

1C EXPONENTS: QUESTIONS

Exponential Expressions



Apply the given law provided in each of the 6 cases below to simplify the following expressions.

Law 1: $a^m \times a^n = a^{m+n}$

1.1 $x^5 \times 2x^3$

1.2 $3x^2 \times 2x^3$

1.3 $2^{-4} \times 2^5 \times 2^0$

Law 2: $a^m \div a^n = a^{m-n}$

1.4 $2^5 \div 2^2$

1.5 $\frac{p^7}{p^3}$

1.6 $\frac{a^2}{a^{-1}}$



Law 3: $(a^m)^n = a^{mn}$

1.7 $(2^3)^2$

1.8 $(5^3)^5$

1.9 $(3^x)^2$

Law 4: $(ab)^m = a^m b^m$



Remember:
Apply Law 4 for these examples.

1.10 $(2 \times 5)^2$

1.11 $(3x^3)^3$

1.12 $(-4a^5b^3)^2$



Law 5: $a^0 = 1$; $a \neq 0$

1.13 5^0

1.14 $7a^0$

1.15 $3p^0 + (3p)^0$

Law 6: $a^{-n} = \frac{1}{a^n}$; $a \neq 0$

1.16 2^{-3}

1.17 x^{-4}

1.18 $a^3 \cdot b^{-4}$

Note

$(-3)^2 = 9$ but $-3^2 = -9$

&

$(-3)^0 = 1$ but $-3^0 = -1$



Now combine the laws...

Simplify the following as far as possible.

Where applicable, leave the answer with positive exponents.



Questions including Laws 1 & 2

2.1 $3a \cdot 2ab \cdot 3abc$ 2.2 $2x^3 \times -3x^5$ (2)(2)

2.3 $2a^4 \times 4a^2$ 2.4 $a^{-4} \times a^7$ (2)(1)

2.5 $x^3(x^2)^3x^0x^{-2}$ 2.6 $6a^5 \times a \div 3a^2$ (2)(3)

2.7 $5x^3y^5 \times 3x^{-2}y^2$ 2.8 $8y^3 \times \frac{1}{4}y^2$ (2)(2)

2.9 $\frac{a^3 \cdot b^2 \cdot c}{a \cdot b^2 \cdot c^3}$ 2.10 $\frac{5^2 \cdot 5^3 \cdot x^2 \cdot y^4}{5^6 \cdot x^3 \cdot y^2}$ (2)(3)

2.11 $\frac{3ab^4c^0}{18a^2bc}$ 2.12 $\frac{4x^3y^7}{8x^2y^9}$ (2)(2)

2.13 $\frac{8b^{-3}c^5}{12b^2c^{-6}}$ 2.14 $\frac{121x^7y^{13}}{11x^{-4}y^2}$ (3)(3)

2.15 $\frac{55x^3y^{12}}{11x^{-2}y^{17}}$ 2.16 $\frac{15xy^{-2}}{3x^{-3}y^4}$ (3)(4)

2.17 $\frac{18a^{-2}b^3c}{12a^3b^5c^{-4}}$ 2.18 $\frac{-39x^{17}y^{10}}{-3x^4y^{-3}}$ (3)(3)



Questions extending to Laws 3 & 4

3.1 $(-3x^2)^2$ 3.2 $(-3x^4)(2x^3)$ (2)(2)

3.3 $(2^3x^2y)^3$ 3.4 $(3p^5q^3)^2$ (3)(3)

3.5 $4(-a)^2 - (-2a)^2$ 3.6 $x^{-7}(x^{13} + x^{11})$ (3)(3)

3.7 $\frac{ab^2 \times a^3b}{(a^2b^2)^2}$ 3.8 $\frac{ab(-2a^2b^3)^3}{-56b^3}$ (3)(4)

3.9 $\frac{(3m^3n)(-2mn^4)}{(-2mn)^4}$ 3.10 $\frac{(x^2y) \times (x^3y^3)}{(x^2y)^3}$ (4)(3)

Term 1: 1C Exponents

Questions extending to Laws 5 & 6

4.1 $\frac{x^{-3}}{y^{-4}}$ 4.2 $\frac{m^5 \cdot n^{-2} \cdot p^0}{m \cdot n^3}$ (1)(3)

4.3 $\frac{x \cdot y^{-2}}{x^0 \cdot y}$ 4.4 $\frac{x^0}{0,25}$ (3)(2)

4.5 $\frac{(5m)^0}{5m^0}$ 4.6 $(a^{-2})(-3a^0)$ (2)(3)

4.7 $(-2a^4b^3)^2(-3a^2b^0)$ (3)

4.8 $\frac{(2^2q^{-3})^0 \times (p^{-3}q)^{-2}}{(-2pq^{-1})^2}$ (4)



4.9 $\frac{(4x^{-3})^2(-3x)^0}{-6x^2}$ (4)

Mixed Questions

Evaluate the following **without the use of a calculator**:



5.1 $3^{-2} + 3^0 + 3^2$ (2)

5.2 $-5^2 \div \sqrt[3]{-1}$ (3)

5.3 $\sqrt{3^2 + 3^1 + 3^0 + 3^{-1} + 3^{-2}}$ (4)

5.4 $\sqrt[3]{27} - \sqrt{49} + 4$ (3)

5.5 $\sqrt{9+16}$ (1)

5.6 $\sqrt{\frac{18}{2}} - (-2)^3$ (4)

5.7 $\sqrt[3]{\frac{27}{8}} + \sqrt{2\frac{1}{4}}$ (4)

Remember to use the exponent laws



Simplify, leaving the answer with positive exponents where applicable:

5.8 $\sqrt{36x^{36} + 64x^{36}}$ (3)

5.9 $\sqrt{9x^{10} + 16x^{10}}$ (3)

5.10 $\sqrt{144a^6b^{10}} \cdot (-2ab^2)$ (3)

5.11 $\sqrt{9(a+2b)^2x^4}$ (3)

5.12 $\sqrt{169x^{14}y^{22}}$ (3)

5.13 $\sqrt{\frac{4a^3}{a^9}}$ (2)

5.14 $\left(\frac{5x^{-1}}{2}\right)^{-1} \cdot \sqrt{25x^4y^{-2}}$ (3)

5.15 $\sqrt{\frac{(ab^2)^3}{a(-4c)^2}}$ (4)

5.16 $\frac{(3x^5y^{-3})^2}{-6y^5} \times \frac{2x^{-4}}{x^0}$ (6)

5.17 $\frac{2xy^2}{3m} \div \frac{4y^2}{9xm}$ (3)

5.18 $\frac{3x}{y^2z^3} \div \frac{9x^2}{2yz^4}$ (3)

5.19 $\frac{(2ac^2)^4}{4a^4} \times \frac{(a^2b^3)^2}{(b^2c)^3}$ (5)



5.20 $\frac{(2a^2b^3)^4 \times (8ab^{-2})^2}{4ab^5 \times 12a^9b^7}$ (5)

5.21 $\frac{(5x^{-3}y)^2}{4xy \times (x^2y)^2} \div \left(\frac{5xy}{2}\right)^2$ (5)

5.22 $\frac{xy^3}{x^2} \div \frac{x^3y}{x^4} \times \frac{x^0}{x^2y}$ (6)

5.23 $\frac{x^2y^3}{x^4} \times \frac{x^3y^4}{y^7} \div \frac{x^2}{x^3}$ (6)

5.24 $\frac{x^4y}{y^0} \div \frac{xy^3}{x^2} \div \frac{x^2y^3}{x^{-3}y^4}$ (6)

5.25 $\frac{\sqrt{49a^6b^{-2}} \cdot (3a^2b^{-1})^{-2}}{2a^0b^{-3}}$ (4)

6.1 Determine which of the following has the largest value (you may use a calculator):
 $\left(\frac{1}{7}\right)^{-7}$ $7^{\frac{10}{7}}$ $\sqrt[7]{777777}$ $777,777^{\frac{1}{7}}$ $0,7^{-0,7}$ (2)

6.2 Now, without the use of a calculator, determine which is larger: 2^{-5} or 5^{-2} ? (3)

7. Round off each of the following to three dec. places.
 7.1 $\pi \times \sqrt[5]{237}$ 7.2 $\left(\frac{1}{7}\right)^{-7} \times 0,13574$ (1)(1)

8. Express the number 32 as a power with a base of 4. [Hint: Remember: $2^2 = 4$] (2)

9. For each of the following questions, four options have been given for the answer. Only one of the options provided is correct. In each case, write down the correct letter. (10)

9.1 $\frac{x^2}{y^2} = \dots$

A: $\frac{x}{y}$

B: $\frac{y}{x}$

C: $x - y$

D: cannot be simplified



9.2 $\sqrt{36x^{16}} = \dots$

A: $6x^8$

B: $6x^4$

C: $18x^8$

D: $18x^4$

9.3 $\sqrt{\frac{64a^{16}}{b^{36}}} = \dots$

A: $\frac{8a^8}{b^{18}}$

B: $\frac{8a^4}{b^6}$

C: $\frac{32a^8}{b^{18}}$

D: $\frac{64^2 a^{32}}{b^{72}}$



9.4 If $p = -\frac{1}{2}$ then $-p^2 = \dots$

A: $\frac{1}{4}$

B: $-\frac{1}{4}$

C: -1

D: 1

9.5 $a^{-1} + b^{-1} = \dots$

A: $\frac{1}{a+b}$

B: $\frac{1}{ab}$

C: $-a - b$

D: $\frac{1}{a} + \frac{1}{b}$

10. The following statements are both false. In each case correct the right hand side.



10.1 $x^2 + x^2 = 2x^4$ 10.2 $\frac{1}{6x^{-2}} = 6x^2$ (1)(1)

11. State whether the following are True or False.



Give the correct solution where false.

EXPRESSION	TRUE OR FALSE	CORRECT SOLUTION, IF FALSE
11.1 $2a^{-3} = \frac{1}{2a^3}$		
11.2 $(-1)^5 = -1$		
11.3 $(2ab^3)^3 = 6a^3b^9$		
11.4 $a^0 = 0$		
11.5 $2^{-1} = -2$		
11.6 $a^{-3}a^2 = \frac{1}{a}$		
11.7 $\left(\frac{3}{4}\right)^{-1} = \frac{4}{3}$		
11.8 $\frac{a^3b^5}{ab^7} = \left(\frac{a}{b}\right)^2$		
11.9 $2^3 \times 2^4 = 4^7$		
11.10 $5^2 \div 5^5 = \frac{1}{5^3}$		

[10]

Substitution



- 12.1 Calculate the value of $a \times b^c$, where $a = 3$, $b = 2$ and $c = -1$. (3)
- 12.2 Calculate the value of $(ab)^c$, where $a = 1$, $b = 5$ and $c = -2$. (3)
- 12.3 Calculate the value of $a^b + b^c$, where $a = 2$, $b = -1$ and $c = 3$. (3)

Exponential Equations



Remember to use the exponent laws where necessary

Solve for x in each of the following equations:



- 13.1 $2^x = 2^3$ 13.2 $5^{x-1} = 5^2$ (1)(1)
- 13.3 $3^{2x} = 3^6$ 13.4 $3^x = 9$ (1)(1)
- 13.5 $8^x = 64$ 13.6 $2^x = \frac{1}{4}$ (1)(1)
- 13.7 $7^x = 1$ 13.8 $5^{2x} = 5$ (1)(1)
- 13.9 $11^x = 121$ 13.10 $7^x = 49$ (1)(1)
- 13.11 $3^{x-2} = 81$ 13.12 $10^x = 0,1$ (2)(2)
- 13.13 $\left(\frac{1}{3}\right)^x = 3$ 13.14 $9^x = 27$ (2)(3)

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Term 1: 1C Exponents

- 13.15 $2^x = 0,125$ 13.16 $5^x = 0,04$ (3)(3)
- 13.17 $3^{2x+1} = 3^{x+3}$ 13.18 $2^x \cdot 2^3 = 32$ (2)(3)
- 13.19 $(4^x)^2 = 64$ 13.20 $\frac{5^x}{5^2} = 125$ (3)(3)
- 13.21 $8^{x+1} = \frac{1}{8}$ 13.22 $7^{x-2} = 1$ (3)(2)
- 13.23 $9^{x-2} = 81$ 13.24 $x^3 = -8$ (3)(2)
- 13.25 $2x^3 = 54$ 13.26 $x = \sqrt[3]{27}$ (3)(3)
- 13.27 $x^{-1} = \frac{1}{2}$ 13.28 $x^{-2} = \frac{4}{9}$ (2)(3)
14. Determine the value of x if $(p^x)^3 = p^2 \cdot p^4$ (2)
15. Determine the product of x and y if $2^x + 3^y = 41$,
where x and y are natural numbers. (3)
16. Determine which sign ($<$; $>$; $=$) should be placed
in each empty box if $x = 3$ and $y = -2$.
- 16.1 $y^2 \square x^2$ (2)
- 16.2 $(3^x)^3 \square (y^2)^2$ (2)
- 16.3 $(x \cdot y)^4 \square (4)^{xy}$ (2)



NOTES