = 3^{\frac{x}{y}} \Leftrightarrow 3^{\frac{11}{8}} = 3^{\frac{x}{y}} \end{aligned}$$

$$x=11$$

$$y=8$$

$$x+y=19$$

18. A

$$\frac{5^{2-n} - (0,2)^n}{5^{1-n} + (0,2)^n} = \frac{5^{2-n} - \left(\frac{1}{5}\right)^n}{5^{1-n} + \left(\frac{1}{5}\right)^n} = \frac{5^2 \cdot \frac{1}{5^n} - \frac{1}{5^n}}{5^1 \cdot \frac{1}{5^n} + \frac{1}{5^n}} = \frac{25 \cdot \frac{1}{5^n} - \frac{1}{5^n}}{5 \cdot \frac{1}{5^n} + \frac{1}{5^n}} = \frac{24 \cdot \frac{1}{5^n}}{6 \cdot \frac{1}{5^n}} = \frac{24}{6} = 4$$

19. A

$$5^{2x+1} - 6 \cdot 5^x + 1 = 0$$

$$5^{2x} \cdot 5^1 - 6 \cdot 5^x + 1 = 0$$

$$5 \cdot (5^x)^2 - 6 \cdot 5^x + 1 = 0$$

Misalkan $5^x = a$

$$5a^2 - 6a + 1 = 0$$

$$(5a - 1)(a - 1) = 0$$

$$5a - 1 = 0 \quad \vee \quad a - 1 = 0$$

$$5a = 1 \quad a = 1$$

$$a = \frac{1}{5} \quad 5^x = 1$$

$$5^x = \frac{1}{5} \quad x = 0$$

$$x = -1$$

20. A

$$9^{3x} - 2 \cdot 3^{3x+1} - 27 = 0$$

$$(3^2)^{3x} - 2 \cdot 3^{3x} \cdot 3^1 - 27 = 0$$

$$(3^{3x})^2 - 6 \cdot 3^{3x} - 27 = 0$$

Misalkan $3^{3x} = a$

$$a^2 - 6a - 27 = 0$$

$$(a - 9)(a + 3) = 0$$

$$a - 9 = 0 \quad \vee \quad a + 3 = 0$$

$$a = 9 \quad a = -3$$

$$3^{3x} = 3^2 \quad 3^{3x} = -3$$

$$3x = 2 \quad x = \text{tidak ada}$$

$$x = \frac{2}{3}$$

21. E

$$\left(2^{-\frac{6}{5}}\right)^3 = 2^{-\frac{18}{5}} = \frac{1}{2^{\frac{18}{5}}} = \frac{1}{2^{\frac{3 \cdot 3}{5}}} = \frac{1}{2^3 \times 2^{\frac{3}{5}}} = \frac{1}{8} \times \frac{1}{\sqrt[5]{8}}$$

22. A

$$\frac{3\sqrt{5} \times 5\sqrt{5}}{25} = \frac{3 \times 5 \times \sqrt{5} \times \sqrt{5}}{25} = \frac{3 \times 5 \times 5}{25} = 3$$

23. A

$$\frac{\sqrt{10}-\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{10}}{\sqrt{5}} - \frac{\sqrt{5}}{\sqrt{5}} = \sqrt{\frac{10}{5}} - 1 = \sqrt{2} - 1 = -1 + \sqrt{2}$$

24. D

$$\begin{aligned} \frac{5}{3\sqrt{2}-\sqrt{3}} &= \frac{5}{3\sqrt{2}-\sqrt{3}} \times \frac{3\sqrt{2}+\sqrt{3}}{3\sqrt{2}+\sqrt{3}} = \frac{5(3\sqrt{2}+\sqrt{3})}{(3\sqrt{2})^2-(\sqrt{3})^2} = \frac{15\sqrt{2}+5\sqrt{3}}{18-3} = \frac{15\sqrt{2}+5\sqrt{3}}{15} \\ &= \frac{15\sqrt{2}}{15} + \frac{5\sqrt{3}}{15} = \sqrt{2} + \frac{\sqrt{3}}{3} = \sqrt{2} + \frac{1}{3}\sqrt{3} \end{aligned}$$

25. A

$$\sqrt{18} + \sqrt{50} - \sqrt{72} = \sqrt{9 \cdot 2} + \sqrt{25 \cdot 2} - \sqrt{36 \cdot 2} = 3\sqrt{2} + 5\sqrt{2} - 6\sqrt{2} = 2\sqrt{2}$$

26. A

$$\begin{aligned} \sqrt{31+\sqrt{936}} - \sqrt{21-\sqrt{416}} &= \sqrt{31+\sqrt{4 \times 234}} - \sqrt{21-\sqrt{4 \times 104}} \\ &= \sqrt{31+2\sqrt{234}} - \sqrt{21-2\sqrt{104}} \\ &= \sqrt{(18+13)+2\sqrt{(18 \times 13)}} - \sqrt{(13+8)-2\sqrt{(13 \times 8)}} \\ &= (\sqrt{18} + \sqrt{13}) - (\sqrt{13} - \sqrt{8}) \\ &= \sqrt{18} + \sqrt{8} \\ &= \sqrt{9 \times 2} + \sqrt{4 \times 2} \\ &= 3\sqrt{2} + 2\sqrt{2} = 5\sqrt{2} \end{aligned}$$

27. B

$$\begin{aligned} \frac{\sqrt{2}-\sqrt{3}}{\sqrt{2}+\sqrt{3}} &= \frac{\sqrt{2}-\sqrt{3}}{\sqrt{2}+\sqrt{3}} \times \frac{\sqrt{2}-\sqrt{3}}{\sqrt{2}-\sqrt{3}} = \frac{(\sqrt{2})^2 - 2(\sqrt{2})(\sqrt{3}) + (\sqrt{3})^2}{(\sqrt{2})^2 - (\sqrt{3})^2} = \frac{2-2\sqrt{6}+3}{2-3} = \frac{5-2\sqrt{6}}{-1} \\ &= -5+2\sqrt{6} \end{aligned}$$

$$a = -5$$

$$b = 2$$

$$a+b = -5+2 = -3$$

28. A

$$\sqrt[m]{\sqrt[n]{a^p}} = \left(\sqrt[n]{a^p}\right)^{\frac{1}{m}} = \left((a^p)^{\frac{1}{n}}\right)^{\frac{1}{m}} = a^{\frac{p}{mn}}$$

35. B

$$\frac{f(x+3)}{f(x-1)} = \frac{2^{x+3}}{2^{x-1}} = \frac{2^x \cdot 2^3}{\frac{2^x}{2^1}} = 2^x \cdot 2^3 \times \frac{2^1}{2^x} = 2^3 \cdot 2^1 = 2^4 = f(4)$$

36. D

$$\left(\frac{3}{3^{x-2}}\right)^2 = \sqrt[3]{\frac{1}{9}}$$

$$\left(\frac{3^2}{3^{2|x-2|}}\right) = \left(\frac{1}{9}\right)^{\frac{1}{3}}$$

$$\frac{3^2}{3^{2x-4}} = (3^{-2})^{\frac{1}{3}}$$

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

$$6-2x = -\frac{2}{3}$$

$$18-6x = -2$$

$$-6x = -20$$

$$x = \frac{20}{6} = \frac{10}{3}$$

37. B

$$3^{x+3} = \sqrt[5]{27^{x-5}}$$

$$3^{x+3} = (27^{x-5})^{\frac{1}{5}}$$

$$3^{x+3} = 3^{3|x-5| \times \frac{1}{5}}$$

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

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

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

$$5x-3x = -15-15$$

$$2x = -30$$

$$x = -15$$

38. D

$$(0,25)^{x+4} = \sqrt{8^{2x-5}}$$

$$\left(\frac{1}{4}\right)^{x+4} = (8^{2x-5})^{\frac{1}{2}}$$

$$(4^{-1})^{x+4} = (2^{3(2x-5)})^{\frac{1}{2}}$$

$$2^{-2(x+4)} = (2^{6x-15})^{\frac{1}{2}}$$

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

$$-2x-8 = 3x-\frac{15}{2}$$

$$-4x-16 = 6x-15$$

$$-4x-6x = -15+16$$

$$-10x = 1$$

$$x = -\frac{1}{10} = -0,1$$

39. A

$$\begin{aligned} \sqrt{108} - \frac{2}{3-\sqrt{27}} &= \sqrt{36 \times 3} - \left(\frac{2}{3-\sqrt{27}} \times \frac{3+\sqrt{27}}{3+\sqrt{27}} \right) = 6\sqrt{3} - \left(\frac{6+2\sqrt{27}}{9-27} \right) = 6\sqrt{3} - \left(\frac{6+2\sqrt{27}}{-18} \right) \\ &= 6\sqrt{3} - \left(\frac{6}{-18} + \frac{2\sqrt{27}}{-18} \right) = 6\sqrt{3} + \frac{1}{3} + \frac{1}{9}\sqrt{9 \cdot 3} = 6\sqrt{3} + \frac{1}{3} + \frac{1}{9}\sqrt{9 \cdot 3} \\ &= 6\sqrt{3} + \frac{1}{3} + \frac{1}{3}\sqrt{3} = \frac{19\sqrt{3}+1}{3} \end{aligned}$$

40. C

$$\frac{(3p^{-2}q^3)^{-2}}{(3^2p^{-1}q^2)^{-3}} = \frac{(3^2p^{-1}q^2)^3}{(3p^{-2}q^3)^2} = \frac{3^{2 \times 3}p^{-1 \times 3}q^{2 \times 3}}{3^{1 \times 2}p^{-2 \times 2}q^{3 \times 2}} = \frac{3^6p^{-3}q^6}{3^2p^{-4}q^6} = 3^{6-2}p^{-3-(-4)}q^{6-6} = 3^4p = 81p$$