

Indices

1. Simplify each of the following

(a) $a^2 \times a^3$

(b) $x.x.x^2$

(c) $2x^3 \times 3x^2$

(d) $\frac{x^5}{x^2}$

(e) $\frac{x^4}{x}$

(f) a^0

(g) $\sqrt[3]{27}$

(h) $(a^3)^2$

(i) $\frac{(x^3)^2}{x^3}$

(j) $(3ab)^2$

2. $\frac{8^{-\frac{3}{2}}}{4^{-\frac{5}{2}}} = 2^n$

3. $\frac{27^{\frac{2}{3}} \times 81^{-\frac{1}{2}}}{9^{-1}} = 3^n$

4. $\frac{16^{\frac{1}{3}} \times 4^{\frac{1}{3}}}{8} = 2^n$

5. $\frac{8^0 \times 16^{-\frac{1}{2}}}{32^{-\frac{2}{3}}} = 2^n$

6. Solve each of the index equations

(a) $9^x = \frac{1}{27}$

(b) $4^x = \frac{1}{32}$

(c) $4^{x-1} = 2^{x+1}$

(d) $\frac{1}{9^x} = 27$

7. Find the value of x in each of these equations

(a) $2^x = \frac{\sqrt{2}}{2}$

(b) $25^X = \frac{125}{\sqrt{5}}$

(c) $\frac{1}{8^x} = \sqrt{2}$

(d) $7^x = \frac{1}{\sqrt[3]{7}}$

8. $8^{4+3x} = 32^{1+2x}$
9. $7^{2x-1} = \frac{49}{\sqrt{7}}$
10. $2^{2x-1} = \left(\frac{16}{\sqrt{8}}\right)^2$
11. $\sqrt{3}(3^x) = \left(\frac{243}{\sqrt{27}}\right)^2$
12. $8^{\frac{4}{3}} = \frac{2^{5x-3}}{\sqrt{2}}$
13. $8(2^{x^2}) = 16^x$
14. $\frac{(8^x)^x}{32^x} = 4$
15. $2^{5x-2y} = 8$
 $3^{x+y} = 9$
16. $2^x = 8^{y+1}$
 $3^{x-9} = 9^y$
17. $3^x \times 9^y = 3$
 $2^x \times 4^{2y} = 2$
18. $\frac{2^{2x}}{2^y} = 32$
 $2^x \times 2^{3y} = \frac{1}{2}$
19. $5^{3x-y} = 1$
 $9^x \times 3^y = 243$
20. $\frac{3^x}{3^{-y}} = 9$
 $7^x \times 7^{2y} = 1$
21. Solve for x
 - (a) $3^{2x} + 3^x = 90$
 - (b) $5^{2x} + 2(5^x) = 35$
 - (c) $2^{2x+1} - 15(2^x) - 8 = 0$
 - (d) $3^{2x+1} + 26(3^x) - 9 = 0$
 - (e) $2^{2x} + 2^x - 6 = 0$
 - (f) $2^{2x} - 6(2^x) + 8 = 0$
22. Solve for x
 - (a) $2^x + 2^{2-x} = 5$
 - (b) $3^x + 3^{1-x} = 4$
 - (c) $2^x + 2^{-x} = \frac{17}{4}$
 - (d) $3^x - 3^{1-x} + 2 = 0$

- (e) $3^{2x+1} - 4(3^x) + 1 = 0$
23. (a) $5^{2x+1} - 124(5^x) - 25 = 0$
 (b) $4^{2x+1} + 63(4^x) - 16 = 0$
24. Solve each of these equations
 (a) $2^{2x} - 9(2^x) + 8 = 0$
 (b) $3^{2x} - 10 \cdot 3^x + 9 = 0$
25. if $y = 2^x$, write
 (a) 2^{2x}
 (b) 2^{2x+1}
 (c) 2^{x+3}
 in terms of y
 Hence solve the equation $2^{2x+1} - 2^{x+3} - 2^x + 4 = 0$
26. If $y = 3^x$, write 3^{2x+1} in terms of y .
 hence solve the equation $3^{2x+1} - 28(3^x) + 9 = 0$
27. By using the substitution $y = 3^x$, find the two values of x such that $3 \cdot 3^x + 3^{-x} = 4$
28. Solve the equation $2(4^x) + 4^{-x} = 3$
29. Solve the equation $3^x - 28 + 27(3^{-x}) = 0$
30. $2^{2x} - 5(2^{x+1}) + 16 = 0$
31. $2^{2x+1} - 15(2^x) = 8$
32. $3^{2x+1} + 26(3^x) - 9 = 0$
33. $2^{2x+1} - 3(2^x) + 1 = 0$
34. $2^x - 6 + 2^{3-x} = 0$
35. $3^{x+2} - 82 + 3^{2-x} = 0$
36. Find the value of rational number p for which $\frac{3^{\frac{1}{4}} \times 3 \times 3^{\frac{1}{6}}}{\sqrt{3}} = 3^p$
37. Simplify $\frac{a^n(a^{n-1})^n}{a^{n+1} \cdot a^{n-1}}$
38. Let $f(x) = \left(\frac{b^n - a^n}{b - a}\right)x + ab\left(\frac{a^{n-1} - b^{n-1}}{b - a}\right)$, for $a \neq b$.
 Show that $f(a) = a^n$
39. Find k , if

$$\sqrt{\frac{(e^8 + e^4)(e^3 - 1)}{(e^8 - 1)(e^2 + e + 1)}} = \frac{e^k}{\sqrt{(e^k + 1)(e + 1)}}$$