Math Mastery Worksheet

Algebra 2 · Geometry 2 · 20 Core Problems · Answers on Last Page

ALGEBRA 2

UNIT 1 · QUADRATICS & POLYNOMIALS

A·01 Quadratic Formula — Discriminant Trap

Solve: 2x^2 - 5x + 4 = 0. How many real solutions does this equation have?

A) Two real solutions
B) One real solution
C) No real solutions
D) x = 5/4

** Memory: DISC = b^2 - 4ac · Positive=2 real Zero=1 real Negative=0 real*

A·02 Polynomial Division — Remainder Theorem Trick

If f(x) = x^3 - 3x^2 + 2x - 5, what is the remainder when f(x) is divided by (x - 2)?

A) -5
B) -1
C) 3
D) 0

** Memory: PLUG IN · Remainder = f(divisor root) · No long division needed!*

UNIT 2 · EXPONENTIAL & LOGARITHMIC FUNCTIONS

A·03 Logarithms — Log Rules Mastery

Simplify: log_3(81) - log_3(9)

A) 1
B) 2
C) 3
D) 9

** Memory: SUBTRACT LOG = DIVIDE · log(a/b) = log a - log b*

A·04 Exponential Equations — Same Base Strategy

Solve for x: 4^(x+1) = 8^(x-1)

A) x = 1
B) x = 5
C) x = 7
D) x = 3

** Memory: SAME BASE · Convert both to base 2, then set exponents equal*

UNIT 3 · RATIONAL FUNCTIONS & COMPLEX NUMBERS

A·05 Rational Functions — Vertical Asymptote Hunt

Find the vertical asymptote(s) of: f(x) = (x^2 - 4) / (x^2 - x - 6)

[Warning: Factor first — holes vs. asymptotes!]

A) x = 2 and x = -3

B) x = -2 and x = 3
C) x = 3 only
D) x = -3 only

** Memory: CANCEL=HOLE REMAIN=ASYMPTOTE · Factor top AND bottom first!*

A·06 Complex Numbers — Powers of i

Simplify: i^47

A) 1
B) -1
C) i
D) -i

** Memory: CYCLE 4 · i^1=i, i^2=-1, i^3=-i, i^4=1 · Divide exponent by 4, use remainder*

UNIT 4 · SEQUENCES, SERIES & PROBABILITY

A·07 Geometric Series — Infinite Sum Trap

Find the sum of the infinite geometric series: 3 + 1 + 1/3 + 1/9 + ...

A) 9/2
B) 4
C) 3/2
D) Does not converge

** Memory: S = a/(1-r) · Works ONLY when |r| < 1 · r = (2nd)/(1st)*

A·08 Binomial Theorem — Specific Term Finder

What is the coefficient of x^3 in the expansion of (2x + 1)^5?

A) 40
B) 80
C) 10
D) 160

** Memory: nCr * a^r * b^(n-r) · Term with x^k: use r=k*

A·09 Systems of Equations — Nonlinear System

How many solutions does this system have?

y = x^2 - 3 and y = 2x

A) No solutions
B) Exactly one solution
C) Two solutions
D) Infinitely many

** Memory: SUBSTITUTION -> DISCRIMINANT · Set equal, form quadratic, check disc*

A·10 Inverse Functions — Composition Trap

If f(x) = 3x - 7, find f^(-1)(f^(-1)(2)).

[Warning: Apply inverse TWICE — don't skip steps!]

A) 9/3
B) 16/3
C) 34/9
D) 9/2

** Memory: SWAP x,y THEN SOLVE · f^(-1)(x) = (x+7)/3 · Apply twice!*

GEOMETRY 2

UNIT 1 · CIRCLES & ARC THEOREMS

G·01 Circle Theorems — Inscribed Angle Rule

An inscribed angle intercepts an arc of 140 degrees. What is the measure of the inscribed angle?

A) 140°
B) 70°
C) 280°
D) 35°

** Memory: INSCRIBED = HALF ARC · Inscribed angle = 1/2 x intercepted arc*

G·02 Tangent Lines — Tangent-Radius Angle

A tangent and a radius meet at point P on a circle. What is the angle between them?

A) 45°
B) 60°
C) 90°
D) 180°

** Memory: TANGENT PERPENDICULAR RADIUS · Always 90 degrees at point of tangency!*

UNIT 2 · SIMILARITY, PROOFS & TRIGONOMETRY

G·03 Similar Triangles — Proportionality Trap

Two similar triangles have perimeters 18 and 30. If the area of the smaller triangle is 27, what is the area of the larger triangle?

A) 45
B) 75
C) 108
D) 54

** Memory: LENGTH:AREA = k:k^2 · Scale ratio squared for area, cubed for volume!*

G·04 Trigonometry — Law of Sines Shortcut

In triangle ABC: angle A = 30, angle B = 45, and a = 6. Find side b.

A) 6*sqrt(2)
B) 3*sqrt(6)
C) 4*sqrt(2)
D) 6*sqrt(3)

** Memory: a/sinA = b/sinB · OPPOSITE sides and angles pair up!*

UNIT 3 · COORDINATE GEOMETRY & 3D SOLIDS

G·05 Coordinate Geometry — Perpendicular Bisector

Find the equation of the perpendicular bisector of the segment joining A(2, 4) and B(8, -2).

A) y = x - 2
B) y = -x + 9
C) y = x + 3
D) y = -x + 5

** Memory: MIDPOINT + FLIP SLOPE · Find midpoint, negate-reciprocal slope, write line*

G·06 Volume of Solids — Cone vs Cylinder

A cone and a cylinder share the same radius r = 3 and height h = 8.

What is the ratio of cone's volume to cylinder's volume?

A) 1/4
B) 1/3
C) 1/2
D) 2/3

** Memory: CONE = 1/3 CYLINDER · Same base, same height -> cone is always exactly 1/3!*

UNIT 4 · TRANSFORMATIONS, QUADRILATERALS & PARALLEL LINES

G·07 Transformations — Rotation Rules

Point P(3, -5) is rotated 90 degrees counterclockwise about the origin.

What are the new coordinates?

A) (5, 3)
B) (-3, 5)
C) (5, -3)
D) (-5, -3)

** Memory: CCW 90: (x,y)->(-y,x) CCW 180: (-x,-y) CCW 270: (y,-x)*

G·08 Parallel Lines — Angle Pair Confusion

Two parallel lines cut by a transversal. One angle is (3x+20) degrees and its co-interior angle is (2x+10) degrees. Find x.

A) x = 20
B) x = 30
C) x = 25
D) x = 10

** Memory: CO-INTERIOR = 180 (supplementary) ALTERNATE = EQUAL CORRESPONDING = EQUAL*

G·09 Quadrilaterals — Special Parallelogram

In a rhombus, one diagonal has length 16 and the other has length 12.

What is the perimeter of the rhombus?

A) 40
B) 56
C) 80
D) 28

** Memory: RHOMBUS DIAG PERPENDICULAR BISECT · Use Pythagorean theorem on half-diagonals!*

G·10 Circle Equations — Standard Form Conversion

What is the center and radius of the circle: x^2 + y^2 - 6x + 4y - 3 = 0?

[Warning: Complete the square for BOTH variables!]

A) Center (3,-2), r=4
B) Center (-3,2), r=4
C) Center (3,-2), r=16
D) Center (6,-4), r=4

** Memory: COMPLETE THE SQUARE · Group x's and y's Add (b/2)^2 to both sides!*

ANSWER KEY

Q	Topic	Ans		Q	Topic	Ans		
A·01	Quadratic Formula	C		G·01	Inscribed Angle	B		
A·02	Remainder Theorem	A		G·02	Tangent-Radius	C		
A·03	Logarithms	B		G·03	Similar Triangles	B		
A·04	Exponential Eq.	B		G·04	Law of Sines	A		
A·05	Rational Functions	C		G·05	Perp. Bisector	A		
A·06	Powers of i	D		G·06	Cone vs Cylinder	B		
A·07	Geometric Series	A		G·07	Rotation Rules	A		
A·08	Binomial Theorem	B		G·08	Parallel Lines	B		
A·09	Nonlinear System	C		G·09	Rhombus	A		
A·10	Inverse Functions	B*		G·10	Circle Equation	A		

* A·10 Note: f■¹(x) = (x+7)/3 | Step 1: f■¹(2) = 3 | Step 2: f■¹(3) = 10/3