Math Practice Workbook

Algebra 2 & Geometry · 20 Essential Word Problems

Instructions: Circle the letter of your chosen answer. Check the answer key below each question.

Topics: Quadratics, Logarithms, Sequences, Trig, Circles, Similarity, Volume, and more.

Memory Points: Read the ★ MEMORY POINT box before each question — it's your shortcut!

ALGEBRA 2 · Word Problems

Q1. *QUADRATIC EQUATIONS*

> ★ **MEMORY POINT:** DISCRIMINANT RULE: b^2 - 4ac > 0 (two roots) | = 0 (one root) | < 0 (no real roots)
> VERTEX of parabola: t = -b / (2a)

Example: Example: For x^2 - 5x + 6 = 0, discriminant = 25 - 24 = 1 > 0, so two real roots: x = 2 and x = 3.

A ball is thrown upward. Its height (in feet) after t seconds is h(t) = -16t^2 + 48t + 5. How many seconds does it take for the ball to reach its MAXIMUM HEIGHT?

A) t = 1 second
B) t = 1.5 seconds ← CORRECT
C) t = 2 seconds
D) t = 3 seconds

Answer: ____ | Correct Answer: **B** | Vertex at t = -b/(2a) = -48/(2×-16) = 1.5 sec. Trap: t=3 is when ball LANDS, not max height!

Q2. *SYSTEMS OF EQUATIONS*

> ★ **MEMORY POINT:** SUBSTITUTION STEPS: (1) isolate one variable → (2) plug into other equation → (3) solve → (4) back-substitute

Example: Example: y = 2x + 1, x + y = 7 → x + (2x+1) = 7 → x = 2, y = 5.

A school store sells pencils for $0.25 and pens for $0.75. A student buys 12 items total and spends exactly $5.00. How many PENS did the student buy?

A) 2 pens
B) 4 pens ← CORRECT
C) 5 pens
D) 6 pens

Answer: ____ | Correct Answer: **B** | p + n = 12 and 0.25p + 0.75n = 5. Substituting: 0.5n = 2, so n = 4 pens.

Q3. *EXPONENTIAL GROWTH & DECAY*

> ★ **MEMORY POINT:** GROWTH: A = P(1 + r)^t | DECAY: A = P(1 - r)^t | r = rate as decimal

Example: Example: $1,000 at 5% for 3 years: A = 1000(1.05)^3 ≈ $1,157.63.

A car was purchased for $24,000. It depreciates at 15% per year. Which expression represents the car's value after 5 years?

A) 24000(0.85)^5 ← CORRECT
B) 24000(1.15)^5
C) 24000 - 0.15 x 5
D) 24000(0.15)^5

Answer: ____ | Correct Answer: **A** | Decay multiplier = (1 - 0.15) = 0.85. Trap: 1.15 means GROWTH, not decay!

Q4. *LOGARITHMS*

> ★ **MEMORY POINT:** LOG <-> EXPO: log_b(x) = y means b^y = x | 'log asks: what POWER?'

Example: Example: log_2(8) = 3 because 2^3 = 8.

An earthquake has intensity I = 100,000 x I_0. Using M = log(I / I_0), what is its Richter magnitude M?

A) M = 4
B) M = 5 ← CORRECT
C) M = 6
D) M = 10

Answer: ____ | Correct Answer: **B** | M = log(100,000) = log(10^5) = 5. Trap: counting digits gives 6 — wrong!

Q5. *RATIONAL FUNCTIONS — WORK RATE*

> ★ **MEMORY POINT:** WORK RATE FORMULA: 1/A + 1/B = 1/T | Add RATES (1/time), NOT the times!

Example: Example: Pipe A fills in 4 hrs, Pipe B in 6 hrs: 1/4 + 1/6 = 5/12, so T = 12/5 = 2.4 hrs.

Machine A completes a job in 6 hours. Machine B completes it in 9 hours. Working together, how long will they take?

A) 3.6 hours ← CORRECT
B) 4 hours
C) 5 hours
D) 7.5 hours

Answer: ____ | Correct Answer: **A** | 1/6 + 1/9 = 5/18 jobs/hr. T = 18/5 = 3.6 hrs. Trap: averaging (6+9)/2 = 7.5 is WRONG!

Q6. *ARITHMETIC SEQUENCES*

> ★ **MEMORY POINT:** nth TERM: $a_n = a_1 + (n-1)d$ | SUM: $S_n = n/2 \times (a_1 + a_n)$

Example: Example: Sequence 3, 7, 11... has $a_1=3$, $d=4$. The 10th term: $a_{10} = 3 + 9(4) = 39$.

A theater's first row has 20 seats. Each row has 3 more seats than the previous. With 15 rows, what is the TOTAL number of seats?

A) 510 seats
B) 595 seats
C) 615 seats ← CORRECT
D) 720 seats

Answer: ____ | Correct Answer: **C** | $a_{15} = 20 + 14(3) = 62$. Sum = 15/2 x (20+62) = 615. Trap: using n=14 instead of (n-1)=14.

Q7. *GEOMETRIC SEQUENCES*

> ★ **MEMORY POINT:** GEOMETRIC nth TERM: a_n = a_1 x r^(n-1) | MULTIPLY, don't add!

Example: Example: 2, 6, 18, 54... r=3. The 5th term: 2 x 3^4 = 162.

A bacteria colony starts with 500 bacteria and doubles every hour. After how many hours will it FIRST exceed 10,000 bacteria?

A) 3 hours
B) 4 hours
C) 5 hours ← CORRECT
D) 6 hours

Answer: ____ | Correct Answer: **C** | At hour 4: 500x2^4 = 8,000. At hour 5: 500x2^5 = 16,000 > 10,000. Answer: 5 hours.

Q8. *COMPLEX NUMBERS*

> ★ **MEMORY POINT:** i^2 = -1 | Cycle: i^1=i, i^2=-1, i^3=-i, i^4=1 (repeats every 4!) | Add FIRST, then find magnitude

Example: Example: (2+3i)(1-i) = 2+i-3(i^2) = 2+i+3 = 5+i.

The impedance Z = (3 + 4i) + (1 - 2i). What is |Z|, the MAGNITUDE of the total impedance?

A) |Z| = 5
B) |Z| = sqrt(20) ← CORRECT
C) |Z| = sqrt(40)
D) |Z| = 6

Answer: ____ | Correct Answer: **B** | Add first: (4+2i). Then |Z| = sqrt(16+4) = sqrt(20). Trap: adding magnitudes separately gives wrong answer!

Q9. *POLYNOMIAL FUNCTIONS — FACTOR THEOREM*

> ★ **MEMORY POINT:** REMAINDER THEOREM: f(c) = remainder when f(x) divided by (x-c) | JUST PLUG IN the value!

Example: Example: Is x=2 a root of f(x) = x^3 - 3x + 2? f(2) = 8-6+2 = 4 ≠ 0. No.

V(x) = x^3 - 6x^2 + 11x - 6. If (x-1) is one factor, which of the following is ALSO a factor?

A) (x - 2) ← CORRECT
B) (x + 2)
C) (x - 4)
D) (x + 1)

Answer: ____ | Correct Answer: **A** | Test x=2: f(2) = 8-24+22-6 = 0 ✓. Full factorization: (x-1)(x-2)(x-3).

Q10. *INVERSE FUNCTIONS*

> ★ **MEMORY POINT:** INVERSE: swap x and y, then solve for y | f^-1 'undoes' f(x)

Example: Example: f(x) = 2x+3. Inverse: x = 2y+3 → y = (x-3)/2. So f^-1(x) = (x-3)/2.

The formula F = (9/5)C + 32 converts Celsius to Fahrenheit. A report shows 77°F. What is this in Celsius?

A) 20 degrees C
B) 25 degrees C ← CORRECT
C) 30 degrees C
D) 35 degrees C

Answer: ____ | Correct Answer: **B** | C = 5/9 x (F-32) = 5/9 x (77-32) = 5/9 x 45 = 25 C. Trap: subtracting 32 AFTER multiplying gives wrong answer!

GEOMETRY · Word Problems

Q1. *PYTHAGOREAN THEOREM*

> ★ **MEMORY POINT:** a^2 + b^2 = c^2 | c is ALWAYS the hypotenuse (longest side, opposite right angle)

Example: Example: 3-4-5 right triangle: 3^2 + 4^2 = 9+16 = 25 = 5^2.

A ladder's base is 5 feet from a wall, and the ladder reaches 12 feet up the wall. What is the LENGTH of the ladder?

A) 11 feet
B) 13 feet ← CORRECT
C) 14 feet
D) 17 feet

Answer: ____ | Correct Answer: **B** | c = sqrt(5^2 + 12^2) = sqrt(25+144) = sqrt(169) = 13. Classic 5-12-13 triple! Trap: adding legs (5+12=17) is WRONG.

Q2. *SIMILAR TRIANGLES*

> ★ **MEMORY POINT:** SIMILAR TRIANGLES: corresponding sides are PROPORTIONAL → set up cross-multiply ratio

Example: Example: Triangles 3,4,5 and 6,8,10 are similar (ratio 1:2). Missing side: 3/6 = x/8 → x = 4.

A 6-foot person casts a 4-foot shadow. At the same time, a tree casts a 10-foot shadow. How TALL is the tree?

A) 12 feet
B) 15 feet ← CORRECT
C) 18 feet
D) 20 feet

Answer: ____ | Correct Answer: **B** | 6/4 = h/10 → 4h = 60 → h = 15 ft. Trap: flipping the ratio (4/6 = h/10) gives h ≈ 6.7 ft. Keep height/shadow consistent!

Q3. *CIRCLE — ARC LENGTH & SECTOR AREA*

> ★ **MEMORY POINT:** ARC LENGTH = (theta/360) x 2*pi*r | SECTOR AREA = (theta/360) x pi*r^2 | theta in degrees

*Example: Example: Circle r=6, angle=90. Arc = (90/360) x 2*pi*6 = 3*pi.*

A sprinkler rotates 120 degrees and waters a circular region with radius 9 feet. What is the AREA of the watered region? (In terms of pi)

A) 18*pi sq ft
B) 27*pi sq ft ← CORRECT
C) 36*pi sq ft
D) 81*pi sq ft

Answer: ____ | Correct Answer: **B** | Sector area = (120/360) x pi(9^2) = (1/3) x 81*pi = 27*pi. Trap: using arc formula gives 6*pi (wrong!). Area uses r^2.

Q4. *VOLUME OF 3D SHAPES*

> ★ **MEMORY POINT:** CONE = (1/3)*pi*r^2*h | CYLINDER = pi*r^2*h | SPHERE = (4/3)*pi*r^3

*Example: Example: Cylinder r=3, h=5: V = pi(9)(5) = 45*pi. Cone (same): V = (1/3)(45*pi) = 15*pi.*

An ice cream cone has radius 3 cm and height 12 cm. A sphere of ice cream (r=3 cm) sits on top. What is the TOTAL VOLUME? (In terms of pi)

A) 72*pi cm^3 ← CORRECT
B) 108*pi cm^3
C) 48*pi cm^3
D) 84*pi cm^3

Answer: ____ | Correct Answer: **A** | Cone: (1/3)*pi*9*12 = 36*pi. Sphere: (4/3)*pi*27 = 36*pi. Total: 72*pi. Trap: forgetting (1/3) for cone!

Q5. *COORDINATE GEOMETRY — MIDPOINT*

> ★ **MEMORY POINT:** MIDPOINT: M = ((x1+x2)/2, (y1+y2)/2) | DISTANCE: d = sqrt[(delta-x)^2 + (delta-y)^2]

Example: Example: Midpoint of (2,4) and (6,8): M = (4, 6).

A fire station is at (1, 3) and a hospital is at (7, 11). An ambulance stops at the EXACT MIDPOINT. What are the coordinates?

A) (3, 6)
B) (4, 7) ← CORRECT
C) (4, 8)
D) (6, 14)

Answer: ____ | Correct Answer: **B** | M = ((1+7)/2, (3+11)/2) = (4, 7). Trap: forgetting to divide by 2 gives (8,14) — that's option D!

Q6. *EXTERIOR ANGLES OF TRIANGLES*

> ★ **MEMORY POINT:** EXTERIOR ANGLE = sum of the TWO non-adjacent INTERIOR angles (remote interior angles)

Example: Example: Interior angles 50 and 70 degrees: exterior angle = 50 + 70 = 120 degrees.

In triangle PQR, angle P = 40 and angle Q = 65 degrees. A student extends side QR past R. What is the EXTERIOR angle at R?

A) 75 degrees
B) 95 degrees
C) 105 degrees ← CORRECT
D) 115 degrees

Answer: ____ | Correct Answer: **C** | Exterior angle = 40 + 65 = 105. OR: interior angle R = 75, exterior = 180-75 = 105. Trap: stopping at 75 (interior angle)!

Q7. *PARALLEL LINES & TRANSVERSALS*

> ★ **MEMORY POINT:** Z-shape = ALTERNATE angles (EQUAL) | F-shape = CORRESPONDING (EQUAL) | C-shape = CO-INTERIOR (add to 180 degrees)

Example: Example: Alternate interior angles are equal. If one is 55 degrees, the other is also 55 degrees.

Two parallel streets are cut by a diagonal road. One angle is (3x+15) degrees and its co-interior angle is (2x+25) degrees. Find x.

A) x = 20
B) x = 24
C) x = 28 ← CORRECT
D) x = 30

> Answer: ____ | Correct Answer: **C** | Co-interior angles add to 180: (3x+15)+(2x+25)=180 → 5x+40=180 → x=28. Trap: setting equal (alternate) gives x=10. WRONG!

Q8. *TRIGONOMETRY — SOH CAH TOA*

> ★ **MEMORY POINT:** SOH: sin = Opp/Hyp | CAH: cos = Adj/Hyp | TOA: tan = Opp/Adj

Example: Example: Hyp=10, angle=30: opposite side = 10 x sin(30) = 10 x 0.5 = 5.

A ramp makes a 20-degree angle with the ground. The ramp is 15 feet long. How HIGH does the ramp rise? (sin 20 degrees ≈ 0.342)

A) 3.9 feet
B) 5.1 feet ← CORRECT
C) 14.1 feet
D) 43.9 feet

> Answer: ____ | Correct Answer: **B** | Height = hyp x sin(20) = 15 x 0.342 = 5.1 ft. Trap: using cosine gives 14.1 ft (horizontal distance, not height)!

Q9. *CIRCLES — INSCRIBED ANGLE THEOREM*

> ★ **MEMORY POINT:** INSCRIBED ANGLE = (1/2) x intercepted arc | CENTRAL ANGLE = intercepted arc (full, not halved)

Example: Example: Inscribed angle intercepts arc 100 degrees: inscribed angle = 100/2 = 50 degrees.

A central angle AOB = 140 degrees. An inscribed angle ACB intercepts the same arc (C is on the major arc). What is angle ACB?

A) 40 degrees
B) 70 degrees ← CORRECT
C) 110 degrees
D) 140 degrees

> Answer: ____ | Correct Answer: **B** | Arc AB = 140. Inscribed angle = 140/2 = 70 degrees. Trap: using the full 140 (that's the central angle, not inscribed)!

Q10. *SURFACE AREA — CYLINDER*

> ★ **MEMORY POINT:** CYLINDER SA = 2*pi*r^2 + 2*pi*r*h | 'top + bottom + curved side' | Closed = include both circles!

*Example: Example: Cylinder r=2, h=5: SA = 2*pi(4) + 2*pi(2)(5) = 8*pi + 20*pi = 28*pi.*

A CLOSED cylindrical water tank has radius 4 feet and height 10 feet. How many square feet of metal are needed? (In terms of pi)

A) 80*pi sq ft
B) 112*pi sq ft ← CORRECT
C) 96*pi sq ft
D) 120*pi sq ft

> Answer: ____ | Correct Answer: **B** | SA = 2*pi(16) + 2*pi(4)(10) = 32*pi + 80*pi = 112*pi. Trap: forgetting the two circular caps (only lateral = 80*pi)!

ANSWER KEY SUMMARY

Q	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
Algebra 2	**B**	**B**	**A**	**B**	**A**	**C**	**C**	**B**	**A**	**B**
Geometry	**B**	**B**	**B**	**A**	**B**	**C**	**C**	**B**	**B**	**B**

Score: _____ / 20 | Date: _____ | Name: _____