Math 8 Unit 1 worksheet: Writing and reading scientific notation (answer key)

ANSWERS AT A GLANCE

1. (a) 3.09×10^{6} (b) 7.04×10^{-4} (c) 5.8×10^{10} (d) 6×10^{-2} (e) 8.001×10^{5} (f) 1.02×10^{-5} (g) 4.17×10^{1} (h) 9×10^{-9}
2. (a) 506,000,000 (b) 0.00000023 (c) 40,005 (d) 0.19 (e) 0.0602 (f) 888,000
3. (a) 7.3×10^{-5} (b) 4.8×10^{-4} (c) 9×10^{2} (d) 1.2×10^{6}
4. (a) −2 (b) 5 (c) 9.1 (d) 6.2
5. 380,000, which is 3.8×10^{5}
6. (a) $-72{,}000 = -7.2 \times 10^{4}$ and $-0.0038 = -3.8 \times 10^{-3}$. (b) No. The exponent is negative because the size of the number, 0.0038, is less than 1; the minus sign of the number rides in front.
7. (a) Wrong: `5.1E4` means $5.1 \times 10^{4} = 51{,}000$, not 5.1 to the fourth power. (b) Wrong: the point moves three places, not four, so the value is 0.00307. (c) Correct.

WORKED SOLUTIONS

1. Write each number in scientific notation.

(a) 3,090,000 (b) 0.000704 (c) 58,000,000,000 (d) 0.06

(e) 800,100 (f) 0.0000102 (g) 41.7 (h) 0.000000009

ANSWER

(a) 3.09×10^{6} (b) 7.04×10^{-4} (c) 5.8×10^{10} (d) 6×10^{-2} (e) 8.001×10^{5} (f) 1.02×10^{-5} (g) 4.17×10^{1} (h) 9×10^{-9}

SOLUTION

(a) The point goes just after the 3, giving 3.09; the zero between 3 and 9 stays. The number has 7 digits, so the exponent is 6: 3.09×10^{6}.

(b) The first digit that is not zero, the 7, is in the fourth decimal place, so the exponent is −4. The zero between 7 and 4 stays: 7.04×10^{-4}.

(c) 11 digits, so the exponent is 10: 5.8×10^{10}.

(d) The 6 is in the second decimal place: 6×10^{-2}. Check: $6 \times \frac{1}{100} = 0.06$.

(e) The leading number is 8.001; the zeros between the 8 and the 1 hold the 1 in its place, and only the trailing zeros go. 6 digits, so the exponent is 5: 8.001×10^{5}.

(f) The 1 is in the fifth decimal place: 1.02×10^{-5}.

(g) The point moves one place left to sit after the 4: 4.17×10^{1}.

(h) The 9 is in the ninth decimal place: 9×10^{-9}.

2. Write each as an ordinary number.

(a) 5.06×10^{8} (b) 2.3×10^{-7} (c) 4.0005×10^{4}

(d) 1.9×10^{-1} (e) 6.02×10^{-2} (f) 8.88×10^{5}

ANSWER

(a) 506,000,000 (b) 0.00000023 (c) 40,005 (d) 0.19 (e) 0.0602 (f) 888,000

SOLUTION

(a) The point moves eight places right. The 0 and the 6 use up two moves, and the other six places are filled with zeros: 506,000,000.

(b) The point moves seven places left, so the 2 lands in the seventh decimal place, with six zeros before it: 0.00000023.

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(c) The point moves four places right, and the four digits 0, 0, 0, 5 use up all four moves: 40,005.

(d) The point moves one place left: 0.19.

(e) The point moves two places left, so the 6 is in the second decimal place: 0.0602.

(f) The point moves five places right. The two 8s after the point use up two moves and three zeros fill the rest: 888,000.

3. None of these values is in scientific notation. Write the leading number itself in scientific notation, then combine the powers of ten.

(a) 73×10^{-6} (b) 0.48×10^{-3} (c) 0.009×10^{5} (d) 1200×10^{3}

ANSWER

(a) 7.3×10^{-5} (b) 4.8×10^{-4} (c) 9×10^{2} (d) 1.2×10^{6}

SOLUTION

(a) $73 = 7.3 \times 10^{1}$, so $73 \times 10^{-6} = 7.3 \times (10^{1} \times 10^{-6}) = 7.3 \times 10^{-5}$.

(b) $0.48 = 4.8 \times 10^{-1}$, so $0.48 \times 10^{-3} = 4.8 \times (10^{-1} \times 10^{-3}) = 4.8 \times 10^{-4}$.

(c) $0.009 = 9 \times 10^{-3}$, so $0.009 \times 10^{5} = 9 \times (10^{-3} \times 10^{5}) = 9 \times 10^{2}$, which is 900.

(d) $1200 = 1.2 \times 10^{3}$, so $1200 \times 10^{3} = 1.2 \times (10^{3} \times 10^{3}) = 1.2 \times 10^{6}$.

In each one, making the leading number 10^{k} times smaller adds k to the exponent, and making it 10^{k} times bigger takes k away.

4. Fill in each blank so that the equation is true.

(a) $0.0507 = 5.07 \times 10^{n}$, so $n =$ _____ (b) $3.4 \times 10^{n} = 340{,}000$, so $n =$ _____

(c) $\square \times 10^{-3} = 0.0091$ (d) $62{,}000 = \square \times 10^{4}$

ANSWER

(a) −2 (b) 5 (c) 9.1 (d) 6.2

SOLUTION

(a) The 5 is in the second decimal place, so the exponent is −2: $5.07 \times 10^{-2} = 0.0507$.

(b) 340,000 has 6 digits, so the exponent is 5: $3.4 \times 10^{5} = 340{,}000$.

(c) Multiplying by 10^{-3} moves the point three places left, so undo that: move the point of 0.0091 three places right, which gives 9.1. Check: $9.1 \times 10^{-3} = 0.0091$.

(d) Dividing 62,000 by 10^{4} moves the point four places left: 6.2. Check: $6.2 \times 10^{4} = 62{,}000$.

5. Hannah reads in a news story that the number of trees in a state forest was about 380 thousand. Write this number as an ordinary number and in scientific notation.

ANSWER

380,000, which is 3.8×10^{5}

SOLUTION

One thousand is $1{,}000 = 10^{3}$, so 380 thousand is 380×10^{3}. That is not in the form, since 380 is not less than 10. Write $380 = 3.8 \times 10^{2}$; then $380 \times 10^{3} = 3.8 \times 10^{5}$. As an ordinary number: 380,000.

6. (a) Write −72,000 and −0.0038 in scientific notation.

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(b) Mateo says the exponent for −0.0038 is negative because the number is negative. Is his reason right? Explain, using both numbers from (a).

ANSWER

(a) $-72{,}000 = -7.2 \times 10^{4}$ and $-0.0038 = -3.8 \times 10^{-3}$. (b) No. The exponent is negative because the size of the number, 0.0038, is less than 1; the minus sign of the number rides in front.

SOLUTION

(a) The minus sign stays in front and the size is written as usual. 72,000 has 5 digits, so $72{,}000 = 7.2 \times 10^{4}$ and $-72{,}000 = -7.2 \times 10^{4}$. In 0.0038 the 3 is in the third decimal place, so $0.0038 = 3.8 \times 10^{-3}$ and $-0.0038 = -3.8 \times 10^{-3}$.

(b) Mateo's reason is wrong. −72,000 is negative too, yet its exponent is 4, a positive number. The sign of the exponent depends only on the size of the number: 0.0038 is between 0 and 1, so the power of ten has to make the leading number 3.8 smaller, and only a negative power does that. The sign of the number itself is the minus sign written in front of the leading number.

7. In a science lab, Yuna's calculator showed three answers, and she copied each one into her notebook. Check each copy. If it is wrong, say what went wrong and write the correct value as an ordinary number.

(a) The screen showed `5.1E4`. Yuna wrote 5.1^{4}.

(b) The screen showed `3.07E-3`. Yuna wrote 0.000307.

(c) The screen showed `8E12`. Yuna wrote 8,000,000,000,000.

ANSWER

(a) Wrong: `5.1E4` means $5.1 \times 10^{4} = 51{,}000$, not 5.1 to the fourth power. (b) Wrong: the point moves three places, not four, so the value is 0.00307. (c) Correct.

SOLUTION

(a) The number after E is the exponent of a power of ten, and the × 10 is left out. So `5.1E4` is 5.1×10^{4}, and moving the point four places right gives 51,000. Yuna's 5.1^{4} is $5.1 \cdot 5.1 \cdot 5.1 \cdot 5.1$, which is about 677, a different number.

(b) `3.07E-3` is 3.07×10^{-3}. Moving the point three places left puts the 3 in the third decimal place: 0.00307. Yuna moved the point four places, which gives a number ten times too small.

(c) `8E12` is 8×10^{12}. There are no digits after the 8, so all twelve places are filled with zeros, and Yuna's number has an 8 followed by twelve zeros. Check: it has 13 digits, one more than the exponent. The copy is correct.

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