Introduction to Scientific Notation

Spot mistakes, reason, and work backward

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

Scientific notation has the form $a \times 10^n$ with $1 \le a < 10$ for positive values. $720 = 7.2 \times 10^2$ and $0.072 = 7.2 \times 10^{-2}$. A negative exponent means a small positive number, not a negative measurement.

Worked example

Write 0.0635 in scientific notation.

1. Shift the decimal two places right to get 6.35, a coefficient between 1 and 10.
2. Compensate with two factors of $1/10$: $10^{-2} = 0.01$.
3. Check $6.35(0.01) = 0.0635$.
Answer: 6.35×10^{-2}.

Practice Problems

Show your thinking.

1. A student writes 42×10^3 for 42000. Preserve the value but normalize the coefficient. Show the first value as a sum of place values.

2. A claim says $\frac{13}{2} \times 10^{-3} = 0.065$. Repair the misplaced decimal and explain the power of ten. If this value is in meters, convert it to millimeters.

3. A student writes 80×10^4 for 800000. Preserve the value but normalize the coefficient. Find the ratio of the first value to 10^5 in the same units.

4. A claim says $\frac{5}{4} \times 10^{-4} = 0.00125$. Repair the misplaced decimal and explain the power of ten. Recover the exponent from the ordinary value when the coefficient is fixed at 1.25.

5. A student writes 31×10^2 for 3100. Preserve the value but normalize the coefficient. Give the ordinary values when the first value is divided and multiplied by 10.

6. A claim says $9 \times 10^{-2} = 0.9$. Repair the misplaced decimal and explain the power of ten. Compare the ordinary numerical value with 0.1 and find the difference.

7. Signal record: correct the nonnormalized form 27×10^5 without changing its value.

8. Distance marker: find integer q in $4.8 \times 10^q = 0.000048$.

9. Balance check: correct the nonnormalized form 62.5×10^1 without changing its value.

10. Reference scale: write 1.2×10^{-2} as an ordinary decimal.

Answer Key

1. $4.2 \times 10^4 = 42000$.
$4.2(10000) = 4(10000) + 2(1000) = 42000$.
2. $6.5 \times 10^{-3} = 0.0065$. $0.0065(1000) = 6.5$ mm.
3. $8 \times 10^5 = 800000$. Ratio $(8 \times 10^5)/10^5 = 8$.
4. $1.25 \times 10^{-4} = 0.000125$. $0.000125/1.25 = 0.0001 = 10^{-4}$, so exponent -4.
5. $3.1 \times 10^3 = 3100$. $3100/10 = 310$ and $3100(10) = 31000$.
6. $9 \times 10^{-2} = 0.09$. $0.1 - 0.09 = 0.01$; the value is smaller by 0.01.
7. $2.7 \times 10^6 = 2700000$.
8. $q = -5$.
9. $6.25 \times 10^2 = 625$.
10. $1.2 \times 10^{-2} = 0.012$.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The coefficient 42 is at least 10, so divide it by 10 to get 4.2.
2. Keep the value unchanged by multiplying the power of ten by 10: $10^3(10) = 10^4$.
3. The result is $4.2 \times 10^4 = 42000$.
4. $4.2(10000) = 4(10000) + 2(1000) = 42000$.

Problem 2

1. The coefficient 6.5 satisfies $1 \le 6.5 < 10$.
2. $10^{-3} = 0.001$; multiply by 6.5 to obtain 0.0065.
3. Check: $0.0065 \div (0.001) = 6.5$.
4. $0.0065(1000) = 6.5$ mm.

Problem 3

1. The coefficient 80 is at least 10, so divide it by 10 to get 8.
2. Keep the value unchanged by multiplying the power of ten by 10: $10^4(10) = 10^5$.
3. The result is $8 \times 10^5 = 800000$.
4. Ratio $(8 \times 10^5)/10^5 = 8$.

Problem 4

1. The coefficient 1.25 satisfies $1 \le 1.25 < 10$.
2. $10^{-4} = 0.0001$; multiply by 1.25 to obtain 0.000125.
3. Check: $0.000125 \div (0.0001) = 1.25$.
4. $0.000125/1.25 = 0.0001 = 10^{-4}$, so exponent -4.

Problem 5

1. The coefficient 31 is at least 10, so divide it by 10 to get 3.1.
2. Keep the value unchanged by multiplying the power of ten by 10: $10^2(10) = 10^3$.
3. The result is $3.1 \times 10^3 = 3100$.
4. $3100/10 = 310$ and $3100(10) = 31000$.

Problem 6

1. The coefficient 9 satisfies $1 \le 9 < 10$.
2. $10^{-2} = 0.01$; multiply by 9 to obtain 0.09.
3. Check: $0.09 \div (0.01) = 9$.
4. $0.1 - 0.09 = 0.01$; the value is smaller by 0.01.

Problem 7

1. The given coefficient 27 is at least 10, so divide it by 10 to get 2.7.
2. Multiply the power by 10 to keep the value unchanged: $10^5 \times 10 = 10^6$.
3. The normalized form is $2.7 \times 10^6 = 2700000$.

Problem 8

1. Divide the given value by its coefficient: $10^q = 0.000048 \div 4.8 = 0.00001$.
2. $0.00001 = 10^{-5}$, so the required exponent is $q = -5$.
3. Check: $4.8 \times 10^{-5} = 0.000048$.

Problem 9

1. The given coefficient 62.5 is at least 10, so divide it by 10 to get 6.25.
2. Multiply the power by 10 to keep the value unchanged: $10^1 \times 10 = 10^2$.
3. The normalized form is $6.25 \times 10^2 = 625$.

Problem 10

1. $10^{-2} = 0.01$.
2. $1.2(0.01) = 0.012$.
3. The coefficient 1.2 is at least 1 and less than 10, so 1.2×10^{-2} is normalized.

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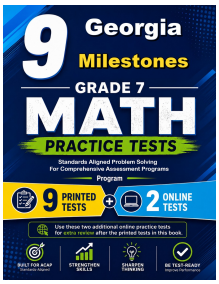

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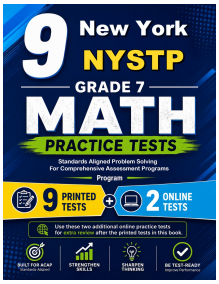

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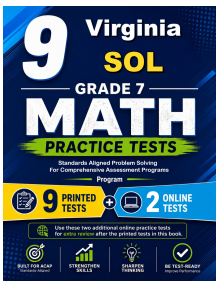

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