

Equating Powers

Whenever you see 4 you should think 2^2 .

Whenever you see 8 you should think 2^3 .

Whenever you see 27 you should think 3^3 .

Whenever you see 64 you should think 4^3 or 8^2 or 2^6 .

Etcetera...

Also, pro tip; when you see 1 you should think 2^0 or 3^0 or 5^0 or ...

All of these problems reduce to

$$k^{\text{fish}} = k^{\text{dog}} \quad \Rightarrow \quad \text{fish} = \text{dog}.$$

Questions

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|--|--------------------|--|------------------------------|
| 1. Solve $2^{x+1} = 4^x$. | $x = 1$ | 14. Solve $8 \times \frac{2^{2-x}}{4^{3-2x}} = \frac{8^x}{4^{2+x}}$. | $x = -\frac{3}{2}$ |
| 2. Solve $8^{3x} = 2^{x-2}$. | $x = -\frac{1}{4}$ | 15. Solve $1 = 8^2 \times 4^{x-1} \times 2^{x+1}$. | $x = -\frac{5}{4}$ |
| 3. Solve $3^{2x-1} = 9^{4x}$. | $x = -\frac{1}{6}$ | 16. Solve $\frac{7^x}{49^{6-x}} = \frac{343^{1-x}}{7^{2x-3}}$. | $\frac{9}{4}$ |
| 4. Solve $27^{3-x} = 81^{2x}$. | $x = \frac{9}{11}$ | 17. Solve $8^{ax} = 4^{bx+1}$. | $x = \frac{2}{3a-2b}$ |
| 5. Solve $2 \times 2^{2x+1} = 8^{x-1}$. | $x = 5$ | 18. Solve $27^{ax+b} = 3^{cx-a}$. | $x = \frac{a+3b}{c-3a}$ |
| 6. Solve $5^x \times 25^3 = 5^{2x-1}$. | $x = 7$ | 19. Solve $9^{ax} \times 27^x \times 3^{ax} = 1$. | $x = 0$ |
| 7. Solve $4^x \times 8^{x-1} = 2 \times 4^{3x+1}$. | $x = -6$ | 20. Solve $\frac{5^{ax-2}}{25^{b-x}} = 125^{cx+d}$. | $x = \frac{3d+2+2b}{a+2-3c}$ |
| 8. Solve $8 \times 2^{x-1} = 4^{2x-1}$. | $x = \frac{4}{3}$ | 21. Solve $\frac{2^{ax}}{2^{3-bx}} = \frac{4^{4+cx}}{8^{k-x}}$. | $x = \frac{11-3k}{a+b-2c-3}$ |
| 9. Solve $16 \times 8^{2x+1} = 2 \times 16^x$. | $x = -3$ | Only do the following if you've studied solving quadratics by factorisation. | |
| 10. Solve $32^x = \frac{8^x}{2^{x+1}}$. | $x = -\frac{1}{3}$ | 22. Solve $4^{x+2} = 2^{x^2+5}$. | $x = 1$ (repeated) |
| 11. Solve $\frac{2^{x+1}}{4} = \frac{4^{x+3}}{8^x}$. | $x = \frac{7}{2}$ | 23. Solve $3^{x^2+2} = 27^x$. | $x = 1$ or $x = 2$ |
| 12. Solve $\frac{9^x}{27^{x+1}} = \frac{3^x}{81^{1-x}}$. | $x = \frac{1}{6}$ | 24. Solve $5^{2x^2} = 25^{2x+3}$. | $x = 3$ or $x = -1$ |
| 13. Solve $\frac{5^{-2x+1}}{25^{3-x}} = \frac{125^x}{5^{x-4}}$. | $x = -\frac{9}{2}$ | 25. Solve $(x^2 + 5x + 5)^{x^2+11x+30} = 1$. | |