

1) Joanne has  $2a^3$  number of animals. Ronnie has  $3a^3$  number of animals. Odessa has  $a^4$  number of animals. How many animals do Joanne, Ronnie, and Odessa have altogether?

- A)  $5a^{10}$       B)  $6a^{10}$       C)  $5a^3 + a^4$       D)  $6a^3 + a^4$

2) Which expression equals  $(4xy^2z^3)^2$ ?

- A)  $4x^2y^4z^6$       B)  $8x^2y^4z^6$       C)  $16x^2y^4z^6$       D)  $16x^3y^4z^5$

3) Which expression is equivalent to  $6^5 \cdot 6^{-5} \cdot \left(\frac{4^9}{4^7}\right)^{-3}$ ?

- A)  $\frac{1}{4}$       B)  $\frac{1}{4^6}$       C)  $\frac{6}{4^{20}}$       D)  $\frac{6}{4^{34}}$

4) What is another way to express  $4^{-2}$ ?

- A)  $\frac{1}{16}$       B)  $\frac{16}{4}$       C)  $\frac{8}{1}$       D)  $\frac{32}{2}$

5) Jordan drove  $a^3$  miles per hour for  $a^5$  hours. How far did Jordan drive?

- A)  $a^2$  miles      B)  $a^8$  miles      C)  $a^{12}$  miles      D)  $a^{15}$  miles

6) If  $x^2 = 8(x - 2)$ , what is the value of  $x$ ?

- A) 2      B) 4      C) 6      D) 8

7) Find the value of  $3x - 2x^2$  when  $x = -3$ .

- A) -27      B) -18      C) 0      D) 9

8) Why is one of the square roots of any positive number less than zero?

- A) because a negative number times a negative number is a positive number
- B) because a negative number times a negative number is a negative number
- C) because a negative number times a positive number is a negative number
- D) because a negative number times a positive number is a positive number

9) A square-shaped playground has an area of  $290 \text{ ft}^2$ . Approximately, how long is one side of the playground?

- A) 12 ft                      B) 17 ft                      C) 36 ft                      D) 73 ft

10) Which of the following best represents  $\sqrt{39}$ ? A number between —

- A) 3 and 4                      B) 6 and 7                      C) 7 and 8                      D) 8 and 10

11) Which expression below represents 456.8 in scientific notation?

- A)  $4.568 \times 10^2$       B)  $45.68 \times 10^1$       C)  $456.8 \times 10^0$       D)  $4568.0 \times 10^1$

12) A warehouse stores goods in cube-shaped boxes, each with a volume of  $x^3$  cubic feet.

**Part A**

If the volume of a single box is 216 cubic centimeters, what is the value of  $x$ ? Explain your answer.

**Part B**

In one room, the boxes are arranged together to form a rectangular solid measuring  $2x$  feet high,  $5x$  feet long, and  $6x$  feet wide. How many boxes are arranged together in this room? Explain your answer.

**Part C**

In a second room,  $3x$  boxes are arranged together in a straight line. What is the total volume of all the boxes in the second room in terms of  $x$ ? Explain your answer.

13) The number of stars in the Milky Way is estimated to be  $2 \times 10^{11}$ . The number of stars in a different galaxy, Abell 2029, is estimated to be  $1 \times 10^{14}$ .

**Part A**

Very large numbers, such as the number of stars in a galaxy, are often written in exponential form to make them easier to multiply or divide. Explain how to apply the laws of exponents when multiplying and dividing numbers with the same base but different exponents.

**Part B**

How many times the number of stars in the Milky Way galaxy is in the Abell 2029 galaxy? Express your answer in scientific notation. Show your work.

14) The table shows the population estimates for 3 countries in scientific notation.

**Population Estimates**

Country	Number of People
P	$5.4 \times 10^8$
Q	$6.0 \times 10^8$
R	$3.0 \times 10^5$

**Part A**

What number, written in scientific notation, represents the combined total population of countries P and Q? Show your work or explain your answer.

**Part B**

How many times greater is the population of Q than the population of R? Show your work or explain your answer.

**Part C**

The population of P is predicted to increase by 10% during the next 20 years. What number, written in scientific notation, represents the predicted total population of P? Show your work.

**Part D**

The population of R is twice the population it was 40 years ago. What was the average gain per year in population during this time period? Show your work.

15) Television manufacturers often use the term “dynamic contrast ratio” to make claims about the quality of the picture on the screen.

- Company X claims their television has a 500,000 to 1 dynamic contrast ratio.
- Company Y claims their television has a 9,000,000 to 1 dynamic contrast ratio.

**Part A**

Write the numbers 500,000 and 9,000,000 in scientific notation.

**Part B**

Using your answers in Part A, how many times greater is the dynamic contrast ratio of television Y than the dynamic contrast ratio of television X? Show your work.

**Part C**

Company Z claims their television has a dynamic contrast ratio that is 50% of the dynamic contrast ratio of television Y. Write the dynamic contrast ratio of television Z in scientific notation.

**Part D**

What percentage is the dynamic contrast ratio of television Z in comparison to television X? Show your work.

16) The number of members of an online music company grew at a constant rate per year from 2006 to 2008. The table shows the numbers of members during the first and last years.

**Online Music Company**

Year	Number of Members
2006	$8 \times 10^4$
2008	$4 \times 10^5$

**Part A**

In 2006, each member paid \$15 to join. How much money did the company receive from these members? Write your answer in scientific notation and show your work.

**Part B**

How many times greater was the number of members in 2008 than the number of members in 2006? Explain your answer.

**Part C**

What was the yearly rate of increase in the number of members? Write your answer in standard notation and explain your reasoning.

**Part D**

If the yearly rate you found in Part C remains the same, how many members will there be in 2015? Write your answer in scientific notation.