

Answers: Laws of indices

Isabella Lewis, Akshat Srivastava

Summary

Answers to questions relating to using laws of indices.

These are the answers to [Questions: Laws of indices](#).

Please attempt the questions before reading these answers!

Q1

1.1. $3^4 = 81$

1.2. $125^{\frac{2}{3}} = 5^2 = 25$

1.3. $32^{\frac{2}{5}} = 2^2 = 4$

1.4. $729^{\frac{-2}{3}} = 9^{-2} = \frac{1}{81}$

1.5. $4^3 \cdot 2^5 = 2^6 \cdot 2^5 = 2^{11} = 2048$

1.6. $2^2 \cdot 3^2 = (2 \cdot 3)^2 = 6^2$

1.7. $8^5 \cdot 6^5 = (8 \cdot 6)^5 = 48^5$

1.8. $12^6 \cdot 3^6 = (12 \cdot 3)^6 = 36^6 = 2176782336$

1.9. $\frac{9^2}{27^2} = 3^{-2} = \frac{1}{9}$

1.10. $(5^2)^2 = 5^4 = 625$

1.11. $(35^0)^9 = 1$

1.12. $(35^9)^0 = 1$

1.13. $(729^9)^{\frac{1}{9}} = 729^{\frac{9}{9}} = 729$

1.14. $7^{-3} = \frac{1}{7^3} = \frac{1}{343}$

1.15. $(\frac{4^5}{2^5}) = (\frac{4}{2})^5 = 2^5$

1.16. $(\frac{2^{-2}}{13^{-2}}) = (\frac{2}{13})^{-2} = (\frac{13}{2})^2$

1.17. $64^{\frac{4}{3}} = 4^4 = 256$

1.18. $\left(\frac{4^3 \cdot 3^3}{6^3}\right) = \left(\frac{4 \cdot 3}{6}\right)^3 = \left(\frac{12}{6}\right)^3 = 2^3 = 8$

$$1.19. \left(\frac{4^2 \cdot 8^2}{2^2} \right) \cdot \left(\frac{1}{2} \right)^2 = \left(\frac{4 \cdot 8}{2} \right)^2 \cdot \left(\frac{1}{2} \right)^2 = \left(\frac{4 \cdot 8 \cdot 1}{2 \cdot 2} \right)^2 = \left(\frac{32}{4} \right)^2 = 8^2 = 64$$

$$1.20. \frac{\left[\left(\frac{-2}{3} \right)^{-3} \cdot \left(\frac{-3}{5} \right)^{-3} \right]}{\left(\frac{2}{3} \right)^{-3}} = \frac{\left(\frac{6}{15} \right)^{-3}}{\left(\frac{2}{3} \right)^{-3}} = \frac{\left(\frac{15^3}{6^3} \right)}{\left(\frac{3}{2} \right)^3} = \left(\frac{15 \cdot 2}{6 \cdot 3} \right)^3 = \left(\frac{5}{3} \right)^3 = \frac{125}{27}$$

$$1.21. \frac{\left(\frac{1}{2} \right)^4 \left(\frac{3}{5} \right)^4}{\left(\frac{8}{3} \right)^4} = \frac{\left(\frac{5}{6} \right)^4}{\left(\frac{8}{3} \right)^4} = \left(\frac{15}{48} \right)^4 = \left(\frac{5}{16} \right)^4 = \frac{625}{65536}$$

$$1.22. \left(\frac{2}{3} \right)^{14} \cdot \left(\frac{9}{12} \right)^{14} = \left(\left(\frac{2}{3} \right) \cdot \left(\frac{9}{12} \right) \right)^{14} = \left(\frac{18}{36} \right)^{14} = \left(\frac{1}{2} \right)^{14} = \frac{1}{16384}$$

Q2

$$2.1. (b^7)^4 = b^{28}$$

$$2.2. y^{13} \cdot y^5 = y^{18}$$

$$2.3. a^2 \cdot b^2 = (ab)^2$$

$$2.4. \frac{x^{13}}{x^5} = x^8$$

$$2.5. (3y^{-2})^5 = (3)^5 \cdot (y^{-2})^5 = 243y^{-10}$$

$$2.6. (a)^{-4} \cdot (b)^{-4} = (ab)^{-4} = \frac{1}{(ab)^4}$$

$$2.7. (7z^{-5})^3 = (7)^3 \cdot (z^{-5})^3 = 343z^{-15}$$

$$2.8. \left(\frac{8x^5}{4x^{-5}} \right) = 2x^{(5+5)} = 2x^{10}$$

$$2.9. ((x^2)^3 \cdot x^5) = x^6 \cdot x^5 = x^{11}$$

$$2.10. \frac{2a^{-4}}{3a^{-2}} = \left(\frac{2}{3} \right) \cdot (a^{-4+2}) = \frac{2}{3a^2}$$

$$2.11. \frac{x^5}{y^5} = \left(\frac{x}{y} \right)^5$$

$$2.12. \frac{2y^3}{2y^5} = y^{-2}$$

$$2.13. \left(\frac{2}{a} \right)^4 \cdot \left(\frac{a}{12} \right)^3 = \frac{2^4 \cdot a^3}{a^4 \cdot 12^3} = \frac{16}{1728a} = \frac{1}{108a}$$

$$2.14. \frac{25t^{-4}}{60t^5} = \frac{5}{12t^9}$$

$$2.15. \left(\frac{a}{b} \right)^{-4} \cdot \left(\frac{c}{d} \right)^4 \cdot \left(\frac{e}{f} \right)^4 = \left(\frac{bce}{adf} \right)^4$$

$$2.16. \frac{5^{x+1} \cdot 6^{x+1}}{3^{x+1}} = \left(\frac{5 \cdot 6}{3} \right)^{x+1} = 10^{x+1}$$

$$2.17. a^{\frac{1}{2}} \cdot b^{-\frac{1}{2}} = \left(\frac{a}{b}\right)^{\frac{1}{2}} = \sqrt{\frac{a}{b}}$$

$$2.18. \left(\frac{a}{b}\right)^n \cdot \left(\frac{c}{d}\right)^{-n} = \left(\left(\frac{a}{b}\right) \cdot \left(\frac{d}{c}\right)\right)^n = \left(\frac{ad}{bc}\right)^n$$

Version history and licensing

v1.0: initial version created 08/23 by Isabella Lewis, Akshat Srivastava as part of a University of St Andrews STEP project.

- v1.1: edited 05/24 by tdhc.

This work is licensed under [CC BY-NC-SA 4.0](#).