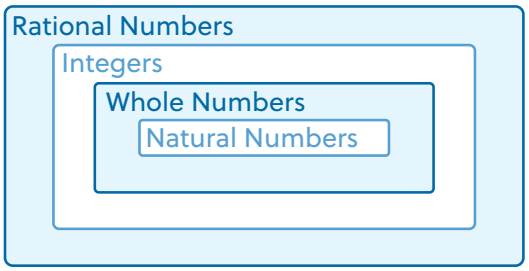
# TACHS MATH CRAM SHEET

## NUMBER BASICS




Each number system is a subset another.

A rational number is also a real number, a real number is also a complex number, etc.

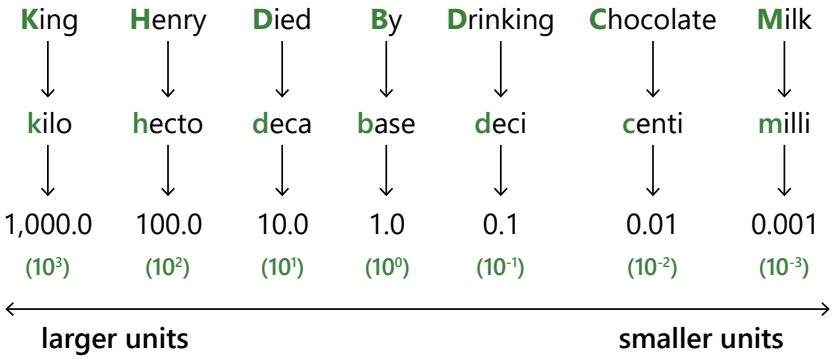
| Number Class | Definition | Examples |
|---|---|---|
| Natural numbers | The number 1 or any number obtained by adding 1 to it one or more times. | 1, 2, 3, 4, 5, ... |
| Whole Numbers | Whole numbers do not include fractions or decimal parts and is a positive integer or zero. | 0, 1, 2, 3, 4, 5, ... |
| Integers | Any whole number or its opposite. | ..., −5, −4, −3, −2, −1, 0, 1, 2, 3, 4, 5, ... |
| Rational numbers | A number can that be expressed as a ratio or fraction. | • 2/10.6<br>• 3/10<br>• 2.957 |
| Real Numbers | A number that has no imaginary part. All real numbers can be located on a number line. | • −92<br>• 5/9<br>• √2 |
| Complex Numbers | $a + bi$ where $a$ and $b$ are real numbers and $i$ (imaginary number) is a formal square root of −1 ($i$= √-1, $i^2$ = -1) | • -1 + 2$i$<br>• 7 - 9$i$<br>• -6$i$ |

**Place Value**

| Place | thousands | hundreds | tens | ones | tenths | hundredths | thousandths |
|---|---|---|---|---|---|---|---|
| Value | 1,000 | 100 | 10 | 1 | 0.1 | 0.01 | 0.001 |

## METRIC CONVERSIONS

Metric units are multiples of 10s. To convert to a larger unit, divide numbers by base of 10s. To convert to a smaller unit, multiply numbers by base of 10s.



# TACHS MATH CRAM SHEET

## DISTANCE

1 ft = 12 in

1 in = 2.54 cm

1 yd = 3 ft

1 m ≈ 3.28 ft ≈ 1.09 yd

1 mi = 5,280 ft ≈ 1.61 km

## CAPACITY

1 oz ≈ 28.35 g

1 cup = 8 oz

2 cups = 1 pint

2 pints = 1 quart

4 quarts= 1 gallon

1 gallon ≈ 3.8 L

## WEIGHT

1 lb = 16 oz

1 kg ≈ 2.2 lb ≈ 35.27 oz

1 t = 2,000 lb ≈ 907.19 kg

## TEMPERATURE

$°F = \frac{9}{5}(°C) + 32$

$°C = \frac{9}{5}(°F) - 32$

## FACTORS

**What is a factor?**

A whole number is a factor of another whole number if it divides it evenly.

**Greatest common factor (GCF)**

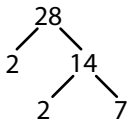
The greatest common factor of two or more whole numbers is the largest number that is a factor of them all.

7: 1, 7

28: 1, 2, 7, 14

**GCF: 7**

**Factor Tree**




## MULTIPLES

**What is a multiple?**

A whole number is a multiple if it is the result of multiplying another whole number by an integer.

**Least Common Multiple (LCM)**

The least common multiple of two or more whole numbers is the smallest number that is a multiple of them all.

3: 3, 6, 9, 12, 15, 18, 21, 24

7: 7, 14, 21, 28, 35, 42, 49, 56

**LCM: 21**

### Multiples of 3

| × | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | multiplication |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 3 × 1 = 3 |
| 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 3 × 2 = 6 |
| 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 3 × 3 = 9 |
| 4 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 3 × 4 = 12 |
| 5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 3 × 5 = 15 |
| 6 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 3 × 6 = 18 |
| 7 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 3 × 7 = 21 |
| 8 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 3 × 8 = 24 |

### Multiples of 7

| × | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | multiplication |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 7 × 1 = 7 |
| 2 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 7 × 2 = 14 |
| 3 | 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 7 × 3 = 21 |
| 4 | 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 7 × 4 = 28 |
| 5 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 7 × 5 = 35 |
| 6 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 7 × 6 = 42 |
| 7 | 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 7 × 7 = 49 |
| 8 | 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 7 × 8 = 56 |

# GED® MATH CRAM SHEET

## FRACTIONS

**Proper Fraction**
$\frac{1}{8}$ Numerator is less than the denominator

**Improper Fraction**
$\frac{8}{3}$ Numerator is greater than the denominator

**Mixed Number**
$3\frac{1}{8}$ Whole number and proper fraction together

### Add or subtract fractions with different denominators

1. Change to equivalent fractions with common denominators using a scale factor
2. Add or subtract following the rules for fractions with the same denominators

$$\frac{A}{B} + \frac{C}{D} = \frac{AD}{BD} + \frac{BC}{BD} = \frac{AD + BC}{BD}$$

$$\frac{A}{B} - \frac{C}{D} = \frac{AD}{BD} - \frac{BC}{BD} = \frac{AD - BC}{BD}$$

### Add or subtract fractions with the same denominators

1. Add or subtract the numerators
2. Keep the denominator the same
3. Simplify if possible

$$\frac{A}{B} + \frac{C}{B} = \frac{A + C}{B}$$

$$\frac{A}{B} - \frac{C}{B} = \frac{A - C}{B}$$

### Multiply fractions

1. Multiply the numerators
2. Multiply the denominators
3. Simplify

$$\frac{A}{B} \times \frac{C}{D} = \frac{A \times C}{B \times D}$$

### Divide fractions

1. Keep the first fraction as is
2. Change from division to multiplication
3. Flip the second fraction to its reciprocal
4. Follow multiplication of fractions rules

$$\frac{A}{B} \div \frac{C}{D} = \frac{A}{B} \times \frac{D}{C} = \frac{A \times D}{B \times C}$$

### Convert Mixed Number

$$4\frac{2}{8} = \frac{(4 \times 8) + 2}{8} = \frac{34}{8} = \frac{17}{4}$$

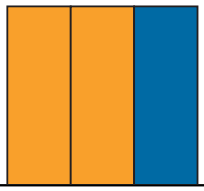
Keep the original denominator when converting a mixed number to an impromper fraction.

Simplify if needed.

# TACHS MATH CRAM SHEET

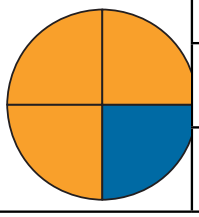
## RATIOS AND PROPORTIONS

### Ratios

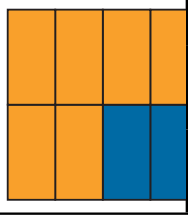


| Part to part | | Part to whole | |
|---|---|---|---|
| 2:1 | 1:2 | 2:3 | 1:3 |
| 2/1 | 1/2 | 2/3 | 1/3 |
| 2 to 1 | 1 to 2 | 2 to 3 | 1 to 3 |

### Proportions

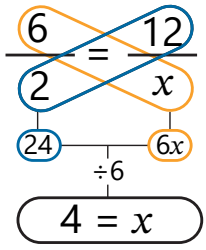


| | | | |
|---|---|---|---|
| 3:4 | = | 6:8 | |
| 3:4 | :: | 6:8 | |
| 3 is to 4 | as | 6 is to 8 | |



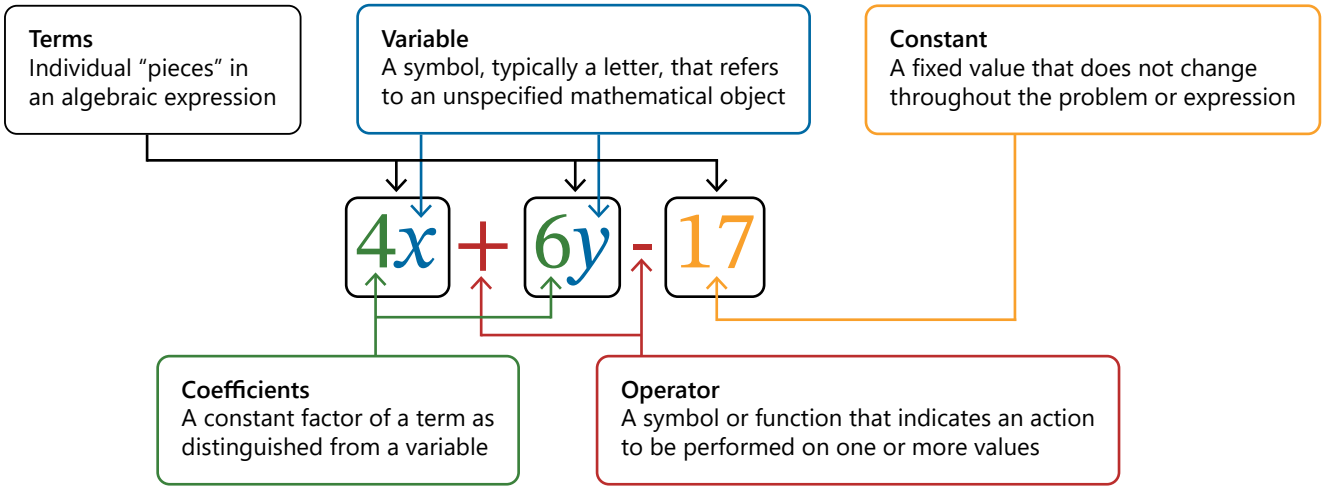
### Calculating Proportions

$$\frac{6}{2} = \frac{12}{?}$$




$$\frac{6}{2} = \frac{12}{4}$$

## ALGEBRAIC EXPRESSION




## FOIL METHOD

Using the FOIL method on binomials: $(x + 2)$ and $(x - 3)$

| | | | | | |
|---|---|---|---|---|---|
| F | Multiply the first terms of each binomial | $(x + 2)(x + (-3))$ | → | $(x)(x)$ | $= x^2$ |
| O | Multiply the outer terms | $(x + 2)(x + (-3))$ | → | $(x)(-3)$ | $= -3x$ |
| I | Multiply the inner terms | $(x + 2)(x + (-3))$ | → | $(2)(x)$ | $= 2x$ |
| L | Multiply the last terms of each binomial | $(x + 2)(x + (-3))$ | → | $(2)(-3)$ | $= -6$ |

# TACHS MATH CRAM SHEET

## SOLVING LINEAR EQUATIONS

### 1. Distribute

Distribute factors across terms in parentheses.

$$\underbrace{2 \times (3x + 2)}_{6x \;\; 4} + 2x + 8 = 14 + 5x$$

Equivalent Equation

$$6x + 4 + 2x + 8 = 14 + 5x$$

### 2. Collect Terms

Check if there are like terms to combine.

$$\underbrace{6x + 4 + 2x}_{8x} + \underbrace{8}_{12} = 14 + 5x$$

Equivalent Equation

$$8x + 12 = 14 + 5x$$

### 3. Move Variables

Gather all $x$-terms on one side of the equation by performing inverse operations on both sides of the equation.

$$\underbrace{8x}_{3x} \underbrace{- 5x}_{3x} + 12 = 14 + \underbrace{5x}_{0} \underbrace{- 5x}_{0}$$

Equivalent Equation

$$3x + 12 = 14$$

### 4. Isolate

Isolate the variable by performing inverse operations on both sides of the equation

| Operation | | Inverse Operation | |
|---|---|---|---|
| Addition | + | − | Subtraction |
| Subtraction | − | + | Addition |
| Multiplication | × | ÷ | Division |
| Division | ÷ | × | Multiplication |

***Subtraction***

$$3x + \underbrace{12}_{-12 = 0} = 14 \; | -12 = 2$$

Equivalent Equation

$$3x = 2$$

***Division***

$$\underbrace{3x}_{\div 3 = x} = 2 \; | \div 3 = \frac{2}{3}$$

Answer

$$x = \frac{2}{3}$$

### 5. Check

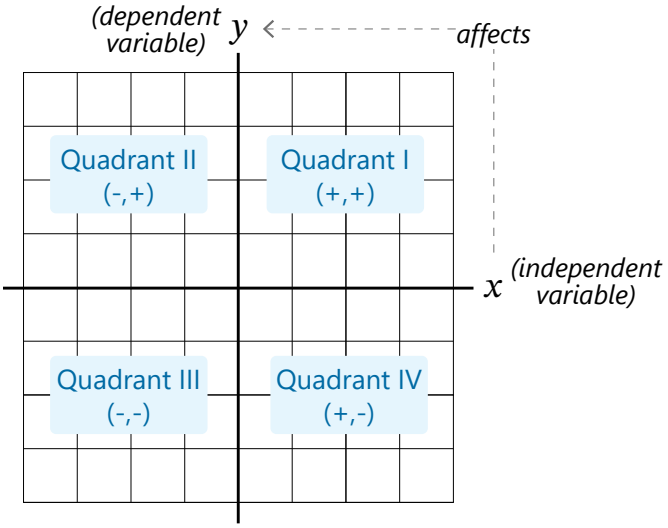
Substitute the solution back into the original equation to verify it works.

$$\underbrace{2 \times (3 \times \tfrac{2}{3} + 2) + 2 \times \tfrac{2}{3} + 8}_{\frac{52}{3}}$$

$$\underbrace{14 + 5\tfrac{2}{3}}_{\frac{52}{3}}$$

# TACHS MATH CRAM SHEET

## SLOPE AND LINEAR EQUATIONS




**Slope**

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{rise}{run}$$

**Slope Intercept Form**

$y = mx + b$

$m$ = slope
$b$ = $y$-intercept

**Distance Formula**

$d = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$

**Point-Slope Form**

$y - y_1 = m(x - x_1)$

$m$ = slope
$(x_1, y_1)$ = point coordinates

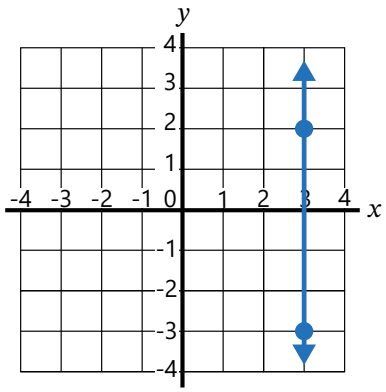
**Midpoint Formula**

$M = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$

**Undefined Slope**

$m = \frac{-3 - 2}{3 - 3} = \frac{-5}{0}$

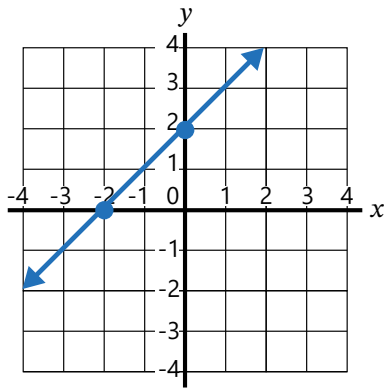
*m = undefined*




**Positive Slope**

$m = \frac{2 - 0}{0 - (-2)} = \frac{2}{2}$

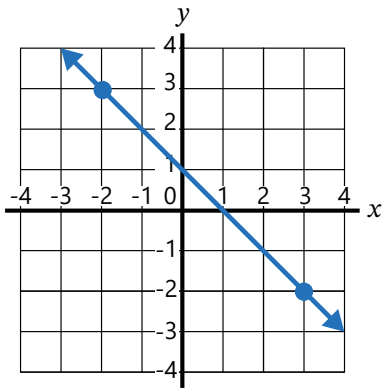
*m = 1*




**Negative Slope**

$m = \frac{-2 - 3}{3 - (-2)} = \frac{-5}{5}$

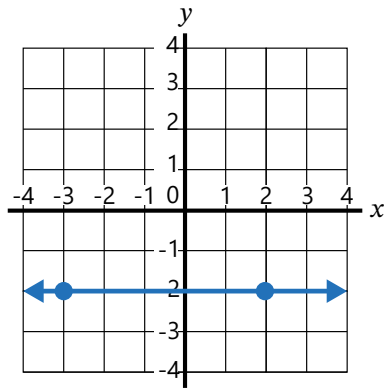
*m = -1*




**Slope of Zero**

$m = \frac{-2 - (-2)}{-3 - 2} = \frac{0}{-5}$

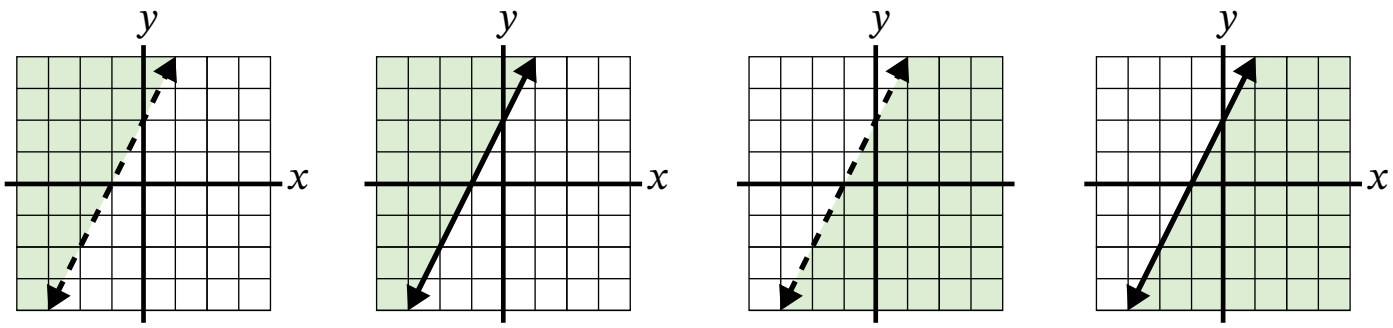
*m = 0*



# TACHS MATH CRAM SHEET

## GRAPHING LINEAR INEQUALITIES

| Greater Than | Greater Than or Equal To | Less Than | Less Than or Equal To |
|---|---|---|---|
| $>$ | $\geq$ | $<$ | $\leq$ |




| $y > 2x + 2$ | $y \geq 2x + 2$ | $y < 2x + 2$ | $y \leq 2x + 2$ |
|---|---|---|---|

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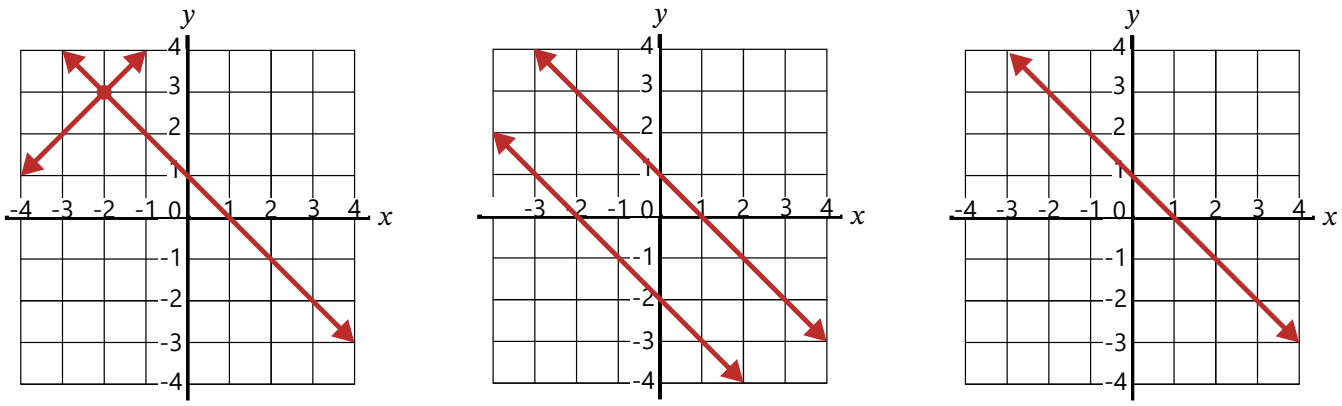
## SYSTEMS OF EQUATIONS

| One Solution | No Solutions | Infinitely Many Solutions |
|---|---|---|
| $y = -x + 1$<br>$y = x + 5$ | $y = -x + 1$<br>$y = -x - 2$ | $y = -x + 1$<br>$3y = -3x + 3$ |




| *Consistent Independent* | *Inconsistent* | *Consistent Dependent* |
|---|---|---|

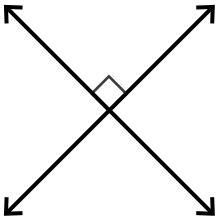
# TACHS MATH CRAM SHEET

## LINES

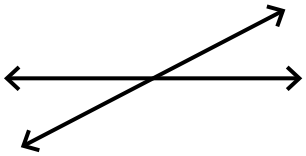
**Line**
a set of points that extends infinitely in two opposite directions

**Segment**
is a portion of a line that has definite endpoints

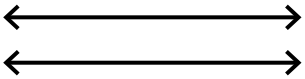
**Ray**
a portion of a line that extends infinitely from a single point on that line in one direction along the line



**Perpendicular**
lines that intersect at right angles



**Intersecting**
lines that have exactly one point in common



**Parallel**
are lines in the same plane that have no points in common and never meet

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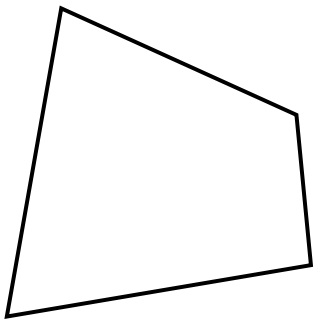
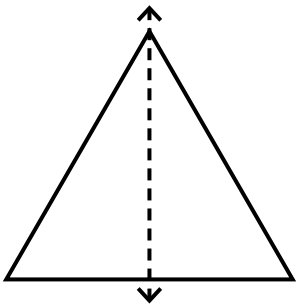
## LINE OF SYMMETRY

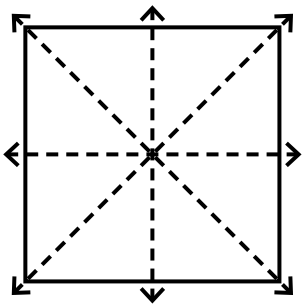
A line that divides a figure or object into congruent parts that are mirror images of each other across the line is called a line of symmetry. An object may have no lines of symmetry, one line of symmetry, or multiple lines of symmetry.



**None**



**One**



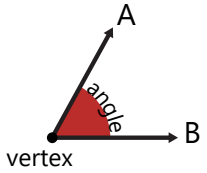
**Multiple**

# TACHS MATH CRAM SHEET

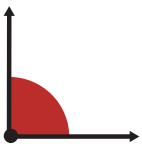
## ANGLES

**An angle** is formed when two lines or line segments meet at a point.

**A vertex** is the point at which two segments or rays meet to form an angle.




### Right

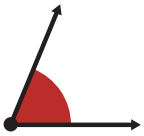


An angle with a degree measure of exactly 90°

### Straight

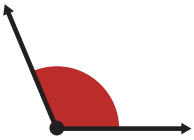
An angle with a degree measure of exactly 180°

### Acute



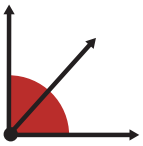
An angle with a degree measure less than 90°

### Obtuse



An angle with a degree measure greater than 90° but less than 180°

### Complementary



Two angles whose sum is exactly 90°

### Supplementary

Two angles whose sum is exactly 180°

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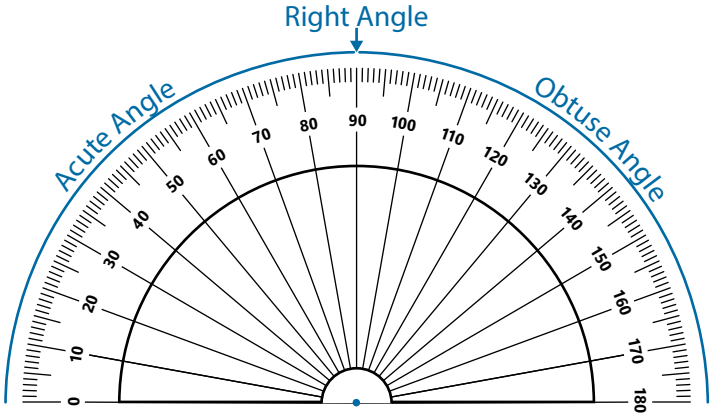
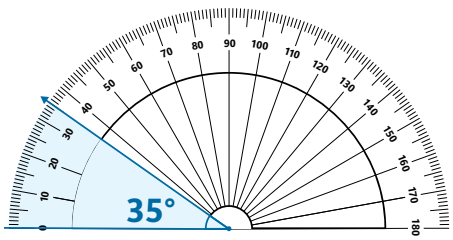
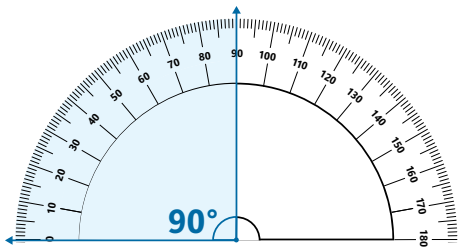
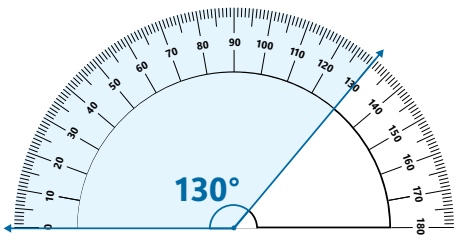
## PROTRACTORS

A protractor is primarily used to measure how wide or narrow an angle is, in degrees (from 0° to 180°).



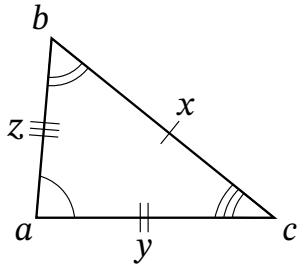



# TACHS MATH CRAM SHEET

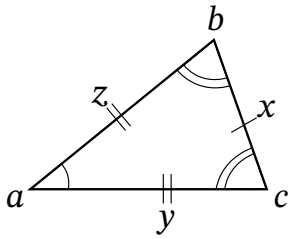
## POLYGONS

### Triangles

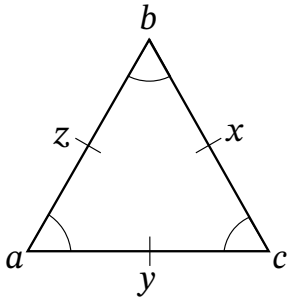
The sum of the interior angles of any triangle is always 180 degrees.




**Scalene Triangle**
No equal side lengths or angles




**Isosceles Triangle**
Two equal side lengths and angles

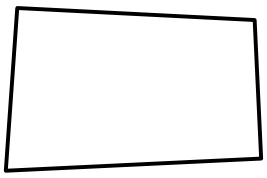



**Equilateral Triangle**
Three equal side lengths and angles

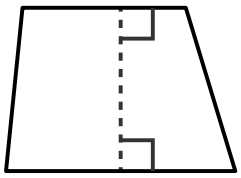
---

### Quadrilaterals

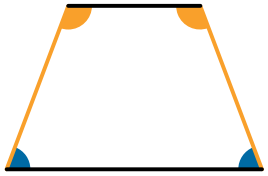
The sum of the interior angles of any simple quadrilateral is always 360 degrees.



**Trapezium**
No sides are parallel and opposite angles are equal

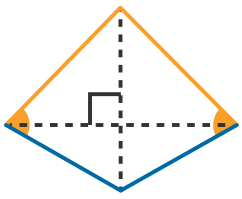


**Trapezoid**
At least one pair of opposite sides are parallel

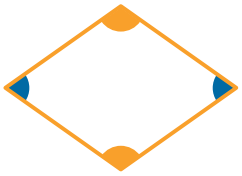


**Isosceles Trapezoid**
One pair of opposite sides are parallel, and the base angles are equal in measure

**Parallelogram**
Two pairs of parallel sides

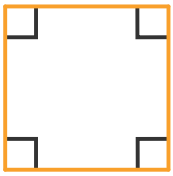


**Kite**
Two pairs of adjacent sides are of equal length



**Rhombus**
All four sides are of equal length and opposite angles are equal

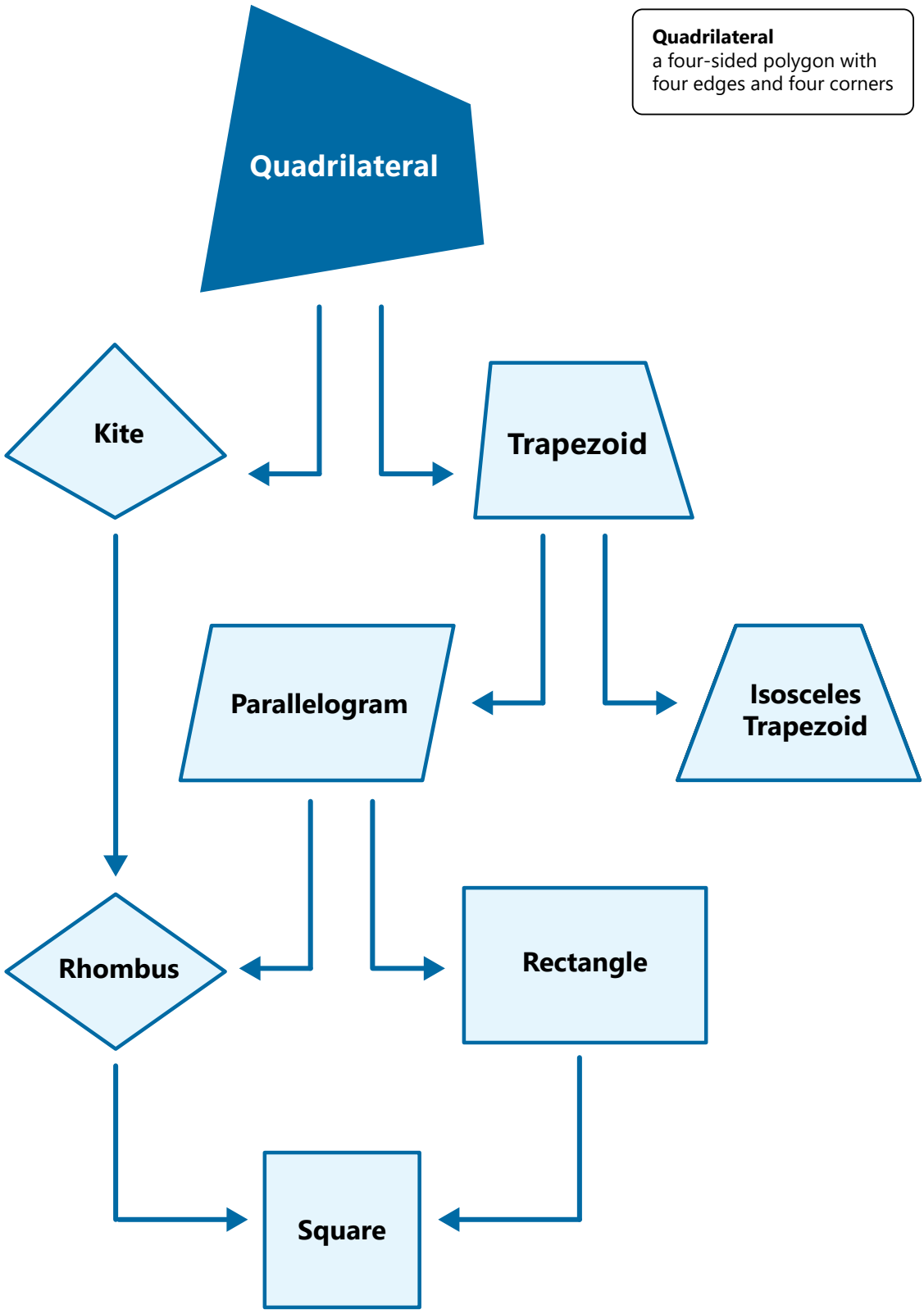
**Rectangle**
All four angles are right angles



**Square**
All four sides are of equal length, and all four angles are right angles

# TACHS MATH CRAM SHEET

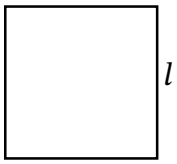
## Quadrilateral Hierarchy



# TACHS MATH CRAM SHEET

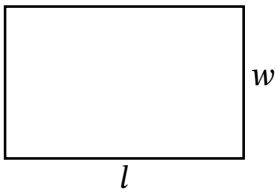
## AREA

**Square**



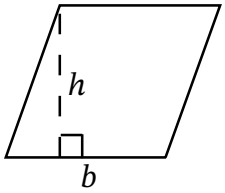

$A = l^2$

**Rectangle**



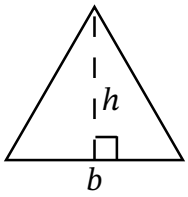

$A = lw$

**Parallelogram**



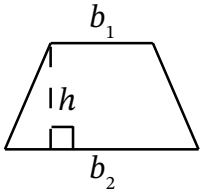

$A = bh$

**Triangle**



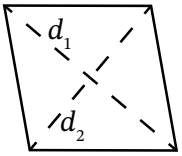

$A = \frac{1}{2}bh$

**Trapezoid**



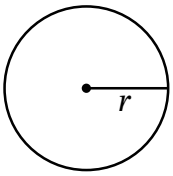

$A = \frac{1}{2}(b_1 + b_2)h$

**Rhombus**



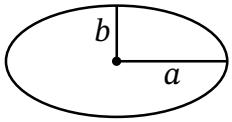

$A = \frac{1}{2}(d_1 \times d_2)$

**Circle**




$A = \pi r^2$

**Ellipse**



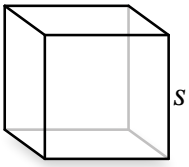

$A = \pi ab$

**Perimeter**
The sum of all sides of a shape

**Circumference**
The distance around a circle ($C=2\pi r$)

## VOLUME AND SURFACE AREA

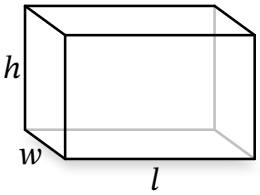
**Cube**




$V = s^3$

$SA = 6s^2$

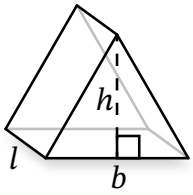
**Rectangular Prism**




$V = l \times w \times h$

$SA = 2(lw+lh+hw)$

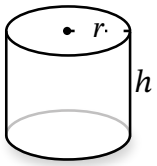
**Triangular Prism**




$V = \frac{b \times h \times l}{2}$

$SA = lsa + 2\ (area\ of\ base)$

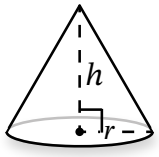
**Cylinder**




$V = \pi r^2 h$

$SA = 2\pi r(r + h)$

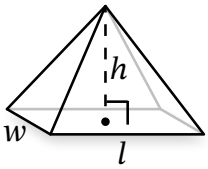
**Cone**




$V = \frac{\pi r^2 h}{3}$

$SA = \pi rs + \pi r^2$

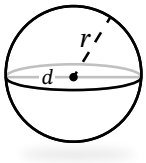
**Rectangular Pyramid**




$V = \frac{l \times w \times h}{3}$

$SA = lsa + area\ of\ base$

**Sphere**




$V = \frac{4}{3}\pi r^3$

$SA = 4\pi r^2$

**LSA (Lateral Surface Area)**
The sides of a three-dimensional shape, excluding any bases

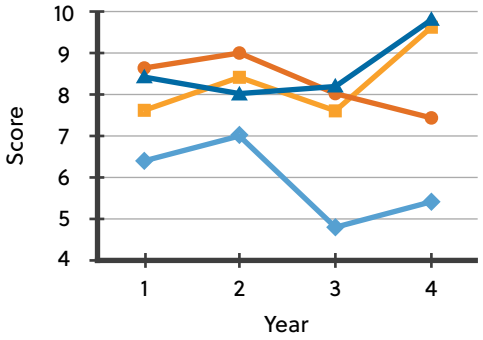
**Base**
The face of a shape perpendicular to the direction height is measured

# TACHS MATH CRAM SHEET

## CHARTS

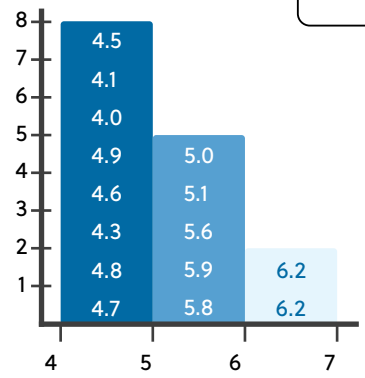
### Line Graph

Shows trends in data collected over time



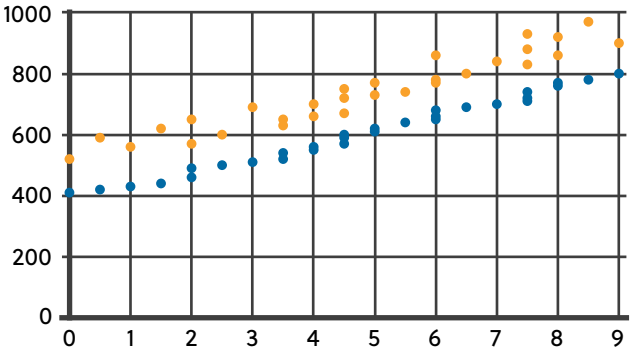

### Histogram

Shows distrubtion of data collected over time.



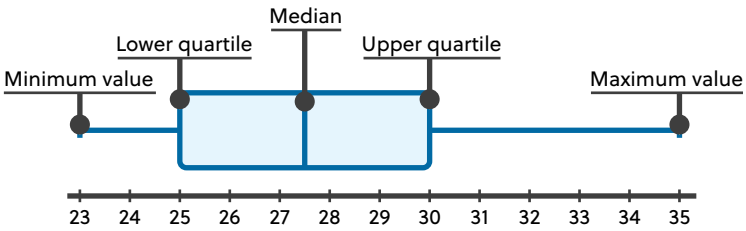

### Scatter Plot

Shows relationship between two variables



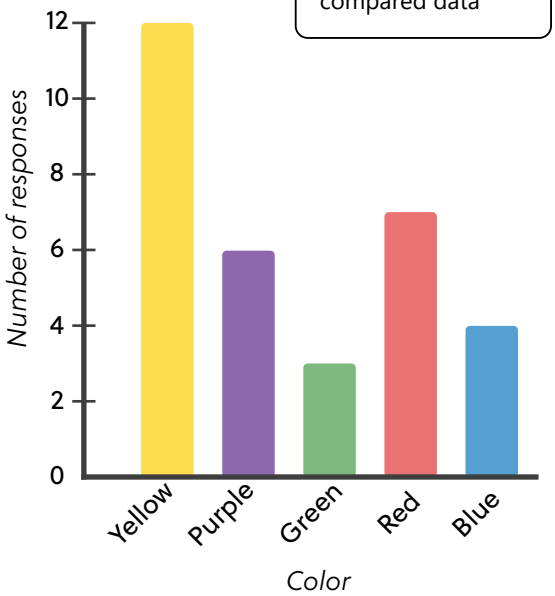

### Box Plot

Shows statistical distribution



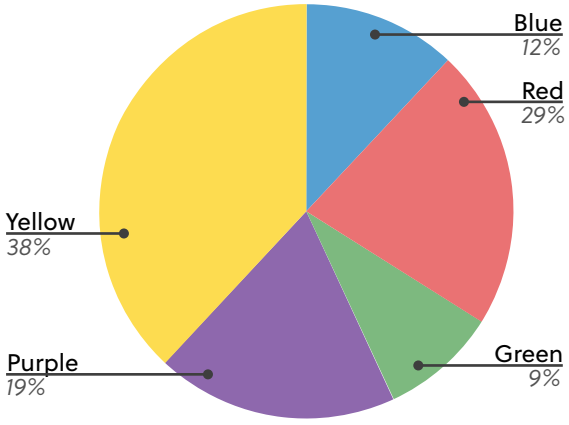

### Bar Chart

Shows categorically compared data




### Pie Chart

Shows proportional parts of data collected

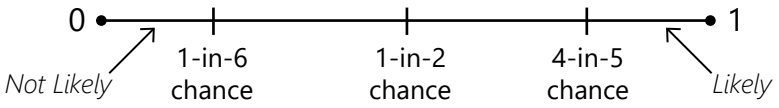


# TACHS MATH CRAM SHEET

## PROBABILITY

$$P(A) = \frac{\text{Number of acceptable outcomes}}{\text{Number of possible outcomes}}$$

| Impossible Event | The Probability of an Event | Certain Event |
|---|---|---|
| P(A) = 0 | $0 \le P(A) \le 1$ | If P(A) = 1 |



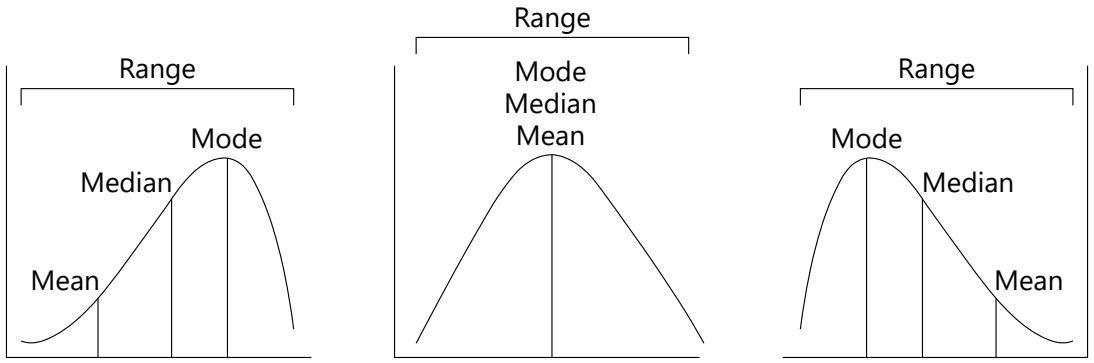

## STATISTICS

**Mean**
sum of all items / total number of items

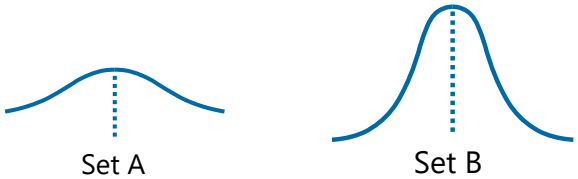
**Range (Spread)**
Distance between smallest and largest item

**Mode**
Most/common item

**Median**
Middle item when ordered from least to greatest




Greater spread equals greater deviation.




**Margin of Error**
sample statistic ± margin of error with confidence level of XX%

# TACHS MATH CRAM SHEET

## ADDITIONAL FORMULAS

| Formula Name | Formula |
|---|---|
| Geometric Sequence | $a_n = a_1 \times r^{n-1}$<br><br>$a_n$ = the value of the nth term<br>$a_1$ = the value of the initial term<br>$r$ = the common ratio<br>$n$ = the number of terms |
| Arithmetic Sequence | $a_n = a_1 + (n\text{-}1)d$<br><br>$a_n$ = the value of the nth term<br>$a_1$ = the value of the initial term<br>$n$ = the number of terms<br>$d$ = the common difference between terms |

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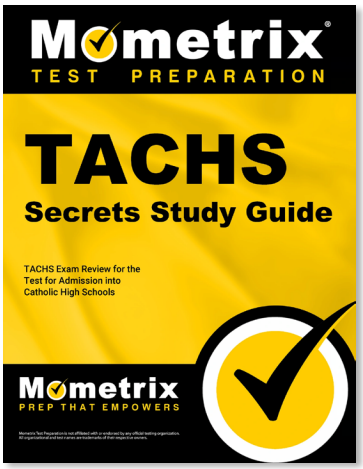
Need more resources? Scan the QR codes below to check out test prep materials from Mometrix that are specifically designed to help you ace the TACHS.




**TACHS Study Guide**

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