Math Mastery

Algebra 2 & Geometry · Core Units Practice · 20 Questions

Part 1 — Algebra 2

Unit: Quadratic Functions — Vertex Form

- `Memory Key: KEY: y = a(x - h)^2 + k => vertex = (h, k). Flip the sign of h!`

■ *Ex: y = 2(x - 3)^2 + 5 => vertex is (3, 5). Inside: x - 3, so h = +3.*

1. What is the vertex of the parabola y = 3(x + 2)^2 - 7 ?

(A) (-2, -7)
(B) (2, -7)
(C) (-2, 7)
(D) (2, 7)

Unit: Quadratic Formula — Discriminant

- `Memory Key: KEY: b^2 - 4ac => Positive=2 real roots, Zero=1 root, Negative=no real roots`

■ *Ex: x^2 - 4x + 4=0 => disc=0 => one repeated root x=2.*

2. How many real solutions does 2x^2 - 3x + 5 = 0 have?

(A) Two distinct real solutions
(B) One repeated real solution
(C) No real solutions
(D) Infinitely many

Unit: Polynomial — Difference of Squares

- `Memory Key: KEY: (a + b)(a - b) = a^2 - b^2 => No middle term!`

■ *Ex: (x+5)(x-5) = x^2 - 25*

3. Expand: (x + 3)(x - 3)

(A) x^2 - 9
(B) x^2 + 9
(C) x^2 - 6x + 9
(D) x^2 + 6x - 9

Unit: Rational Exponents

- Memory Key: `KEY: x^(m/n) = (nth-root of x)^m => denominator = root index`

■ *Ex: 8^(2/3) = (cube-root of 8)^2 = 2^2 = 4*

4. Simplify: 27^(2/3)

(A) 3
(B) 6
(C) 9
(D) 18

Unit: Complex Numbers — Powers of i

- Memory Key: `KEY: i^1=i, i^2=-1, i^3=-i, i^4=1 => Cycle of 4! Divide exponent by 4, use remainder.`

■ *Ex: i^5 = i^4 x i = 1 x i = i. i^23: 23/4=5 r3, i^3 = -i*

5. What is i^23 ?

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

Unit: Logarithms — Switch to Exponential

- Memory Key: `KEY: log_b(x) = y <=> b^y = x => Always SWITCH to exponential form!`

■ *Ex: log_2(8) = ? => 2^? = 8 => 2^3 = 8 => answer = 3*

6. Solve: log_3(x) = 4

(A) x = 12
(B) x = 64
(C) x = 81
(D) x = 7

Unit: Systems of Equations — Elimination

- Memory Key: `KEY: Make ONE coefficient equal, then ADD/SUBTRACT to eliminate that variable.`

■ *Ex: 2x+y=5 and x+y=3 => subtract => x=2 => y=1*

7. Solve the system: 3x + 2y = 12 and x - y = 1

(A) (2, 3)
(B) (3, 2)
(C) (4, 0)
(D) (1, -1)

Unit: Exponential Growth

- `Memory Key: KEY: y = a * b^t => a=start, b=multiplier, t=time. Double=x2, triple=x3.`

■ *Ex: 100 cells tripling per hour => y = 100 * 3^t*

8. A bacteria colony starts at 200 and doubles every hour. After 3 hours, the population is:

(A) 600
(B) 800
(C) 1200
(D) 1600

Unit: Geometric Sequences

- `Memory Key: KEY: Geometric: MULTIPLY by ratio r each time. a_n = a_1 * r^(n-1)`

■ *Ex: 2, 6, 18 ... r=3. a_5 = 2 * 3^4 = 162*

9. Find the 8th term of the geometric sequence: 3, 6, 12, 24, ...

(A) 192
(B) 256
(C) 384
(D) 512

Unit: Radical Equations — Extraneous Solutions

- `Memory Key: KEY: SQUARE both sides to solve, then ALWAYS CHECK answer in ORIGINAL equation!`

■ *Ex: sqrt(x+3) = x - 1 => Square both sides => CHECK both solutions!*

10. Which value satisfies sqrt(x + 5) = x - 1 ?

(A) x = -1
(B) x = 4
(C) x = 0
(D) x = -4

Answer Key — Algebra 2

Q#	Answer	Topic
1	(A)	Quadratic Functions
2	(C)	Quadratic Formula
3	(A)	Polynomial
4	(C)	Rational Exponents
5	(D)	Complex Numbers
6	(C)	Logarithms
7	(B)	Systems of Equations
8	(D)	Exponential Growth

9	(C)	Geometric Sequences
10	(B)	Radical Equations

Part 2 — Geometry

Unit: Triangle Congruence Shortcuts

• `Memory Key: KEY: Valid = SSS, SAS, ASA, AAS. NOT valid = SSA (or AAA which gives similarity only)`

■ *Ex: Two sides + included angle equal => SAS => Congruent!*

1. Which congruence shortcut is NOT valid?

(A) SSS
(B) ASA
(C) SSA
(D) AAS

Unit: Parallel Lines & Transversals

• `Memory Key: KEY: Alternate interior = EQUAL (Z-shape). Co-interior (same side) = ADD to 180.`

■ *Ex: Co-interior angles 70 and x: 70 + x = 180 => x = 110*

2. Parallel lines cut by a transversal. Co-interior angles are (3x + 10) and (2x + 30) degrees. Find x.

(A) x = 20
(B) x = 28
(C) x = 30
(D) x = 14

Unit: Pythagorean Theorem

• `Memory Key: KEY: a^2 + b^2 = c^2 (c = hypotenuse, longest side). Triples: 3-4-5, 5-12-13`

■ *Ex: Legs 6 and 8 => c^2 = 36+64 = 100 => c = 10 (scaled 3-4-5)*

3. A right triangle has legs of 9 and 12. The hypotenuse is:

(A) 13
(B) 15
(C) 17
(D) 21

Unit: Circle — Inscribed Angle Theorem

• `Memory Key: KEY: Inscribed angle = 1/2 x intercepted arc. Central angle = arc (they are equal).`

■ *Ex: Arc = 80 => Inscribed angle = 40. Arc = 120 => Inscribed = 60.*

4. An inscribed angle intercepts an arc of 110 degrees. The inscribed angle measures:

(A) 110 degrees
(B) 220 degrees
(C) 55 degrees
(D) 70 degrees

Unit: Similar Triangles — Area Ratio

• `Memory Key: KEY: Side ratio = k => Area ratio = k^2 (SQUARE the ratio for area!)`

■ *Ex: Sides ratio 1:3 => Area ratio 1:9. If small area=10, large area=90.*

5. Two similar triangles have side lengths in ratio 2:5. The smaller has area 12 cm^2. Find the larger triangle's area.

(A) 30 cm^2
(B) 60 cm^2
(C) 75 cm^2
(D) 100 cm^2

Unit: Volume of a Cone

• `Memory Key: KEY: V(cone) = (1/3) x pi x r^2 x h. Cone = 1/3 of cylinder with same base and height.`

■ *Ex: r=3, h=10 => V = (1/3)(pi)(9)(10) = 30pi*

6. A cone has radius 6 cm and height 9 cm. Its volume is:

(A) 108pi cm^3
(B) 162pi cm^3
(C) 324pi cm^3
(D) 54pi cm^3

Unit: Coordinate Geometry — Midpoint

• `Memory Key: KEY: Midpoint = average the x-coords, average the y-coords. M = ((x1+x2)/2, (y1+y2)/2)`

■ *Ex: (0, 0) and (4, 6) => midpoint = (2, 3)*

7. Find the midpoint of the segment with endpoints (-3, 7) and (5, -1).

(A) (1, 3)
(B) (2, 6)
(C) (1, 4)
(D) (4, 3)

Unit: Reflections — Transformation

- `Memory Key: KEY: Over x-axis: (x,y)=>(x,-y). Over y-axis: (x,y)=>(-x,y). Over origin: (-x,-y).`

■ *Ex: (3,4) reflected over x-axis => (3,-4). Over y-axis => (-3,4).*

8. Point P(4, -2) is reflected over the y-axis. The image is:

(A) (-4, 2)
(B) (-4, -2)
(C) (4, 2)
(D) (2, -4)

Unit: Special Right Triangles — 30-60-90

- `Memory Key: KEY: 30-60-90: short=x, long=x*sqrt(3), hyp=2x. | 45-45-90: leg=x, hyp=x*sqrt(2)`

■ *Ex: Hyp=10 in 30-60-90 => short leg=5, long leg=5*sqrt(3).*

9. In a 30-60-90 triangle, the side opposite 30 degrees is 7. The hypotenuse is:

(A) 7*sqrt(2)
(B) 7*sqrt(3)
(C) 14
(D) 14*sqrt(3)

Unit: Rhombus — Diagonal & Side Length

- `Memory Key: KEY: Rhombus diagonals bisect each other at RIGHT ANGLES. Use Pythagorean Theorem!`

■ *Ex: Diagonals 6 and 8 => half-diagonals 3 and 4 => side = sqrt(9+16) = 5*

10. The diagonals of a rhombus are 10 cm and 24 cm. Find the side length.

(A) 13 cm
(B) 17 cm
(C) 26 cm
(D) 12 cm

Answer Key — Geometry

Q#	Answer	Topic
1	(C)	Triangle Congruence Shortcuts
2	(B)	Parallel Lines & Transversals
3	(B)	Pythagorean Theorem
4	(C)	Circle
5	(C)	Similar Triangles
6	(A)	Volume of a Cone
7	(A)	Coordinate Geometry
8	(B)	Reflections

9	(C)	Special Right Triangles
10	(A)	Rhombus