

Category 1 – Numbers, Operations, and Reasoning

PLACE VALUE, INTEGERS, AND NUMBER LINE

whole numbers				decimals											
billions	millions	thousands	ones	tenths	hundredths	thousandths									
H T O	H T O	H T O	H T O	tenths	hundredths	thousandths									
3	8	1	6	5	9	0	5	5	8	7	0	.	5	8	2

H represents the hundreds place, **T** is the tens place, and **O** is the ones place. Commas separate the whole number sections. A decimal point separates whole numbers from decimals.

integers: whole numbers, their opposites, and 0 **Examples:** -2, -1, 0, 1, 2

number line: tool used to locate, order, add, and subtract numbers; numbers increase from left to right; positive numbers (+ sign or no sign) are to the right of zero; negative numbers (- sign) are to the left of 0

Example: A girl standing at point B moves 4 units to the left. What is her final position? **Answer:** -2



COMPARING AND ORDERING NUMBERS

Symbol	Meaning	Example
=	is equal to	46,745 = 46,745
>	is greater than	46,745 > 46,475
<	is less than	46,475 < 46,745
≥	is greater than or equal to	1.2 and 1.3 are both ≥ 1.2
≤	is less than or equal to	45 and 43 are both ≤ 45

- Write each number you want to compare on its own line.
- Line up the same place values in the same column.
- Starting from the left, compare the value of the digits in each column.
- If numbers in a certain column are the same, move to the next column (to the right) and compare those numbers (until you find a difference).
- Compare the different numbers.

Example: Compare 384,786.722 to 384,863.183
 384,786.722 From left to right, the digits in the thousands, hundreds, and tens places are the same. The digit in the tenths place is different. 7 is less than 8. So, 384,786.722 < 384,863.183

Order numbers of the same form from least to greatest (14.2, 14.6, 14.9) or from greatest to least (14.9, 14.6, 14.2).

ROUNDING AND ESTIMATING

- Find the place to which you are rounding (the target place).
- Look at the number in the place right of it.
- If that number is 5 or greater, round up. If that number is less than 5, round down.

Examples: Round 134.85 to the nearest whole number.
 134.85 rounds to 135 because 8 is greater than 5.
 134.85 rounds to 134.8 because 5 is less than 5.

When you do not need an exact answer, you can estimate numbers by rounding to a given place value (ones, hundreds, thousands, or thousandths).
Example: Reggie earns \$50 per hour. He has \$21. How much more money does he need to buy a video game that costs \$70? **Answer:** \$49

ADDITION AND SUBTRACTION

Rock Sample	Mass (g)
A	33.24
B	985.06
C	198.2

Example 1: What is the total mass of Rock A and Rock C?
Answer 1: 1,216.52 g
Example 2: How much greater is the mass of Rock B than the mass of Rock A?
Answer 2: 951.84 g

fraction addition and subtraction: **Example:** Find $\frac{1}{2} + \frac{1}{4}$
 add or subtract only the numerators of fractions with a common denominator; do not add or subtract denominators
 $\frac{1}{2} = \frac{2}{4}$ and $\frac{1}{4} = \frac{1}{4}$
 So, $\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$

MULTIPLICATION AND DIVISION

multiplication: method to combine numbers; multiply factors together to result in a product; multiply columns starting at the right and then regroup (carry); use a zero as a placeholder.
Example: Show $2 \times 3 = 6$
 $2 \times 3 = 6$ or $2 \times 3 = 6$

division: method to split a number into parts; a number divided by a divisor results in a quotient and a remainder; decide where to place the decimal point; multiply the digit of the quotient by the divisor, subtract and compare; bring down the next digit of the dividend and compare; the remainder is not divided by the divisor.
Example: How many cakes are there if 254 cakes are on 12 trays?
 $254 \div 12 = 21 \text{ R } 2$

rate: comparison of two or more quantities using two different units.
Example: A car wash can wash 2 cars in 3 hours. At this rate, how many cars can it wash in 8 hours?
 $\frac{2 \text{ cars}}{3 \text{ hours}} = \frac{x \text{ cars}}{8 \text{ hours}}$
Answer: 12 cars

decimals: numbers that describe parts of a whole.
Example: $\frac{1}{10} = 0.1$
Example: $\frac{4}{100} = 0.04$
Example: $\frac{3523}{1000} = 3.523$
Example: $\frac{16}{1000} = 0.016$

mixed number: number that includes a whole number and a fraction; to multiply a mixed number, multiply the denominator by the whole number and add the product to the numerator; divide this sum (the new numerator) over the denominator.
Example: Write $5\frac{1}{2}$ as a fraction. $5\frac{1}{2} = \frac{11}{2}$

numerator: number above the fraction bar.
Example: $\frac{3}{4}$
denominator: number below the fraction bar.
Example: $\frac{3}{4}$
common denominator: number that is a common multiple (product of a number and another number) of the denominators of two or more fractions.
Example: 12 is a common denominator of $\frac{1}{3}$ and $\frac{1}{4}$.

comparing fractions: compare the sizes of the numerators of fractions with a common denominator.
Example: Since $11 > 5 > 1$, then $\frac{11}{10} > \frac{5}{10} > \frac{1}{10}$

FACTORS AND MULTIPLES

factor: number that divides another number.
Example: 2 and 5 are factors of 10.
simplest form: numerator and denominator have no common factor greater than 1.
Example: The simplest form of $\frac{3}{5}$ is $\frac{3}{5}$.

exponent: number of times a number (base) is multiplied by itself.
Example: $5^3 = 5 \times 5 \times 5 = 125$ where 5 is the base and 3 is the exponent.

prime number: number whose only factors are itself and 1.
Example: 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 139, 149, 151, 157, 163, 167, 173, 179, 181, 187, 191, 193, 197, 199

composite number: number that has factors besides itself and 1; the number 1 is considered neither prime nor composite.
Examples: 6, 8, 9, 10, 12, 14, 15, 16, 18, 20, 21, 22, 24, 25, 26, 27, 28, 30, 32, 33, 34, 35, 36, 38, 39, 40, 42, 44, 45, 46, 48, 49, 50, 52, 54, 55, 56, 57, 58, 60, 62, 63, 64, 65, 66, 68, 69, 70, 72, 74, 75, 76, 77, 78, 80, 81, 82, 84, 85, 86, 87, 88, 90, 91, 92, 93, 94, 95, 96, 98, 99, 100, 102, 104, 105, 106, 108, 110, 111, 112, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 128, 129, 130, 132, 133, 134, 135, 136, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200

factor tree: diagram showing a number's prime factors until only prime numbers remain.
Example: 20 = 5 x 4 = 5 x 2 x 2 = 5 x 2²

greatest common factor: largest factor shared by two numbers.
Example: Find the greatest common factor (GCF) of 8 and 20.
 factors of 8: 1, 2, 4, 8; factors of 20: 1, 2, 4, 5, 10, 20 **Answer:** The GCF is 4.

least common multiple: smallest multiple for numbers being compared.
Example: Find the least common multiple of 3 and 4.
Answer: 12

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