CRAM CREW

ACT FORMULA SHEET

Arithmetic and Algebra

Properties of Exponents and Radicals

$a^n \cdot a^m = a^{n+m}$ $\quad \frac{a^n}{a^m} = a^{n-m}$ $\quad (a^n)^m = a^{nm}$ $\quad (ab)^n = a^n b^n$

$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$ $\quad a^{-n} = \frac{1}{a^n}$ $\quad \frac{1}{a^{-n}} = a^n$ $\quad \left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$

$\sqrt[n]{a} = a^{\frac{1}{n}}$ $\quad \sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$ $\quad \sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$ $\quad \sqrt[n]{a^m} = a^{\frac{m}{n}}$

Generic Formulas

Quadratic Formula: For $ax^2 + bx + c = 0$, $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

Event Probability: $\frac{\text{Desired Outcomes}}{\text{Possible Outcomes}}$

Percent Growth/Decay: $\text{Original}(1 \pm r_1)(1 \pm r_2)\ldots$

In Percent Growth or Decay, r_1, r_2, ... are the percents an amount is being changed by each year, month, etc.

Arithmetic Mean: $\frac{\text{Sum of Terms}}{\text{Number of Terms}}$

Distance: $\text{Distance} = \text{Rate} \cdot \text{Time}$

Percent Change: $\frac{\text{New - Old}}{\text{Old}} \cdot 100\%$

Arithmetic Sequence/Series

Common Difference: $d = a_{n+1} - a_n$

Find the n^{th} term: $a_n = a_1 + (n - 1)d$

Sum the first n terms: $S_n = \frac{n}{2}(a_1 + a_n)$

Geometric Sequence/Series

Common Ratio: $r = \frac{a_{n+1}}{a_n}$

Find the n^{th} term: $a_n = a_1 r^{n-1}$

Sum the first n terms: $S_n = a_1\left(\frac{1 - r^n}{1 - r}\right)$

Counting and Ordering

Combination (Order Doesn't Matter): ${}_nC_r = \frac{n!}{r!(n - r)!}$

Permutation (Order Does Matter): ${}_nP_r = \frac{n!}{(n - r)!}$

Remember, n is the number of choices you have, and r is how many you are going to choose.

Properties of Logarithms

$\log_a a^x = x$

$x\log_a y = \log_a y^x$

$\log_a x + \log_a y = \log_a(xy)$

$\log_a x - \log_a y = \log_a\left(\frac{x}{y}\right)$

Geometry

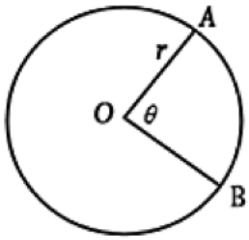
The Circle

Area: $A = \pi r^2$

Circumference: $C = 2\pi r$

Arc length: $L(A,B) = \frac{\theta}{360^\circ} \cdot 2\pi r$

Sector Area: $AOB = \frac{\theta}{360^\circ} \cdot \pi r^2$



Equation for circle with center (h, k) and radius r: $(x - h)^2 + (y - k)^2 = r^2$

Areas

Parallelogram: $A = bh$

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

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

Cube: $A = 6s^2$

Volumes

Cube: $V = s^3$

Rectangular Prism: $V = lwh$

Cylinder: $V = \pi r^2 h$

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

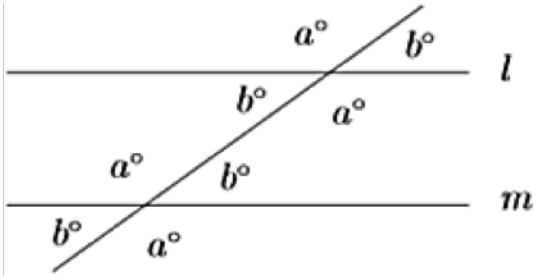
Angles

Sum of Interior Angles: $= 180(n - 2)^\circ$

Each Interior Angle: $= \frac{180(n - 2)^\circ}{n}$

Sum of Exterior Angles: $= 360^\circ$

Each Exterior Angles: $= \frac{360^\circ}{n}$



Lines

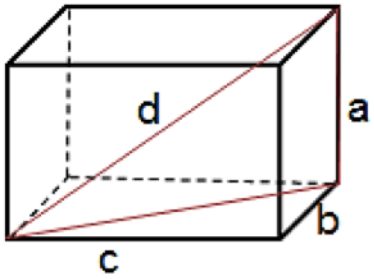
Slope of a Line: $m = \frac{y_2 - y_1}{x_2 - x_1}$

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

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

Pythagorean's Theorem in 3D

$d^2 = a^2 + b^2 + c^2$



Trigonometry

Pythagorean Theorem

Pythagorean Theorem $d^2 = a^2 + b^2 + c^2$

Trigonometric Ratios

$$\sin A = \frac{\text{opposite leg}}{\text{hypotenuse}} \qquad \csc A = \frac{\text{hypotenuse}}{\text{opposite leg}}$$

$$\cos A = \frac{\text{adjacent leg}}{\text{hypotenuse}} \qquad \sec A = \frac{\text{hypotenuse}}{\text{adjacent leg}}$$

$$\tan A = \frac{\text{opposite leg}}{\text{adjacent leg}} \qquad \cot A = \frac{\text{adjacent leg}}{\text{opposite leg}}$$