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8th Grade Exponents Worksheets

Questions

1. Simplify the following exponents:

a. $(-8)^2$

b. $\left(\frac{-1}{2}\right)^3$

2. The height of a ball (in feet) that is thrown upwards is modelled by the equation $h = -16t^2 + 32t + 100$, where t is the amount of time (in seconds) the ball is in the air after it is thrown upwards. Find the height reached by the ball in 3 seconds after it is thrown upwards.



3. Simplify the following expressions.

a. $\left| \left(-\frac{1}{3}\right)^3 \div \left(\frac{1}{6}\right)^2 \right|$

b. $-8 \cdot (-6^2 + 10)$

4. Simplify the following using the rules of exponents and leave the answer in the exponent form.

a. $\left(-\frac{2}{7}\right)^8 \cdot \left(-\frac{2}{7}\right)^9$

b. $\frac{m^{25}}{m^{-2} \cdot m^{10}}$

5. Simplify the following using the rules of exponents and express the answer in terms of positive exponents.

a. $\frac{6^{-2} \cdot a^0 \cdot b^0}{c^{-8}}$

b. $\frac{13b^{-8}}{b^{-6}}$

6. Find the value of $\left\{\left(\frac{1}{2}\right)^{-2} - \left(\frac{1}{3}\right)^{-3}\right\} \div \left(\frac{1}{5}\right)^{-2}$.

7. Solve the following equation for x .

$$5^x \div 5^{-7} = 5^{12}$$

8. Solve the following equation for x .

$$(81)^{-5} \div (729)^{3-x} = (9)^{5x}$$

9. Find the value of $(216^5)^{\frac{1}{3}}$ and express the answer as an exponent.

10. Which of the following is equivalent to $\frac{a^8 - b^8}{(a^4 + b^4)(a^2 + b^2)}$?

- a. $a^4 - b^4$
 b. $a^4 + b^4$
 c. $a^2 - b^2$
 d. $a^2 + b^2$

11. Convert the following into scientific notation.

- a. 0.000000000123
 b. 3186000000

12. Express the following numbers in the standard form.

- a. 5×10^{-5}
 b. 3.42×10^4

13. The area occupied by a certain type of a bacteria is 0.000000006 square meters. Find the area occupied by 100 such bacteria and express your answer in scientific notation.



14. Simplify $(3.2 \times 10^{-4}) - (15.2 \times 10^{-7})$ and express the answer in scientific notation.

15. Simplify $(8.3 \times 10^{-3}) \times (3.2 \times 10^{-5})$ and express the answer in scientific notation.

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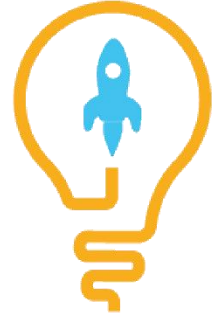
- Barbara Cabrera

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ANSWERS

1(a) 64 (b) $-\frac{1}{8}$	2) 52ft	3) $\frac{4}{3}$
4(a) $\left(-\frac{2}{7}\right)^{17}$ (b) m^{17}	5(a) $\frac{c^8}{36}$ 5(b) $\frac{13}{b^2}$	6) $-\frac{23}{25}$
7) $x = 5$	8) $x = \frac{-19}{2}$	9) 6^5
10) -Option c)	11(a) 1.23×10^{-9} (b) 3.186×10^9	12(a) 0.00005 12(b) 34200
13) 6×10^{-7} square meters	14) 3.1848×10^{-4}	15) 2.656×10^{-7}

**SOLUTIONS**

Complete solution/explanation

1. Simplify the following exponents:

a) $(-8)^2$

b) $\left(\frac{-1}{2}\right)^3$

Solution:

a. $(-8)^2 = (-8) \times (-8) = 64$

b. $\left(\frac{-1}{2}\right)^3 = \frac{-1}{2} \times \frac{-1}{2} \times \frac{-1}{2} = \frac{-1}{8}$

2. The height of a ball (in feet) that is thrown upwards is modelled by the equation $h = -16t^2 + 32t + 100$, where t is the amount of time (in seconds) the ball is in the air after it is thrown upwards. Find the height reached by the ball in 3 seconds after it is thrown upwards.

Solution:

To find the required height, we substitute $t = 3$ in the given equation:

$$h = -16(3)^2 + 32(3) + 100 = 52$$

Thus, the height reached by the ball in 3 seconds is 52 ft.

3. Simplify the following expressions.

a) $\left| \left(-\frac{1}{3}\right)^3 \div \left(\frac{1}{6}\right)^2 \right|$

b) $-8 \cdot (-6^2 + 10)$

Solution:

a. The given expression is,

$$\begin{aligned} \left| \left(-\frac{1}{3} \right)^3 \div \left(\frac{1}{6} \right)^2 \right| &= \left| \frac{-1}{27} \div \frac{1}{36} \right| \\ &= \left| \frac{-1}{27} \times \frac{36}{1} \right| \\ &= \left| \frac{-36}{27} \right| \\ &= \left| -\frac{4}{3} \right| \\ &= \frac{4}{3} \end{aligned}$$

b. The given expression is,

$$\begin{aligned} -8 \cdot (-6^2 + 10) &= -8 \cdot (-36 + 10) \\ &= -8 \cdot (-26) \\ &= 208 \end{aligned}$$

4. Simplify the following using the rules of exponents and leave the answer in the exponent form.

a) $\left(-\frac{2}{7} \right)^8 \cdot \left(-\frac{2}{7} \right)^9$

b) $\frac{m^{25}}{m^{-2} \cdot m^{10}}$

Solution:

a. The given expression is,

$$\begin{aligned} \left(-\frac{2}{7}\right)^8 \cdot \left(-\frac{2}{7}\right)^9 &= \left(-\frac{2}{7}\right)^{8+9} \left[\because a^m \cdot a^n = a^{m+n} \right] \\ &= \left(-\frac{2}{7}\right)^{17} \end{aligned}$$

b. The given expression is,

$$\begin{aligned} \frac{m^{25}}{m^{-2} \cdot m^{10}} &= \frac{m^{25}}{m^8} \left[\because a^m \cdot a^n = a^{m+n} \right] \\ &= m^{25-8} \left[\because \frac{a^m}{a^n} = a^{m-n} \right] \\ &= m^{17} \end{aligned}$$

5. Simplify the following using the rules of exponents and express the answer in terms of positive exponents.

a) $\frac{6^{-2} \cdot a^0 \cdot b^0}{c^{-8}}$

b) $\frac{13b^{-8}}{b^{-6}}$

Solution:

a. The given expression is,

$$\begin{aligned} \frac{6^{-2} \cdot a^0 \cdot b^0}{c^{-8}} &= \frac{6^{-2}}{c^{-8}} \left[\because a^0 = 1 \right] \\ &= \frac{c^8}{6^2} \left[\because a^{-m} = \frac{1}{a^m} \right] \\ &= \frac{c^8}{36} \end{aligned}$$

b. The given expression is,

$$\begin{aligned}\frac{13b^{-8}}{b^{-6}} &= 13b^{-8+6} [\because \frac{a^m}{a^n} = a^{m-n}] \\ &= 13b^{-2} \\ &= \frac{13}{b^2} [\because a^{-m} = \frac{1}{a^m}]\end{aligned}$$

6.

Find the value of $\left\{ \left(\frac{1}{2}\right)^{-2} - \left(\frac{1}{3}\right)^{-3} \right\} \div \left(\frac{1}{5}\right)^{-2}$.

Solution:

$$\begin{aligned}\left\{ \left(\frac{1}{2}\right)^{-2} - \left(\frac{1}{3}\right)^{-3} \right\} \div \left(\frac{1}{5}\right)^{-2} &= \frac{2^2 - 3^3}{5^2} [\because a^{-m} = \frac{1}{a^m}] \\ &= \frac{4 - 27}{25} \\ &= \frac{-23}{25}\end{aligned}$$

7. Solve the following equation for x .

$$5^x \div 5^{-7} = 5^{12}$$

Solution:

$$5^x \div 5^{-7} = 5^{12}$$

$$5^{x+7} = 5^{12} [\because \frac{a^m}{a^n} = a^{m-n}]$$

$$x + 7 = 12 [\because \text{Bases are same on both sides}]$$

$$x = 5$$

8. Solve the following equation for x

$$(81)^{-5} \div (729)^{3-x} = (9)^{5x}$$

Solution:

$$(81)^{-5} \div (729)^{3-x} = (9)^{5x}$$

$$(3^4)^{-5} \div (3^6)^{3-x} = (3^2)^{5x}$$

$$3^{-20} \div 3^{18-6x} = 3^{10x}$$

$$3^{-20-(18-6x)} = 3^{10x} \left[\because \frac{a^m}{a^n} = a^{m-n} \right]$$

$$3^{-38+6x} = 3^{10x}$$

$$-38 + 6x = 10x \left[\because \text{Bases are same on both sides} \right]$$

$$-38 = 4x$$

$$x = \frac{-38}{4}$$

$$x = \frac{-19}{2}$$

9. Find the value of $(216^5)^{\frac{1}{3}}$ and express the answer as an exponent.

Solution:

$$(216^5)^{\frac{1}{3}} = ((6^3)^5)^{\frac{1}{3}} \left[\because 6^3 = 216 \right]$$

$$= (6^{15})^{\frac{1}{3}} \left[\because (a^m)^n = a^{mn} \right]$$

$$= 6^5 \left[\because (a^m)^n = a^{mn} \right]$$

10. Which of the following is equivalent to $\frac{a^8 - b^8}{(a^4 + b^4)(a^2 + b^2)}$?

a) $a^4 - b^4$

b) $a^4 + b^4$

c) $a^2 - b^2$

$$d) a^2 + b^2$$

Solution:

$$\begin{aligned} \frac{a^8 - b^8}{(a^4 + b^4)(a^2 + b^2)} &= \frac{(a^4 - b^4)(a^4 + b^4)}{(a^4 + b^4)(a^2 + b^2)} \\ &= \frac{a^4 - b^4}{a^2 + b^2} \\ &= \frac{(a^2 - b^2)(a^2 + b^2)}{a^2 + b^2} \\ &= a^2 - b^2 \end{aligned}$$

Thus, the answer is c).

11. Convert the following into scientific notation.

a) 0.000000000123

b) 3186000000

Solution:

a. $0.000000000123 = 1.23 \times 10^{-9}$ (because the decimal is moved to right side for 9 times)

b. $3186000000 = 3.186 \times 10^9$ (because the decimal is moved to left side for 9 times)

12. Express the following numbers in the standard form.

a) 5×10^{-5}

b) 3.42×10^4

Solution:

a. $5 \times 10^{-5} = \frac{5}{100000} = 0.00005$

b. $3.42 \times 10^4 = 3.42 \times 10000 = 34200$

13. The area occupied by a certain type of a bacteria is 0.000000006 square meters. Find the area occupied by 100 such bacteria and express your answer in scientific notation.

Solution:

The area occupied by 100 bacteria is,

$$0.000000006 \times 100 = 0.0000006 = 6 \times 10^{-7} \text{ square meters.}$$

14. Simplify $(3.2 \times 10^{-4}) - (15.2 \times 10^{-7})$ and express the answer in scientific notation.

Solution:

To subtract the two terms in the given expression, the exponents have to be the same.

$$\begin{aligned} (3.2 \times 10^{-4}) - (15.2 \times 10^{-7}) &= (3200 \times 10^{-7}) - (15.2 \times 10^{-7}) \\ &= (3200 - 15.2) \times 10^{-7} \\ &= 3184.8 \times 10^{-7} \\ &= 3.1848 \times 10^{-4} \end{aligned}$$

15. Simplify $(8.3 \times 10^{-3}) \times (3.2 \times 10^{-5})$ and express the answer in scientific notation.

Solution:

$$\begin{aligned} (8.3 \times 10^{-3}) \times (3.2 \times 10^{-5}) &= (8.3 \times 3.2) \times (10^{-3} \times 10^{-5}) \\ &= 26.56 \times 10^{-8} [\because a^m \cdot a^n = a^{m+n}] \\ &= 2.656 \times 10^{-7} \end{aligned}$$

FUN FACT

1. If you raise zero to any number, it will still be zero.
2. The first time exponents was used was way back in the 15th century.
3. Robert Recorde took it further in the next century and developed the exponents system

