ACT Math Formula Sheet

Rules of Exponents

$x^m \cdot x^n = x^{m+n}$ $\quad \frac{x^m}{x^n} = x^{m-n}$

$(x^m)^n = x^{mn}$ $\quad x^0 = 1$

$x^{\frac{a}{b}} = \sqrt[b]{x^a}$ $\quad x^{-1} = \frac{1}{x}$ $\quad \frac{1}{x^{-1}} = x$

$4^{2x} = 8^{x+4}$ change to same base. Set exponents equal to each other and solve

Logarithm/Exponential

$log_b x = y \quad b^y = x \quad LOG = log_{10}\ ln = log_e$

$\log mn = \log m + \log n$

$\log \frac{m}{n} = \log m - \log n$

$\log m^n = n\log m$

Imaginary Numbers

$i = \sqrt{-1} \quad i^2 = -1$

Sequences

Arithmetic: $a_n = a_1 + (n-1)d$

Geometric: $a_n = a_1 \cdot r^{n-1}$

Arithmetic Sum: $S_n = \frac{n}{2}(2a_1 + (n-1)d)$

Absolute value Equation

$|x+5| = 3$

$x + 5 = 3 \quad x + 5 = -3$

Matrices

Add/Sub: Add/Sub corresponding locations

Multiply: Row of first times column of second

Determinant $\begin{bmatrix} a & b \\ c & d \end{bmatrix} = ad - cb$

To multiply, number of columns of first matrix must equal number of rows of second matrix

Uniform Motion

Distance = rate x time

Percent

$\frac{part}{whole} = \frac{percent}{100}$ $\quad$ p% of x = $\frac{p}{100}(x)$

Percent Change

$\frac{amount\ of\ change}{original\ amount} \times 100\%$

Statistics

Mean = $\frac{sum}{count}$

Mean of Frequency Distribution $\frac{\sum f \cdot x}{\sum f}$

Median: Least to greatest. Middle term

Mode: Number that appears the most

Range: Highest minus lowest

Standard Deviation: Measure of variation

Probability

$P(A) = \frac{Favorable\ Outcomes}{Total\ Possible\ Outcomes}$

$P(A\ or\ B) = P(A) + P(B) - P(A\ and\ B)$

$P(A\ and\ B) = P(A) \cdot P(B)$

Expected Value: $\sum x \cdot P(x)$

Counting Principle: m x n to do both things.

Combination: $nCr = \frac{n!}{r!(n-r)!}$

Permutation: $nPr = \frac{n!}{(n-r)!}$

Sum of Probability Distribution = 1

Given: Reduces total possible outcomes

Functions

$f(3)$ set x=3 and evaluate

Domain: The complete set of x values

Range: The complete set of y values

Domain Restrictions: **1)** division by zero **2)** square root of negative number **3)** Logarithm of zero or negative number

Vertical Asymptote

Located at x values that cause division by zero

Horizontal Asymptote

$\frac{x}{x^2} : y = 0 \quad \frac{ax^2}{bx^2} : y = \frac{a}{b} \quad \frac{ax^2}{bx}$: none/slant

Composition of Functions

$f(g(2))$ means to plug in 2 for x in the g(x) function then plug that result into the f(x) function

$f(g(x))$ means to replace the x's in the f(x) with g(x)

$f(g(x)) = 0$ means to find the x value that makes the composite function equal to zero

Function Translations

$f(x) + c$ shift up

$f(x) - c$ shift down

$f(x + c)$ shift left

$f(x - c)$ shift right

$-f(x)$ reflection about x axis

$f(-x)$ reflection about y axis

Linear Functions

Slope = $\frac{y_2 - y_1}{x_2 - x_1}$

Slope-Intercept Form: $y = mx + b$

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

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

Parallel: Same Slope

Perpendicular: Negative Reciprocal

Parabolas/Quadratics

Standard Form: $y = ax^2 + bx + c$

Vertex Form: $y = a(x-h)^2 + k$

Intercept Form: $y = a(x-p)(x-q)$

Find vertex: $h = -\frac{b}{2a} \quad k = f\left(-\frac{b}{2a}\right)$

If a positive, it's upward otherwise downward

Sum of solutions = $-\frac{b}{a}$

Trig Functions

$y = Asin(Bx) + D$

A = Amplitude

D = Vertical Shift

Period = $\frac{2\pi}{B}$

π radians = 180°

Trig Identities

$sin^2(\theta) + cos^2(\theta) = 1$

$\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)} \quad \sin(\theta) = cos\ (90 - \theta)$

$\tan(\theta) = \frac{\sin(\theta)}{\cos(\theta)} \quad \cos(\theta) = sin\ (90 - \theta)$

$\sec(\theta) = \frac{1}{\cos(\theta)} \quad \csc(\theta) = \frac{1}{\sin(\theta)}$

Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Discriminant Rules

$b^2 - 4ac > 0$ Two real roots

$b^2 - 4ac = 0$ One real root

$b^2 - 4ac < 0$ Two imaginary roots

Binomial Expansion

$$(x+y)^n = \sum_{k=0}^{n} \binom{n}{k} x^k y^{n-k}$$

Pascal's Triangle or Combination

Circle Arc $\frac{x}{360} \cdot$ Circumference

Circle Sector $\frac{x}{360} \cdot$ Area

where x = Central Angle

Geometry

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

Isosceles Triangle: Two sides congruent and corresponding angles congruent

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

Pythagorean Triplets: 3-4-5, 6-8-10, 5-12-13

Triangle: Interior angles sum is 180

Perimeter

Circle: $2\pi r = \pi d$

Area

Rectangle: L x W

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

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

Circle: πr^2

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

Parallelogram Properties

- Opposite sides parallel
- Opposite sides congruent
- Opposite angles congruent
- Consecutive angles add up to 180
- Diagonals bisect one another

SOHCAHTOA

$sine = \frac{opposite}{hypotenuse} \quad cosine = \frac{adjacent}{hypotenuse}$

$tangent = \frac{opposite}{adjacent}$

System of Linear Equations

One Solution: Difference Slopes

Multiple Solutions: Same slope and y-intercept

No Solutions: Same slope different y-intercepts

Special Right Triangles

30-60-90: $x, x\sqrt{3}, 2x$

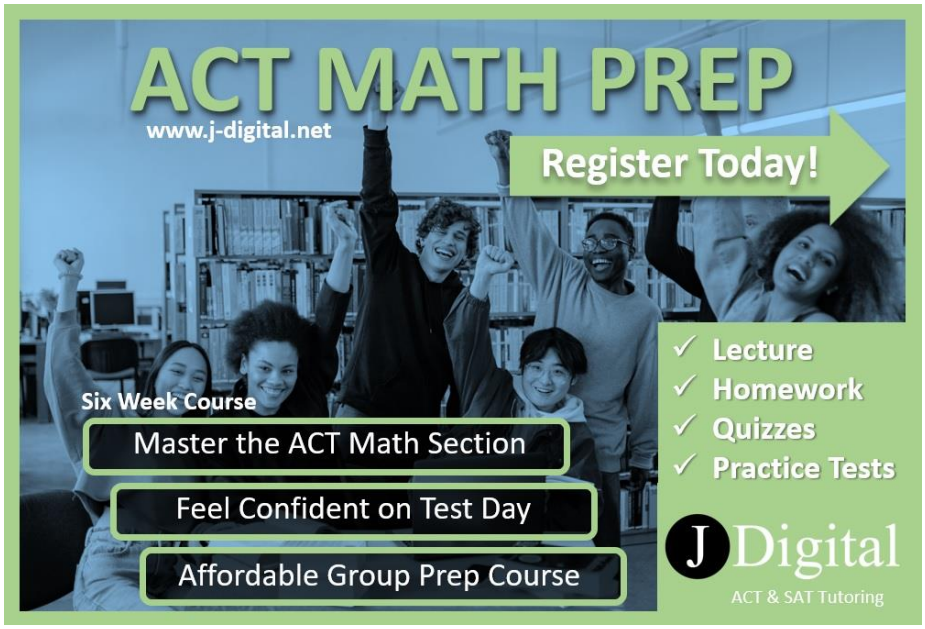
45-45-90: $x, x, x\sqrt{2}$

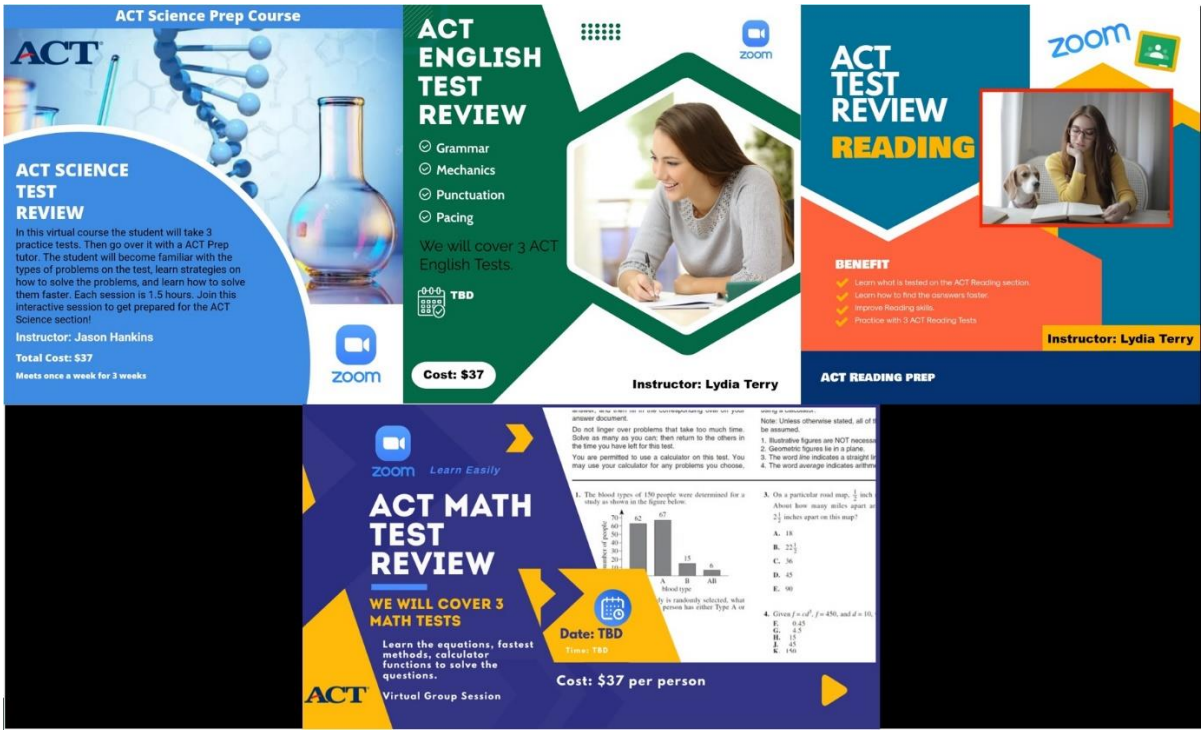
Circle: $(x-h)^2 + (y-k)^2 = r^2$

Ellipse: $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$

Law Of Sines: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$

Law of Cosines: $c^2 = a^2 + b^2 - 2abCos\ C$





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