



ACT Math

TEST PREP



Strategies and practice to achieve high test scores

NUMBER & QUANTITY

NUMBER SYSTEMS

REAL NUMBERS

- Natural (counting) numbers: 1, 2, 3, 4, ...
- Whole numbers: 0, 1, 2, 3, 4, ...
- Integers: ..., -3, -2, -1, 0, 1, 2, 3, ...

RATIONAL NUMBERS

- Can be expressed in the form $\frac{a}{b}$, where a and b are integers

EX: $\frac{1}{2}$, $1\frac{1}{2}$, $-\frac{3}{4}$

- Can also be expressed as decimals that terminate or repeat a pattern

IRRATIONAL NUMBERS

- Cannot be expressed in the form $\frac{a}{b}$

EX: 2.789524, ..., π , $\sqrt{11}$

IMAGINARY & COMPLEX NUMBERS

- Not part of the real number system

IMAGINARY NUMBERS

- $i = \sqrt{-1}$

Notice the recurring pattern of i every four terms:

$$i^1 = i, i^2 = -1, i^3 = -i, i^4 = 1, i^5 = i, i^6 = -1, i^7 = -i, i^8 = 1$$

EX: What is the value of i^{20} ? $18 \div 4 = 9$ remainder 2

$9 \div 2$ means nine patterns of i have been completed and we are two places into the tenth.

Thus, $i^{20} = i^2 = -1$

COMPLEX NUMBERS

- Contain a real and an imaginary component

EX: $2i$, $5 + 3i$, $-4 - i$

- Addition: add like terms

$$\text{EX: } (5 + 2i) + (3 - 5i) = 8 - 3i$$

- Multiplication: use the distributive property

$$\text{EX: Multiply } (4 - 3i)(2 - 5i)$$

Use FOIL (First, Outer, Inner, Last) to multiply.

$$F: 4 \times 2 = 8$$

$$O: 4 \times -5i = -20i$$

$$I: -3i \times 2 = -6i$$

$$L: -3i \times -5i = 15i^2 = -15$$

Combine like terms:

$$8 - 20i - 6i - 15 = -7 - 26i$$

NUMERICAL PLACE VALUE

EX: 736.2958

- 7 is in the hundreds place
- 3 is in the tens place
- 6 is in the ones (unit) place
- 2 is in the tenths place
- 9 is in the hundredths place
- 5 is in the thousandths place
- 8 is in the ten-thousandths place

DIVISIBILITY RULES

If number divisible by:

2	last digit even
3	sum of digits divisible by 3
5	last digit 5 or 0
9	sum of digits divisible by 9
10	last digit 0

EX: Is 7,002 divisible by 3?

$$7 + 0 + 0 + 2 = 9$$

9 is divisible by 3, so 7,002 is divisible by 3.

EX: Is 23,472 divisible by 9?

$$2 + 3 + 4 + 7 + 2 = 18$$

18 is divisible by 9, so 23,472 is divisible by 9.

ABSOLUTE VALUE

- Distance of a number from 0 on a number line; symbol is $| |$

$$\text{EX: } |4| = 4 \text{ and } |-4| = 4$$

4 and -4 are both four units away from 0 on a number line.



ORDERING FRACTIONS ON A NUMBER LINE

- Convert each fraction to a decimal

EX: Place the following fractions in order on a number line: $\frac{2}{5}$, $\frac{3}{8}$, $\frac{4}{11}$, $\frac{5}{9}$

$$\frac{2}{5} = 0.78, \frac{3}{8} = 0.625, \frac{4}{11} = 0.36, \frac{5}{9} = 0.43$$



MATRICES

A matrix is a rectangular arrangement of rows and columns enclosed in brackets.

EX: What type of matrix is shown below?

$$\begin{bmatrix} 2 & 7 & 9 \\ 4 & 8 & 3 \end{bmatrix}$$

There are two rows and three columns, so it's a 2×3 matrix.

MULTIPLYING BY A CONSTANT

EX: Multiply $\begin{bmatrix} 4 & -2 \\ 8 & 3 \end{bmatrix}$ by 6.

$$6 \begin{bmatrix} 4 & -2 \\ 8 & 3 \end{bmatrix} = \begin{bmatrix} 6 \times 4 & 6 \times (-2) \\ 6 \times 8 & 6 \times 3 \end{bmatrix} = \begin{bmatrix} 24 & -12 \\ 48 & 18 \end{bmatrix}$$

MULTIPLYING BY ANOTHER MATRIX

You will only need to know if two matrices can be multiplied.

$$\text{EX: } A = \begin{bmatrix} 2 & 6 & 3 \\ 5 & 4 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 4 & 9 \\ 6 & -2 \\ 5 & -11 \end{bmatrix}$$

Is it possible to multiply matrix A by matrix B (i.e., AB)?

A : two rows, three columns (2×3)
 B : three rows, two columns (3×2)

If the columns of the first matrix equal the rows of the second matrix, the matrices can be multiplied.

$2 \times 3 \quad 3 \times 2 \rightarrow 2 \times 2$ matrix

NOTE: $B \cdot A$ is also possible:

$3 \times 2 \quad 2 \times 3 \rightarrow 3 \times 3$ matrix

PROPERTIES OF EXPONENTS

An exponent, also known as a power, is a small, raised number that indicates how often a number is multiplied by itself.

EX: $9^2 = 9 \times 9 = 81$

When multiplying, add exponents: $(x^3)(x^2) = x^{3+2} = x^5$

When raising an exponent to a power, multiply exponents: $(x^3)^2 = x^{3 \times 2} = x^6$

When dividing, subtract exponents:

$$\text{EX: } \frac{x^5}{x^2} = x^{5-2} = x^3$$

$$\text{EX: } \frac{x^5}{x^6} = x^{5-6} = x^{-1} = \frac{1}{x}$$

SCIENTIFIC NOTATION

A number expressed in the form $a \times 10^n$, where $1 \leq a < 10$ and n is an integer

EX: Express 11,203 in scientific notation.

$$11,203 = 1.1203 \times 10^4$$

Decimals less than 1 can also be expressed in scientific notation.

EX: Express 0.00012 in scientific notation.

Move the decimal three places to the right to arrive at 3.12.

Since the decimal point moved to the right, the exponent becomes negative.

$$0.00012 = 3.12 \times 10^{-5}$$

ALGEBRAIC DEFINITIONS

- Symbol that represents some value

a , n , b , and y are often used

COEFFICIENT

Real number value that precedes a variable

EX: In the term $9m$, 9 is the coefficient and m is the variable.

When no value precedes a variable, it's understood to be 1

TERM

Value that expresses a coefficient and one or more variables raised to exponents

$$\text{EX: } 3m, -3mn, m^2y^2, 4x^2y^3$$

EXPRESSION

Collection of terms set apart by plus or minus signs

$$\text{EX: } -3mn^2 - 5, 4x + 2y, \frac{2y^2}{3}, 3y$$

LIKE TERMS

- Terms that have the same variables and exponents and can be simplified

$$\text{EX: } 9mn^2 - 11mn^2 = -2mn^2$$

$$4hm + 11hm + 8m = 15hm$$

EQUATION

- Equivalence of two terms or expressions

$$\text{EX: } 3x = 21 \quad 5x + 6 = 4x - 5$$

SOLVING EQUATIONS

- Isolate a variable

Use inverse operations and perform the same action on both sides of an equation

EX: Solve to find x .

$$6x + 8 = 26$$

$$6x + 8 - 8 = 26 - 8$$

$$6x = 18$$

$$\frac{6x}{6} = \frac{18}{6}$$

$$x = 3$$

ALGEBRA & FUNCTIONS

WITH MORE THAN ONE VARIABLE

EX: Solve for y .

$$6x + 4y = 24$$

$$6x - 6x + 4y = -6x + 24$$

$$4y = -6x + 24$$

$$\frac{4y}{4} = \frac{-6x + 24}{4}$$

$$y = -\frac{3}{2}x + 6$$

INEQUALITIES

- Show one quantity is larger than another

$$\text{EX: } x > 7 \quad 3x < 12$$

Sometimes one quantity is greater than or equal to another value.

$$\text{EX: } m \geq 4 \quad 4n \leq -16$$

The following phrases are used with "greater than":

• Less than / more than

• Less than / greater than

• Up to / down to

The following phrases are used with "greater than or equal to":

• Greater (less) than or equal to

• No more (no less) than

• Up (down) to and including

DIVIDING & MULTIPLYING BY A NEGATIVE NUMBER

- Reverse the direction of the inequality sign

EX: Solve for n .

$$-7n > 49$$

$$\frac{-7n}{-7} > \frac{49}{-7}$$

$$n < -7$$

GRAPHING ON A NUMBER LINE

When graphing $m > 6$, note that the point at 6 is an open dot.

When graphing $x \leq 2$, note that the point at 2 is a closed dot.

Whenever the point is open, the point is not part of the solution.

Filled-in dots are part of the solution.



ABSOLUTE VALUE

Solve and graph absolute value inequalities.

$$\text{EX: Solve and graph } |m - 2| \geq 6$$

$$m - 2 \geq 6 \quad -(m - 2) \geq 6$$

$$m \geq 8 \quad -m + 2 \geq 6$$

$$m \leq 4$$

$$m \leq -4$$

$$\text{EX: Solve and graph } |x + 1| < 6$$

$$x + 1 < 6 \quad -(x + 1) < 6$$

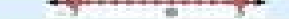
$$x < 5 \quad -x - 1 < 6$$

$$-x < 7$$

$$x > -7$$

This answer will take the form of a compound inequality.

$$-7 < x < 5$$



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Albert A Gayle



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