Answers: Laws of indices

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Summary

Answers to questions relating to using laws of indices.

*These are the answers to* [*Questions: Laws of indices*](../questions/qs-lawsofindices.qmd)*.*

**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. $4^{3}⋅2^{5}=2^{6}⋅2^{5}=2^{11}=2048$

1.6. $2^{2}⋅3^{2}=\left(2⋅3\right)^{2}=6^{2}$

1.7. $8^{5}⋅6^{5}=\left(8⋅6\right)^{5}=48^{5}$

1.8. $12^{6}⋅3^{6}=\left(12⋅3\right)^{6}=36^{6}=2176782336$

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

1.10. $\left(5^{2}\right)^{2}=5^{4}=625$

1.11. $\left(35^{0}\right)^{9}=1$

1.12. $\left(35^{9}\right)^{0}=1$

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

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

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

1.16. $\left(\frac{2^{−2}}{13^{−2}}\right)=\left(\frac{2}{13}\right)^{−2}=\left(\frac{13}{2}\right)^{2}$

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

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

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

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

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

## Q2

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

2.2. $y^{13}⋅y^{5}=y^{18}$

2.3. $a^{2}⋅b^{2}=\left(ab\right)^{2}$

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

2.5. $\left(3y^{−2}\right)^{5}=\left(3\right)^{5}⋅\left(y^{−2}\right)^{5}=243y^{−10}$

2.6. $\left(a\right)^{−4}⋅\left(b\right)^{−4}=\left(ab\right)^{−4}=\frac{1}{\left(ab\right)^{4}}$

2.7. $\left(7z^{−5}\right)^{3}=\left(7\right)^{3}⋅\left(z^{−5}\right)^{3}=343z^{−15}$

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

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

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

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

2.12. $\frac{2y^{3}}{2y^{5}}=y^{−2}$

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

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

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

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

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

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

## Version history and licensing

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

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