

## C-BASE MATHEMATICS REVIEW GUIDE

### TERMINOLOGY REVIEW

#### Classification of Numbers

Integers:	positive and negative whole numbers $\{-5, -6/3, 0, \sqrt{9}, 4\}$
Rational:	can be written in the form of a fraction $\{-7/5, -1, 0, 1.2, 3, 5.12\}$
Irrational:	non-repeating, non-terminating decimals; not rational $\{-0.010010001\dots, \pi, \sqrt{2}\}$
Real:	rational and irrational numbers
Imaginary:	complex numbers, $a+bi$ , where $a, b$ are real numbers and $i = \sqrt{-1}$
Prime:	Only integer factors are itself and 1 ex. 2, 3, 5 are prime 4, 6 are not prime

#### Properties of Real Numbers

Commutative Property:	Reverses the order of the numbers $a + b = b + a$ or $ab = ba$
Associative Property:	$a + (b + c) = (a + b) + c$ or $a(bc) = (ab)c$
Distributive Property:	$a(b + c) = ab + ac$ or $(b + c)a = ba + ca$
Identity Property:	$a + 0 = a = 0 + a$ or $a \bullet 1 = a = 1 \bullet a$
Transitive Property:	If $a = b$ and $b = c$ , then $a = c$ ex. $x=y$ and $y=3$ , then $x=3$

#### Set Theory

Set:	A collection of objects, such that each object in the set meets a certain criteria. {elements}
Finite set:	A set with a limited number of elements; you can count the elements. ex. $\{1, 2, 3\}$
Infinite set:	A set with an unlimited number of elements. ex. Whole numbers, real numbers

Empty set: A set with no elements; also called the null set

Union:  $\cup$  Set of elements that appear in either set.

Intersection:  $\cap$  Set of elements that appear in both sets at the same time.

## **ALGEBRA**

### Order of Operation

*Please Excuse My Dear Aunt Sally*

P: Parentheses Simplify all expressions inside parentheses.  
This includes all grouping symbols  $\{[()]\}$  and the fraction bar. If more than one grouping symbol is present, work your way from inside out.

E: Exponents Calculate all exponents second. An exponent is a shorthand notation used to represent repeated multiplication.

In the expression  $a^n$ , 'a' is called the base, and 'n' is the exponent or power.

$$a^4 = a \cdot a \cdot a \cdot a \quad \text{ex. } 2^4 = 2 \cdot 2 \cdot 2 \cdot 2 = 16$$

$$\text{and } (-2)^4 = (-2) \cdot (-2) \cdot (-2) \cdot (-2) = 16$$

$$\text{but } -2^4 = -(2 \cdot 2 \cdot 2 \cdot 2) = -(16) = -16$$

M: Multiplication

D: Division Multiplication and Division are considered higher order operations and are to be done prior to addition and subtraction. When they appear in a problem they should be performed in order from left to right.

A: Addition

S: Subtraction Addition and Subtraction are of the lowest order of operations. They are to be performed last and in the order they appear in the problem.

## **PROBABILITY AND STATISTICS**

### Terminology

Probability: The estimation of how likely an event is to happen.

Mean: The average.

Median: Value in ordered set that is in the middle of the values.  
ex.  $\{1, 2, 4, 5, 6\} = 4$

Mode: Most common value in a distribution.

Independent events: Two events that have no influence on one another.  
ex. If my first child is male, the probability of my second child being female is still 50%.  
The gender of my first child has not influenced the gender of any following children.

Mutually exclusive events: Two events that cannot happen at the same time.  
ex. A flipped coin will either land on heads or tails; it cannot be both at the same time.

Range: The difference between the lowest and highest value in an ordered set of values.

### Basic Concepts

1. Find the probability that "A" will happen out of "B" choices:

$$\frac{a = \text{the number of "A" items}}{b = \text{the total number of items}} = \frac{a}{b}$$

2. Find the probability that "A" will happen out of "B" choices "C" number of times, with replacement:

$$\frac{a}{b} \cdot \frac{a}{b} \cdot \dots \cdot \frac{a}{b} = \left(\frac{a}{b}\right)^c$$

3. Find the probability that "A" will happen out of "B" choices, and "D" will happen out of "E" choices at the same time:

$$\frac{a}{b} \cdot \frac{d}{e}$$

4. In how many ways can "B" be done if each part of "B" has "A" choices:

$$\text{Parts of } B = B_1 B_2 B_3 \dots B_n$$

$$\text{Choices per part: } A_1 A_2 A_3 \dots A_n$$

$$\text{Number of ways: } A_1 \cdot A_2 \cdot A_3 \dots \cdot A_n$$

## **GEOMETRY**

### Terminology

Congruent: Two shapes that are exactly the same size and shape.

Similar: Figures that have the same shape but not the same size.

Cube: Dice; a 3-D figure with 6 sides where all sides are squares.

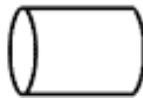
Rectangular solid: a box; four sides are rectangle and the bases are squares.

Sphere: globe, ball; all points of surface are equally distant from the center.

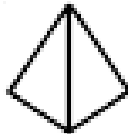
Cone: ice cream cone



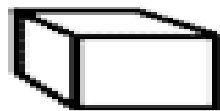
Cylinder: tin can; bases are congruent circles.



Pyramid: base is a polygon, sides are congruent, isosceles triangles



Prism: Bases are polygons, and sides are rectangles.



Circle: Set of all points in a plane that are the same distance from a given point.

Radius: The distance from the center to a point on the circle.

Chord: A line segment that connects two points on a circle.

Diameter: A chord through the center of the circle; its length equals two times the radius.

Arc: A part of a circle.

ex. Semicircle (half of the circle)

minor arc (less than a semicircle)

major arc (greater than a semicircle)

Triangles:

Right Triangles: Triangles that have a right angle, can use Pythagorean theorem.

Acute Triangles: Triangles that have three acute angles.

Obtuse Triangles: Triangles that have one obtuse angle

Equilateral Triangles: All three sides are the same length and all three angles are the same.

Isosceles Triangles: Triangles that has have two sides that are the same length.

Scalene Triangles: Triangles where all three sides have different lengths.

Hypotenuse: The longest leg of a right triangle; the leg opposite the right angle.

Polygons: A figure formed by line segments, usually named accordingly to number of sides.

Regular: All angles and sides are equal.

Quadrilateral: Any four-sided polygon, sum of angles is 360 degrees.

Parallelogram: Quadrilateral with opposite sides parallel.

Rectangle: Quadrilateral with four right-angles; a parallelogram with right angles.

Rhombus: Parallelogram with all sides equal.

Square: A quadrilateral with four equal sides and four right angles.

Trapezoid: Quadrilateral with one pair of parallel sides.

Diagonal: A line segment that joins two vertices of a polygon.

## WORD PROBLEM GUIDE

### 1. "Plan of Attack" for solving word problems

1. READ the problem carefully.
2. DEFINE all variables needed.
3. ORGANIZE the information.
4. TRANSLATE the information into an equation.
5. SOLVE the equation.
6. ANSWER the question completely with an appropriate statement.
7. CHECK your answer to see if it makes sense.

### 2. Key words for translating "English" to "Algebra"

#### ADDITION

$5 + 5 = 10$   
sum (10); addends (5, 5)

#### SUBTRACTION

$5 - 3 = 2$   
difference (2); minuend (5); subtrahend (3)

#### MULTIPLICATION

$4 \times 3 = 12$   
product (12); multiplier (4); multiplicand (3)

#### DIVISION

$12 \div 3 = 4$   
quotient (4); dividend (12); divisor (3)

#### EQUALITY

is; was; is the same as; is equal to; equals; totals

INEQUALITIES

a is greater than b;	$a > b$	
a is less than b;	$a < b$	
a is at most b;	$a \leq b$	
a is at least b;	$a \geq b$	
a is greater than or equal to b;		$a \geq b$
a is less than or equal to b;		$a \leq b$

C-BASE PRACTICE MATH PROBLEMS

1. Which set is infinite?

- A) the set of all integers
- B) the set of positive whole numbers less than 10
- C) { 0 }
- D) {2, 4, 6, 8}

2. What expression means the same as "3 more than 5 times a number is 1 less than twice that number"?

- A)  $3(5+x) = 1 - 2x$
- B)  $3 + 5x = 1 - 2x$
- C)  $5x + 3 = 2x - 1$
- D)  $3 + 5x = 2(x - 1)$

3. Simplify:  $3 - [4 - (3^2 - 2 \cdot 5)]$

- A) 0
- B) -2
- C) 18
- D) 34

4. Solve for x:  $-3x - 12 = 36 - 7x$

- A)  $x = -\frac{24}{5}$
- B)  $x = 12$
- C)  $x = -\frac{12}{5}$
- D)  $x = 6$

5. Solve for  $x$ :  $2x - 8 \geq 5x - 2$

- A)  $x \leq -2$       B)  $x \geq -2$       C)  $x \geq 2$       D)  $x \geq \frac{10}{7}$

6. Solve for  $x$ :  $2x^2 - 4x = 3$

- A)  $x = 1 \pm \sqrt{40}$       B)  $x = \frac{4 \pm \sqrt{8}}{4}$       C)  $x = \frac{4 \pm \sqrt{40}}{4}$       D)  $x = \pm 1$

7. A dress that ordinarily costs \$82 is now offered at a 20% discount. If sales tax is 5%, what is the total cost of the dress now on sale?

- A) \$65.10      B) \$65.60      C) \$68.88      D) \$69.70

8. Susan left Georgetown for Mt. Vernon at 1:00 in the afternoon. She traveled at 50 miles per hour for the first 62.5 miles. She stopped for 20 minutes and then drove at 60 miles per hour for 150 miles. At what time in the afternoon did Susan arrive in Mt. Vernon?

- A) 2:32      B) 4:05      C) 5:05      D) 5:35

9. At 4 p.m. an 8-story building casts a shadow 36 feet long. At the same time a yardstick casts a shadow 16 inches long. How tall is the building?

- A) 81 feet      B) 16 feet      C) 64 feet      D) 162 feet

**C-BASE PRACTICE MATH PROBLEMS  
ANSWER SHEET**

1. A  
2. C  
3. B

$$\begin{aligned} &3 - [4 - 3^2 - 2 \cdot 5] \\ &3 - [4 - (9 - 10)] \\ &3 - [4 - (-1)] \\ &3 - [5] \\ &-2 \end{aligned}$$

4. B

$$\begin{aligned} -3x - 12 &= 36 - 7x && \text{(add } 7x \text{ to both sides)} \\ +7x & && +7x \\ 4x - 12 &= 36 && \text{(add 12 to both sides)} \\ +12 & && +12 \\ \frac{4x}{4} &= \frac{48}{4} && \text{(divide both sides by 4)} \\ x &= 12 \end{aligned}$$

5. A

$$\begin{aligned} 2x - 8 &\geq 5x - 2 && \text{(subtract } 2x \text{ from both sides)} \\ -2x & && -2x \\ -8 &\geq 3x - 2 && \text{(add 2 to both sides)} \\ +2 & && +2 \\ \frac{-6}{3} &\geq \frac{3x}{3} && \text{(divide both sides by 3)} \\ -2 &\geq x \end{aligned}$$

6. C

$$\begin{aligned} 2x^2 - 4x &= 3 \\ 2x^2 - 4x + 2 &= 3 + 2 \\ 2x^2 - 4x + 2 &= 5 \\ x &= \frac{-(-4) \pm \sqrt{(-4)^2 - (4 \cdot 2 \cdot 5)}}{2 \cdot 2} \\ x &= \frac{4 \pm \sqrt{16 + 20}}{4} \\ x &= \frac{4 \pm \sqrt{36}}{4} \end{aligned}$$

7. C

$$\begin{aligned}\text{discount} &= 20 * \$82 \\ &= \$16.40 \text{ discount} \\ \text{discount price} &= \$82 - \$16.40 \\ &= \$65.60 \\ \text{tax} &= .05 * \$65.60 \\ &= \$3.38 \\ \text{total sale price} &= \$65.60 + \$3.28 = \$68.88\end{aligned}$$

8. C

$$\begin{aligned}62.5 \text{ miles} * (1 \text{ hour}/50 \text{ miles}) &= 1.25 \text{ hours} = 1 \text{ hour } 15 \text{ minutes} \\ 20 \text{ minute stop} & \\ 150 \text{ miles} * (1 \text{ hour}/60 \text{ miles}) &= 2.50 \text{ hours} = 2 \text{ hours } 30 \text{ minutes} \\ 3 \text{ hours } 65 \text{ minutes} &= 4 \text{ hours } 5 \text{ minutes} + 1:00 \text{ start time} \\ &= 5:05 \text{ arrival}\end{aligned}$$

9. A

$$\text{building shadow} = 36 \text{ feet} * (12 \text{ inches}/1 \text{ foot}) = 432 \text{ inches}$$

$$\frac{\text{yardstick shadow}}{\text{building shadow}} = \frac{\text{yardstick length}}{\text{building length}}$$

$$\frac{16 \text{ inches}}{432 \text{ inches}} = \frac{36 \text{ inches}}{x} \qquad \frac{16x}{16} = \frac{15552}{16}$$

$$x = 972 \bullet \frac{1 \text{ foot}}{12 \text{ inches}} = 81 \text{ feet}$$