Math Formula Cheat Sheet

Distance/Rate Problems

$\text{Distance} = (\text{rate})(\text{time})$
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 = slope and b = y-intercept
$y_2 - y_1 = m(x_2-x_1)$ → $m = \frac{y_2-y_1}{x_2-x_1}$
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:
$m = [\left(\frac{x_1 + x_2}{2}\right), \left(\frac{y_1 + y_2}{2}\right)]$

Conversions

K = °C +273 and °F = $\frac{9}{5}(°C) + 32$
$0°C = 32°F$ and $-40°C = -40°F$
1 in = 2.54 cm
1 mile = 5280 ft
1 ft = 12 in
1 yard = 3 ft
1 m = 1.1 yd
1 kg = 2.2 lbs
1 lb = 454g = 16 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

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

Log Rules

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

Percent Increase/Decrease:

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

Percent Increase/Decrease Word Problems

"of" = multiplication
"equal to" = equal sign
Example: 30% of 100 is equal to x
$(0.30)(100) = x$

Data Sets

∪ = union. Includes all data but excludes duplicate values

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

X∪Y= {1,2,3,4}

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

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

X∩Y= {1,3}

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)

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

n = number of objects from which you can choose

k = number of objects to be chosen

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 = $\frac{9!}{3!\times2!\times2!}=15120$

Statistics

Mean: average

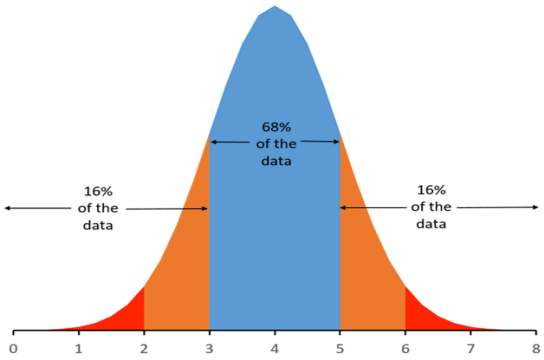
Median: middle number of a set of data (remember to order them numerically and then find the middle number)

Mode: number that occurs most often in a set

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

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?

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

Geometry

Area formulas

Circle = πr^2, r = radius

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

Volume Formulas

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

Cylinder = $\pi r^2 h$

Trigonometry

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

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

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

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

Combined Work Questions

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

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})?

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

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

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

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

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

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 = ***annual*** interest rate
T = Time in years	n = 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.