

Math Formula Cheat Sheet

Distance/Rate Problems

Distance = (rate)(time)

Mnemonic: "DIRT"

D = Distance

R=Rate

T=Time

$$\text{Average Rate} = \frac{\text{Total Distance Traveled}}{\text{Total Time}}$$

*Important Formula

Graphing Formulas

Slope Formulas:

$y = mx + b$, $m = \text{slope}$ and $b = \text{y-intercept}$

$$y_2 - y_1 = m(x_2 - x_1) \rightarrow m = \frac{y_2 - y_1}{x_2 - x_1}$$

Parallel lines: Slopes must be equal

Perpendicular lines: slopes will be negative reciprocal (flipped)

Distance between two points = make a right triangle and solve for the hypotenuse, or:

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

Midpoint = average together the x values and the y values, or:

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

Conversions

$$K = ^\circ C + 273 \text{ and } ^\circ F = \frac{9}{5}(^\circ C) + 32$$

$$0^\circ C = 32^\circ F \text{ and } -40^\circ C = -40^\circ F$$

$$1 \text{ in} = 2.54 \text{ cm}$$

$$1 \text{ mile} = 5280 \text{ ft}$$

$$1 \text{ ft} = 12 \text{ in}$$

$$1 \text{ yard} = 3 \text{ ft}$$

$$1 \text{ m} = 1.1 \text{ yd}$$

$$1 \text{ kg} = 2.2 \text{ lbs}$$

$$1 \text{ lb} = 454\text{g} = 16 \text{ ounces}$$

Dilution Problems

$$C_1V_1 = C_2V_2$$

C = Concentration, V = Volume

*Can use with any concentration unit (Molarity, molality, % concentration)

Quadratic Equations

For any equation in the format $ax^2 + bx + c = 0$,

$$(x + y)^2 = x^2 + 2xy + y^2$$

$$(x - y)^2 = x^2 - 2xy + y^2$$

$$(x + y)(x - y) = x^2 - y^2$$

Exponent Rules

- $(x^a)(x^b) = x^{a+b}$
- $\frac{x^a}{x^b} = x^{a-b}$
- $(x^a)^b = x^{a \times b}$
- $(x^b)(y^b) = (xy)^b$
- $\left(\frac{x}{y}\right)^b = \left(\frac{x}{y}\right)^b$

Log Rules

- $\log(x) + \log(y) = \log(x \cdot y)$
- $\log(x) - \log(y) = \log\left(\frac{x}{y}\right)$
- $\log_a(x^b) = b \cdot \log_a(x)$
- When solving a log problem, remember:
 - $\log x = b$ can be solved as $x = 10^b$

Percent Increase/Decrease:

$$\left(\frac{x_2 - x_1}{x_1}\right) \times 100\% = \text{percent change}$$

Percent Increase/Decrease Word Problems

"of" = multiplication

"equal to" = equal sign

Example: 30% of 100 is equal to x

$$(0.30)(100) = x$$

Probability

Combination vs. Permutation:

You use **combination** when the order **does not** matter. (B,C,A / A,B,C / C,B,A **are** the same)

You use **permutation** when the order **does** matter. (B,C,A / A,B,C / C,B,A are **not** the same)

$$\text{Combination formula} = \frac{n!}{(n-k)! (k!)}$$

n = number of objects from which you can choose

k = number of objects to be chosen

$$\text{Permutation formula} = \frac{n!}{(n-k)!}$$

Dice Problems

Rolling 2 Dice: Total number of permutations = $(6)(6) = 36$

Ex) What is the probability of rolling two dice and having the two numbers add to 4?

Three possibilities: 2+2, 1+3, and 3+1. Therefore probability = $3/36 = 1/12$

Deck of Cards

Total # of Cards = 52 (without jokers)

4 suits (heart, club, ace, diamond)

13 cards per suit

With Replacement – Total number of cards must go back to 52 and cards of interest must go back to initial amount

Without Replacement – Must decrease total number of cards by 1 and decrease number of cards of interest by one

Ex) Probability of pulling 3 spades in a deck without replacement?

$$\frac{13}{52} \times \frac{12}{51} \times \frac{11}{50} = \frac{33}{2550}$$

Letter Problems

Ex) How many ways can the letters in APPALOOSA be arranged?

If no repeating letters = 9!

If repeating letters, we must divide by the factorials of numbers of repeats:

Repeats of A = 3

Repeats of P = 2

Repeats of O = 2

Number of Total Probability = $\frac{9!}{3! \times 2! \times 2!} = 15120$

Statistics

Mean: average

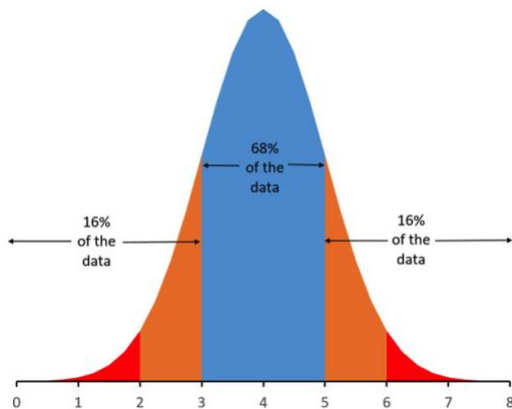
Median: middle number of a set of data (remember to order them numerically and then find the middle number)

Mode: number that occurs most often in a set

$$\text{st. dev} = \sigma = \sqrt{\frac{\sum(x - x_{\text{avg}})^2}{N}}$$

variance = σ^2

In a normal distribution, 68% of the data fall within 1 standard deviation of the mean. 95% of the data fall within 2 standard deviations of the mean, and 99.7% of the data fall within 3 standard deviations of the mean.



Rate Problems

When two things travel toward each other, we need to add the two velocities together.
Ex) Train 1 going East 50 mph. Train 2 going West on 40 mph. They are 135 miles apart.
How long before they collide?

$$t = \frac{135 \text{ miles}}{40 \text{ mph} + 50 \text{ mph}} = \frac{135}{90} = 1.5 \text{ hours}$$

Data Sets

U = union. Includes all data but excludes duplicate values

$$\text{Ex) } x = \{1,2,3\} \text{ and } y = \{1,3,4\}$$

$$X \cup Y = \{1,2,3,4\}$$

\cap = intersection. Includes only data that exists in **both** x and y.

$$\text{Ex) } x = \{1,2,3\} \text{ and } y = \{1,3,4\}$$

$$X \cap Y = \{1,3\}$$

Geometry

Area formulas

$$\text{Circle} = \pi r^2, r = \text{radius}$$

$$\text{Sphere} = 4\pi r^2$$

$$\text{Surface Area of a Cylinder} = 2\pi r h + 2\pi r^2, h = \text{height of cylinder}$$

$$\text{Triangle} = \frac{1}{2}(bh), b = \text{base and } h = \text{height of triangle}$$

$$\text{Equilateral triangle} = \frac{s^2\sqrt{3}}{4}, s = \text{side of triangle}$$

$$\text{Sum of interior angles of a polygon} = (n - 2)(180^\circ) \text{ where } n = \text{number of sides}$$

Volume Formulas

$$\text{Sphere} = \left(\frac{4}{3}\right)\pi r^3$$

$$\text{Cylinder} = \pi r^2 h$$

$$\text{Cone} = \left(\frac{1}{3}\right)\pi r^2 h$$

$$\text{Pyramid} = \frac{1}{3}(\text{Area}_{\text{base}})(h)$$

$$\text{If a square pyramid} = \frac{1}{3}(s^2)h$$

Trigonometry

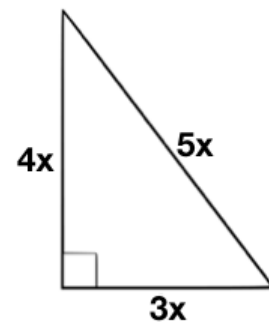
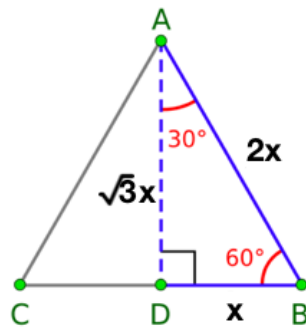
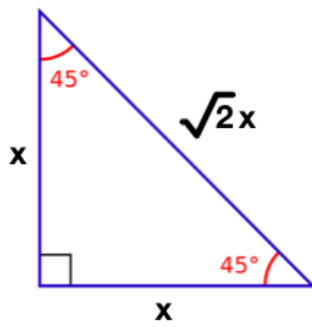
$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan A = \frac{\text{opposite}}{\text{adjacent}}$$

$$\frac{\sin A}{\cos A} = \tan A$$

Must know triangles



Combined Work Questions

$$\frac{1}{t_1} + \frac{1}{t_2} + \frac{1}{t_3} \dots = \frac{1}{t_{total}}$$

Ex. If Tom gets a job done in 4 hours (t_1) and Jerry gets it done in 3 hours (t_2), how many hours does it take to get the job done working together (t_{total})?

$$\frac{1}{4 \text{ hours}} + \frac{1}{3 \text{ hours}} = \frac{1}{t_{total}}$$

$$\frac{3}{12 \text{ hours}} + \frac{4}{12 \text{ hours}} = \frac{1}{t_{total}}$$

$$\frac{7}{12 \text{ hours}} = \frac{1}{t_{total}}$$

$$(7)(t_{total}) = (12 \text{ hours})(1)$$

$$t_{total} = \frac{12 \text{ hours}}{7} = \frac{12}{7} \text{ hours} = 1.714 \text{ hours}$$

Simple and Compound Interest

Simple Interest	Compound Interest
$I = PRT$	$FV = PV(1+r)^n$
I = Interest	FV = Future Value
P = Principal (Initial) Amount	PV = Present Value
R = Annual Rate	$r = \text{annual interest rate}$
T = Time in years	$n = \text{number of periods}$

Compound Interest Example:

If the interest is compounded quarterly (every 3 months), and the length of the investment is one year, then $n = 4$ periods.