ACT: Mathematics Formulas

Math Concepts to Review: decimals/place value, fractions/mixed numbers, integers (...-3, -2, -1, 0, 1, 2, 3...), scientific notation, factors (divide into a number without a remainder), multiples (skip count by a given number), ratios, proportions, percents (literally means "per 100"), P(G)EMDAS (order of operations), types of numbers (rational, irrational...), prime/composite, absolute value, square roots

Arithmetic Sequences: $t_n = t_1 + d(n-1)$ {e.g. 1, 3, 5, 7... where (d) is the common difference}

Geometric Sequences: $t_n = t_1 r^{(n-1)}$ {e.g. 1, 5, 25, 125... where (r) is the common ratio}

Statistics: mean (average; $\frac{sum\ of\ values}{number\ of\ values}$), median (middle number when data is arranged from least to greatest; find average of middle two if no single center data point), mode (value in data which occurs most in set), range (difference between max and min value in data set)

Probability: $\frac{favorable\ outcomes}{possible\ outcomes}$

Combinations: multiply choices

Average Speed: $d=rt$

Work: $w=rt$ **Combined Work:** $w=(r_1+r_2)t$

Exponents & Roots:

$$x^0 = 1 \qquad \frac{x^a}{x^b} = x^{a-b} \qquad (x^a)^b = x^{a \cdot b} \qquad (xy)^a = x^a \cdot y^a$$

$$x^a \cdot x^b = x^{a+b} \qquad x^{-a} = \frac{1}{x^a} \qquad \sqrt[a]{x} = x^{\frac{1}{a}} \qquad x^{\frac{b}{a}} = \sqrt[a]{x^b}$$

Lines: SLOPE OF A LINE $m = \frac{y_2 - y_1}{x_2 - x_1}$ or $\frac{\Delta y}{\Delta x}$ or $\frac{\text{rise}}{\text{run}}$

PARALLEL lines = same slope PERPENDICULAR lines = slopes are negative reciprocals

SLOPE-INTERCEPT FORM $y = mx + b$

POINT-SLOPE FORM $y - y_1 = m(x - x_1)$

MIDPOINT FORMULA $\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}$

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

Exponential Functions:

Growth/Decay {change percent (r) to decimal}

$$A(t) = A_o(1 \pm r)^t$$

Interest {n times for t years, A_o is initial value}

$$A(t) = A_o(1 \pm \frac{r}{n})^{nt}$$

Domain: set of possible x values

Range: set of possible y values

System of Equations: use elimination (linear combination/subtracting) or substitution; if answer is true there are infinite solutions (lines are same & slope and y-intercept are same), if answer is false there are no solutions (lines are parallel & slope is same but y-intercept is different), x = a # if lines intersect at one point

Factorial: 5! is read "5 factorial" and is solved by 5×4×3×2×1...most calculators have a factorial function

Complex Numbers: in the form a + b*i* where $i = \sqrt{-1}, \ i^2 = -1, \ i^3 = -i, \ i^4 = 1$

Multiply by the conjugate to rationalize the denominator: $(3 + 4i)(3 - 4i) = (9 - 16i^2) = 25$

Logarithms: $y = log_b x$ converts to exponent form $b^y = x$

$$log_b b^n = n \qquad log_b xy = log_b x + log_b y$$

$$log_b x^y = y log_b x \qquad log_b(\tfrac{x}{y}) = log_b x - log_b y$$

Change of base formula $\log_b(a) = \frac{\log_x(a)}{\log_x(b)}$

Parabolas: STANDARD FORM $y = ax^2 + bx + c$ Factor with "reverse FOIL" to solve $x^2 + (b+a)x + ab = (x+a)(x+b)$

or use the QUADRATIC FORMULA $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ vertex= $(-\frac{b}{2a}$, plug value back into equation)

VERTEX FORM $y = a(x - h)^2 + k$ vertex= (h, k)

FACTORED/ INTERCEPT FORM $y = a(x-p)(x-q)$ x-intercepts/zeroes/solutions=(p,0) & (q,0)
vertex=(midpoint of two zeroes, plug value back in to find y)

DISCRIMINANT This is the expression under the radical in the Quadratic Formula

$if\ b^2 - 4ac > 0\ then\ 2\ real\ solutions$

$if\ b^2 - 4ac = 0\ then\ 1\ real\ solution$

$if\ b^2 - 4ac < 0\ then\ 0\ real\ solutions,\ 2\ imaginary$

Circles: AREA OF CIRCLE $A = \pi r^2$ AREA OF SECTOR $\frac{n^\circ}{360} \cdot \pi r^2$

CIRCUMFERENCE OF CIRCLE $C = 2\pi r$ LENGTH OF ARC $\frac{n^\circ}{360} \cdot 2\pi r$

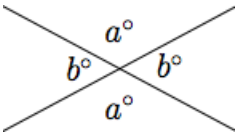
Circle= $360° = 2\pi$ radians Degrees to Radians= $degrees \cdot \frac{\pi}{180}$ Radians to Degrees= $radians \cdot \frac{180}{\pi}$

STANDARD FORM EQUATION OF A CIRCLE with center (h, k) and radius r is $(x - h)^2 + (y - k)^2 = r^2$

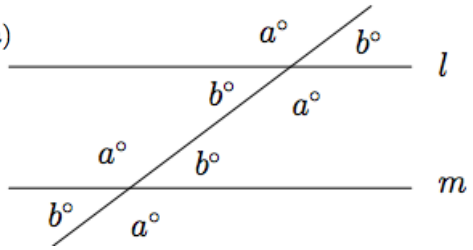
CENTRAL ANGLES are congruent to corresponding arc; INSCRIBED ANGLES are half of their corresponding arc measure.

Angles: SUM OF INTERIOR ANGLES $180(n - 2)^\circ$ SUM OF EXTERIOR ANGLES 360°

INTERSECTING LINES vertical (opposite) angles are congruent and linear pairs add to 180˚



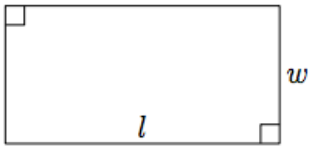
PARALLEL LINES $(l \parallel m)$ alternate interior, alternate exterior, and corresponding angles are congruent



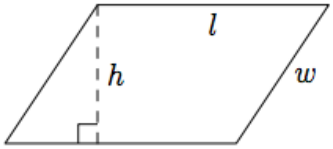
COMPLEMENTARY-angles sum to 90˚

SUPPLEMENTARY-angles sum to 180˚

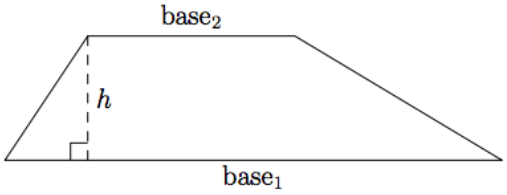
Perimeter/Area/Volume: To find PERIMETER of any shape, simply add all side lengths.



Rectangle
(Square if $l = w$)
Area $= lw$



Parallelogram
(Rhombus if $l = w$)
Area $= lh$



Area of trapezoid $= \left(\frac{\text{base}_1 + \text{base}_2}{2}\right) \cdot h$

VOLUME OF ANY PRISM/CYLINDER= Area of Base x Height VOLUME OF PYRAMID/CONE= $\frac{1}{3}$ Area of Base x Height

SURFACE AREA OF ANY PRISM/PYRAMID= Area of Bases + Area of Sides

SURFACE AREA OF CYLINDER= $2(\pi r^2) + 2\pi r(h)$

SURFACE AREA OF CONE= $\pi r^2 + \pi rl$ where r=radius and l=slant height

VOLUME OF SPHERE= $V = \frac{4}{3}\pi r^3$ SURFACE AREA OF SPHERE= $4\pi r^2$

DIAGONAL OF ANY PRISM= $d = \sqrt{l^2 + w^2 + h^2}$

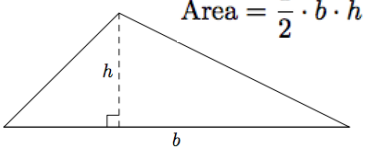
Triangles: TRIANGLE SUM THEOREM-The sum of the three angles in any triangle must equal 180˚.

EXTERIOR ANGLE THEOREM- The exterior angle of a triangle is equal to the sum of the remote interior angles.

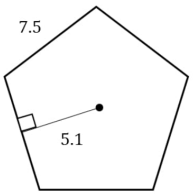
TRIANGLE INEQUALITY THEOREM- The sum of any two sides of a triangle must be greater than the third side.

TRIANGLE SIMILARITY- corresponding angles are congruent and sides are in proportion (AA, SSS, SAS)

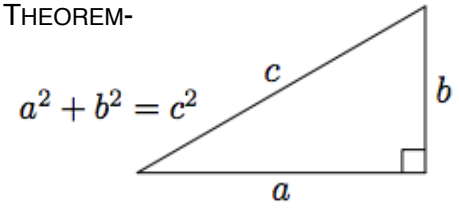
TRIANGLE CONGRUENCY- all corresponding angles and sides are congruent (SSS, ASA, SAS, HL)



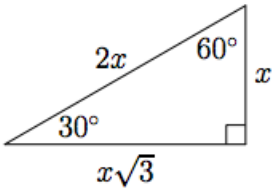
AREA OF REGULAR POLYGONS- find the area for one triangle and multiply by the number of triangles in polygon

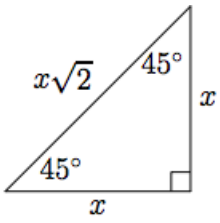


PYTHAGOREAN THEOREM-



SPECIAL RIGHT TRIANGLES-





Pythagorean Triples- consist of three integers which satisfy the PYTHAGOREAN THEOREM (3,4,5) (5,12,13) (8,15,17) (7,24,25)

Trigonometry: "SOH-CAH-TOA"

$$\sin\theta = \frac{opposite}{hypotenuse} \qquad \cos\theta = \frac{adjacent}{hypotenuse} \qquad \tan\theta = \frac{opposite}{adjacent} = \frac{\sin\theta}{\cos\theta}$$

$$\frac{1}{\sin\theta} = \csc\theta \qquad \frac{1}{\cos\theta} = \sec\theta \qquad \frac{1}{\tan\theta} = \frac{\cos\theta}{\sin\theta} = \cot\theta$$

TRIGONOMETRY IDENTITY- $\sin^2\theta + \cos^2\theta = 1$

LAW OF SINES- $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

LAW OF COSINES- $c^2 = a^2 + b^2 - 2ab\cos(C)$