

Foundation GCSE: Index Laws

Name: _____

Class: _____

Instructions: Answer all questions. Questions are ordered from easiest (1) to hardest (20). Working out should be shown where appropriate.

1. Simplify $x^3 \times x^4$.

12. Evaluate $27^{-\frac{2}{3}}$.

2. Simplify $y^7 \div y^2$.

13. Simplify $\frac{12x^5}{4x^2}$.

3. Evaluate 5^0 .

14. Write down the value of $3^{-2} + 2^{-1}$.

4. Simplify $(a^2)^3$.

15. Simplify $\left(\frac{2x^3}{y^2}\right)^4$.

5. Write 2^{-3} as a fraction.

16. Find the value of k given that $5^k \times 5^4 = 5^{12}$.

7. Evaluate $16^{\frac{1}{2}}$.

17. Simplify $\frac{(a^3)^2 \times a^4}{a^5}$.

8. Evaluate $8^{\frac{1}{3}}$.

18. Evaluate $32^{\frac{3}{5}}$.

9. Simplify $\frac{m^4 \times m^3}{m^2}$.

19. Simplify and write with positive indices:
 $\frac{4x^{-3}y^2}{2x^2y^{-1}}$.

10. Evaluate $9^{-\frac{1}{2}}$.

11. Simplify $(3x^2)^3$.

20. Find the value of n if $3^n = \frac{1}{81} \times 9^3$.

Answers & Worked Solutions

1. x^7
Add the powers: $3 + 4 = 7$.
2. y^5
Subtract the powers: $7 - 2 = 5$.
3. 1
Any non-zero number to the power of 0 is 1.
4. a^6
Multiply the powers: $2 \times 3 = 6$.
5. $\frac{1}{8}$
Negative index means reciprocal: $\frac{1}{2^3} = \frac{1}{8}$.
6. p^3
Add the powers: $5 + (-2) = 3$.
7. 4
Fractional power $\frac{1}{2}$ means square root: $\sqrt{16} = 4$.
8. 2
Fractional power $\frac{1}{3}$ means cube root: $\sqrt[3]{8} = 2$.
9. m^5
Numerator is m^7 , then divide by m^2 : $7 - 2 = 5$.
10. $\frac{1}{3}$
 $\sqrt{9} = 3$, then reciprocal gives $\frac{1}{3}$.
11. $27x^6$
Cube the coefficient ($3^3 = 27$) and multiply powers ($2 \times 3 = 6$).
12. $\frac{1}{9}$
Cube root of 27 is 3, squared is 9, reciprocal gives $\frac{1}{9}$.
13. $3x^3$
 $12 \div 4 = 3$, and $x^5 \div x^2 = x^3$.
14. $\frac{11}{18}$
 $3^{-2} = \frac{1}{9} \left(\frac{2}{18}\right)$ and $2^{-1} = \frac{1}{2} \left(\frac{9}{18}\right)$, sum is $\frac{11}{18}$.
15. $\frac{16x^{12}}{y^8}$
Raise every term inside to the power of 4: $2^4 = 16$, x^{12} , y^8 .
16. 8
 $k + 4 = 12$, so $k = 8$.
17. a^5
Numerator is $a^6 \times a^4 = a^{10}$, then $a^{10} \div a^5 = a^5$.
18. 8
Fifth root of 32 is 2, cubed is $2^3 = 8$.
19. $\frac{2y^3}{x^5}$
 $4 \div 2 = 2$, $x^{-3-2} = x^{-5}$, $y^{2-(-1)} = y^3$, move x^{-5} to denominator.
20. 2
 $\frac{1}{81} = 3^{-4}$ and $9^3 = (3^2)^3 = 3^6$, so $3^{-4} \times 3^6 = 3^2$, meaning $n = 2$.