Exponents & Square Roots

Vocabulary:

1. *Exponent:* part of a power that tells you how many times to use the base as a factor (multiplication)
2. *Negative exponent:* tells you that a power is less than one and should be written as a *fraction*
3. *Scientific Notation:* a way to write very large or very small numbers using powers of ten
4. *Linear:* forms a straight line
5. *Rational Number:* any number that can be written as a ratio (fraction)
6. *Irrational Number:* any number whose decimal form never repeats and never ends (most common: $\sqrt{2}$, π)

Symbols:

$\sqrt{\ }$ means **Find the square root** (which number multiplied by itself produces the number inside the box)

$\sqrt[3]{\ }$ means **Find the cubed root** (which number multiplied by itself 3 times would produce the number inside the box)

MGSE8.EE.1 – Properties of Exponents

Review Tips: Exponent Rules

Multiplying: Keep the base number, add the exponents *[Example: $a^2 \bullet a^5 = a^{2+5} = a^7$]*

Dividing: Keep the base number, subtract the exponents *[Example: $\frac{b^{10}}{b^4} = b^{10-4} = b^6$]*

Negative: move the power across the division bar and change the exponent from negative to positive *[Example: $x^{-4} = \frac{1}{x^4}$]*

Zero: any number (except zero) to the zero power = 1 *[Example: $4^0 = 1$, $200^0 = 1$, $(-9)^0 = 1$]*

Different Base Powers: the exponents of different bases **cannot** be combined. *[Example: $a^3b^4 = a^3b^4$]*

Practice Problems:

❶ Evaluate: $4^2 \cdot 4^2$

A. 16^4
B. 256
C. 1
D. 65,536

❷ Evaluate: $\frac{3^7}{3^5}$

A. 36
B. $\frac{1}{9}$
C. 9
D. 3^{12}

❸ Evaluate: 4^{-3}

A. 64
B. -64
C. -12
D. $\frac{1}{64}$

❹ Evaluate: 58^0

A. 1
B. 58
C. 0
D. -58

MGSE8.EE.2 – Perfect Squares & Perfect Cubes

Review Tip:

I. To "un-square" a number, you must take the square root. *[Example: $3^2 = 9$ therefore $\sqrt{9} = 3$]*

II. To "un-cube" a number, you must take the cube root [*Example: $5^3 = 125$ therefore $\sqrt[3]{125} = 5$]*

Practice Problems:

❺ Evaluate: $\sqrt{100}$

A. 10
B. 50
C. 25
D. 98

❻ Evaluate: $\sqrt[3]{64}$

A. 10
B. 8
C. 21.3
D. 4

❼ Find the value of *x*:

$$x^2 = 16$$

A. ± 4
B. ± 8
C. 4
D. 8

❽ Find the value of *x*:

$$x^3 = -8$$

A. ± 4
B. ± 2
C. -2
D. -4

Scientific Notation

MGSE8.EE.3 – Writing in Scientific Notation
MGSE8.EE.4 – Operations in Scientific Notation

Review Tips:

I. Numbers written in scientific notation must have only one number (1 – 9) in front of the decimal place.
[Correct Example: 3.45 x 10^6 Incorrect Example: 34.5 x 10^6]
II. Numbers with **positive exponents** are very large numbers (greater than 1) *[Example: 3.45 x 10^6 = 3,450,000]*
III. Numbers with **negative exponents** are very small numbers (less than 1) *[Example: 3.45 x 10^{-6} = 0.00000345]*
IV. To *multiply or divide* numbers expressed in scientific notation, combine the coefficients first and the powers of ten second. Put in proper format if necessary.
[Example: (2.1 x 10^4) x (9 x 10^5) = (2.1 x 9) x (10^4 x 10^5) = 18.9 x 10^9 = 1.89 x 10^{10})
V. To *add or subtract* numbers in scientific notation, re-write the numbers in standard form, combine, and put back in scientific notation. *[Example: (2.1 x 10^4) + (9 x 10^5) = 21,000 + 900,000 = 921,000 = 9.21 x 10^5)*
VI. *Adjusting an answer* to "perfect" scientific notation:
i. Too big? Move the decimal and **ADD** to the exponent. *[Example: 23.8 x 10^4 = 2.38 x 10^5]*
ii. Too small? Move the decimal and **SUBTRACT** from the exponent. *[Example 0.238 x 10^9 = 2.38 x 10^8]*
VI. Standard calculators will represent a power of ten by using and "E".
[Example: 3.45 x 10^8 on a calculator would read 3.45 E 8]

Practice Problems:

❶ What is 6.79×10^5 written in standard form?
A. 67,900,000 B. 679,000 C. 0.00000679 D. 0.0000679

❷ The width of a human hair is approximately 0.0002 in. What is this width written in scientific notation?
A. 2 x 10^3 in. B. 2 x 10^{-3} in. C. 2 x 10^4 in. D. 2 x 10^{-4} in.

❸ Evaluate: $(6.7 \times 10^4) \times (9.1 \times 10^6)$
A. 6.097 x 10^{11} B. 6.097 x 10^{10} C. 6.097 x 10^9 D. 60.97 x 10^{10}

❹ How many times larger is (5.4×10^6) than (9×10^3)?
A. 0.6 x 10^3 B. 6 x 10^3 C. 6 x 10^2 D. 6 x 10^4

❺ Subtract: $(3.4 \times 10^5) - (2.1 \times 10^4)$
A. 3.19 x 10^3 B. 3.19 x 10^5 C. 1.3 x 10^1 D. 1.3 x 10^5

❻ Add: $12{,}000 + (3.4 \times 10^5)$
A. 4.6 x 10^5 B. 4.6 x 10^9 C. 3.52 x 10^5 D. 3.52 x 10^3

❼ Which value would be the most likely measurement of the distance from the earth to the moon?
A. 1.3 x 10^9 ft. B. 1.3 x 10^{100} ft. C. 1.3 x 10^{-9} ft. D. 1.3 x 10^2 ft.

❽ The display on a calculator reads 9.378 E -5. Which value does this represent?
A. 937,800,000 B. 937,800 C. 0.00009378 D. 0.000009378