

Practice Worksheet

20 Core Problems · Self-Study Edition

Word Problems · Multiple Choice · Answer Key Included

Each problem includes: Memory Key · Common Mistake Warning · Worked Example

ALGEBRA 1

A · 01 Linear Equations [Easy]

★ KEY: Isolate → Inverse Operations

Emma has \$47 in her piggy bank. She earns \$8 per hour babysitting. How many hours must she work to have exactly \$103?

■ *Mistake: Forgetting to subtract \$47 before dividing.*

EXAMPLE FIRST

EXAMPLE: Have \$10, earn \$5/hr, reach \$25: $10 + 5h = 25 \rightarrow h = 3$

A) $h = 5$ B) $h = 6$ C) $h = 7 \leftarrow$ ANSWERD) $h = 8$

SOLUTION: Setup: $47 + 8h = 103 \rightarrow 8h = 56 \rightarrow h = 7$

A · 02 Inequalities [Medium]

★ KEY: Flip inequality sign when dividing by a NEGATIVE number

Jake has \$20. Notebooks cost \$3 each. He must keep at least \$5 for bus fare. What is the max number of notebooks he can buy?

■ Mistake: Spending all \$20, ignoring the \$5 bus fare.

EXAMPLE FIRST

EXAMPLE: $3n \leq 20 - 5 = 15 \rightarrow n \leq 5$

A) 4 notebooks	B) 5 notebooks ← ANSWER
C) 6 notebooks	D) 7 notebooks

SOLUTION: Available: $20 - 5 = \$15$. $3n \leq 15 \rightarrow n \leq 5$. Max = 5 notebooks.

A · 03 Systems of Equations [Medium]

★ KEY: Substitution OR Elimination — pick ONE method

Ava and Ben together have 34 stickers. Ava has 6 more than Ben. How many stickers does BEN have?

■ Mistake: Reporting Ava's count (20) instead of Ben's.

EXAMPLE FIRST

EXAMPLE: $a + b = 10$, $a = b + 2 \rightarrow 2b + 2 = 10 \rightarrow b = 4$

A) 12 stickers	B) 13 stickers
C) 14 stickers ← ANSWER	D) 20 stickers

SOLUTION: Let $b = \text{Ben's}$. $(b+6) + b = 34 \rightarrow 2b = 28 \rightarrow b = 14$. (Ava has 20 — trap!)

A · 04 Proportions & Percent [Easy]

★ KEY: Sale price = Original \times (1 – discount %)

A shirt originally costs \$40. It is on sale for 25% off. What is the sale price?

■ Mistake: Reporting the \$10 discount instead of the final price.

EXAMPLE FIRST

EXAMPLE: 20% off \$50: $\$50 \times 0.80 = \40

A) \$10	B) \$30 ← ANSWER
C) \$35	D) \$50

SOLUTION: Discount = $0.25 \times 40 = \$10$. Sale price = $40 - 10 = \$30$.

A · 05 Rate & Distance [Medium]

★ KEY: $d = r \times t$ | Head start distance = slow rate \times head-start time

Car A travels 60 mph. Car B travels 45 mph, leaving 1 hour earlier. How many hours after Car A departs will Car A catch Car B?

■ Mistake: Forgetting Car B has a 45-mile head start.

EXAMPLE FIRST

EXAMPLE: Head start = $45 \times 1 = 45$ mi. Closing speed = $60 - 45 = 15$ mph.

A) 1 hour	B) 2 hours
C) 3 hours ← ANSWER	D) 4 hours

SOLUTION: Head start: 45 mi. Closing rate: 15 mph. Time: $45 \div 15 = 3$ hours.

A · 06 Slope & Linear Functions [Medium]

★ KEY: $C = (\text{flat fee}) + (\text{rate per unit}) \times h$

A plumber charges \$50 flat fee plus \$75/hour. Find the total cost for 4 hours.

■ *Mistake: Multiplying the flat fee by hours.*

EXAMPLE FIRST

EXAMPLE: $C = 50 + 75h \rightarrow$ at $h = 4$: $C = 50 + 300$

A) \$250	B) \$300
C) \$350 ← ANSWER	D) \$500

SOLUTION: $C = 50 + 75(4) = 50 + 300 = \350 .

A · 07 Exponential Growth [Hard]

★ KEY: $P = P \cdot r^t$ (NOT $P \cdot r \cdot t$)

A bacteria population starts at 50 and doubles every hour. How many bacteria are there after 5 hours?

■ #1 Mistake: Calculating $50 \times 2 \times 5 = 500$. This is LINEAR, not exponential!

EXAMPLE FIRST

EXAMPLE: $P = 50 \cdot 2^t \rightarrow$ after 5 hrs: $50 \cdot 32$

A) 500	B) 800
C) 1,000	D) 1,600 ← ANSWER

SOLUTION: $P = 50 \cdot 2^5 = 50 \cdot 32 = 1,600$.

A · 08 Quadratic — Factoring [Hard]

★ KEY: Find two numbers: Product = c, Sum = b in $x^2 + bx + c$

A rectangle has area 40 m^2 . Its length is 3 m more than its width. Find the width.

■ Mistake: Accepting negative width as a valid answer.

EXAMPLE FIRST

EXAMPLE: $w(w + 3) = 40 \rightarrow w^2 + 3w - 40 = 0 \rightarrow$ factor

A) 4 m	B) 5 m ← ANSWER
C) 8 m	D) 10 m

SOLUTION: $(w + 8)(w - 5) = 0 \rightarrow w = 5$ or $w = -8$. Reject negative. Width = 5 m.

A · 09 Mixture Problems [Medium]

★ KEY: Acid in + Acid added = Acid in result (also update TOTAL volume)

A chemist has 20 L of a 30% acid solution. How many liters of pure acid must be added to create a 50% solution?

■ Mistake: Forgetting that adding pure acid also increases total volume.

EXAMPLE FIRST

EXAMPLE: $0.30(20) + x = 0.50(20 + x)$

A) 6 liters	B) 8 liters ← ANSWER
C) 10 liters	D) 12 liters

SOLUTION: $6 + x = 0.5(20 + x) \rightarrow 6 + x = 10 + 0.5x \rightarrow 0.5x = 4 \rightarrow x = 8 \text{ L}$.

A · 10 Functions & Domain [Hard]

★ KEY: Domain excludes values that make denominator = 0

The function $f(x) = 3 / (x - 4)$ is given. Which value of x is NOT in the domain?

■ *Mistake: Setting the numerator (3) to zero instead of the denominator.*

EXAMPLE FIRST

EXAMPLE: $5/(x-2)$ undefined when $x - 2 = 0 \rightarrow x = 2$ excluded.

A) $x = 0$	B) $x = 3$
C) $x = 4 \leftarrow$ ANSWER	D) $x = 5$

SOLUTION: Denominator = 0: $x - 4 = 0 \rightarrow x = 4$. Domain is all reals except $x = 4$.

GEOMETRY

G · 01 Angles [Easy]

★ KEY: Supplementary = 180° Complementary = 90°

Two angles are supplementary. One is $(3x + 10)^\circ$, the other is $(x + 20)^\circ$. Find x .

■ Mistake: Confusing supplementary (180°) with complementary (90°).

EXAMPLE FIRST

EXAMPLE: $(2x + 5) + (x + 10) = 180 \rightarrow 3x + 15 = 180 \rightarrow x = 55$

A) $x = 30$

B) $x = 37.5 \leftarrow$ ANSWER

C) $x = 45$

D) $x = 60$

SOLUTION: $(3x+10) + (x+20) = 180 \rightarrow 4x + 30 = 180 \rightarrow 4x = 150 \rightarrow x = 37.5$.

G · 02 Pythagorean Theorem [Easy]

★ KEY: $a^2 + b^2 = c^2$ (c = hypotenuse, always the LONGEST side)

A 13 ft ladder leans against a wall. Its base is 5 ft from the wall. How high up the wall does it reach?

■ Mistake: Adding $13^2 + 5^2$ instead of subtracting.

EXAMPLE FIRST

EXAMPLE: hyp = 10, leg = 6: other leg = $\sqrt{(100 - 36)} = \sqrt{64} = 8$

A) 10 ft

B) 11 ft

C) 12 ft \leftarrow ANSWER

D) 13 ft

SOLUTION: $5^2 + h^2 = 13^2 \rightarrow 25 + h^2 = 169 \rightarrow h^2 = 144 \rightarrow h = 12$ ft. (5-12-13 triple!)

G · 03 Area — Triangle [Easy]

★ KEY: $A = \frac{1}{2} \times \text{base} \times \text{height}$ (DON'T forget the $\frac{1}{2}$!)

A triangular park has base 18 m and height 10 m. Grass costs \$4/m². Total cost?

■ Mistake: Forgetting the $\frac{1}{2}$ gives double the area (and double the cost).

EXAMPLE FIRST

EXAMPLE: base = 6, h = 4: $A = \frac{1}{2}(6)(4) = 12 \text{ m}^2$

A) \$180	B) \$360 ← ANSWER
C) \$720	D) \$1,440

SOLUTION: $A = \frac{1}{2}(18)(10) = 90 \text{ m}^2$. Cost = $90 \times \$4 = \360 . Trap C: forgetting $\frac{1}{2}$.

G · 04 Circle — Arc Length [Medium]

★ KEY: Arc = $(\text{angle} \div 360) \times 2\pi r$ | Use RADIUS, not diameter

A circle has radius 9 cm. Find the arc length for a central angle of 120°. (Use $\pi \approx 3.14$)

■ Mistake: Using diameter (18) instead of radius (9) in the formula.

EXAMPLE FIRST

EXAMPLE: 90° arc, r = 4: arc = $(90/360) \times 2\pi(4) = \pi \cdot 2 \approx 6.28$

A) 9.42 cm	B) 12.56 cm
C) 18.84 cm ← ANSWER	D) 56.52 cm

SOLUTION: Arc = $(120/360) \times 2(3.14)(9) = (1/3) \times 56.52 \approx 18.84 \text{ cm}$.

G · 05 Similar Triangles [Medium]

★ KEY: Scale factor = new side ÷ corresponding old side → MULTIPLY all sides

Triangle ABC ~ Triangle DEF. Sides of ABC: 4, 6, 8. Shortest side of DEF: 10. Find the LONGEST side of DEF.

■ Mistake: Adding the scale difference instead of multiplying.

EXAMPLE FIRST

EXAMPLE: Scale factor = $10 \div 4 = 2.5$. Longest = 8×2.5 .

A) 14	B) 18
C) 20 ← ANSWER	D) 24

SOLUTION: Scale = $10/4 = 2.5$. Longest side = $8 \times 2.5 = 20$.

G · 06 Volume — Cylinder [Medium]

★ KEY: $V = \pi r^2 h$ | $r = \text{diameter} \div 2$ (most common test trap!)

A cylindrical tank has diameter 6 ft and height 10 ft. Find its volume. ($\pi \approx 3.14$)

■ #1 Mistake: Using diameter (6) directly as r in $\pi r^2 h$.

EXAMPLE FIRST

EXAMPLE: $d = 8, h = 5: r = 4, V = \pi(4^2)(5) = 80\pi \approx 251.2$

A) 188.4 ft ³	B) 282.6 ft ³ ← ANSWER
C) 1,130.4 ft ³	D) 360 ft ³

SOLUTION: $r = 6/2 = 3. V = \pi(3^2)(10) = 90\pi \approx 282.6 \text{ ft}^3$. Trap C: using $r=6$.

G · 07 Exterior Angle Theorem [Medium]

★ KEY: Exterior angle = sum of the TWO non-adjacent interior angles

In a triangle, two interior angles are 55° and 70° . Find the exterior angle adjacent to the third interior angle.

■ Mistake: Finding only the interior angle (55°) and stopping there.

EXAMPLE FIRST

EXAMPLE: Interior 40° , $60^\circ \rightarrow$ exterior = $40 + 60 = 100^\circ$ (shortcut!)

A) 55°	B) 70°
C) $125^\circ \leftarrow$ ANSWER	D) 180°

SOLUTION: Third interior = $180 - 55 - 70 = 55^\circ$. Exterior = $180 - 55 = 125^\circ$. Or: $55 + 70 = 125^\circ$.

G · 08 Coordinate Geometry — Midpoint [Medium]

★ KEY: Midpoint = (avg of x's, avg of y's) \rightarrow solve for missing endpoint

$M(5, 1)$ is the midpoint of AB. $A = (2, -4)$. Find coordinates of B.

■ Mistake: Subtracting instead of using the midpoint equation to solve.

EXAMPLE FIRST

EXAMPLE: $M = ((x_1 + x_2)/2, (y_1 + y_2)/2) \rightarrow$ solve for x_2, y_2

A) $(3, -1.5)$	B) $(7, 3)$
C) $(8, 6) \leftarrow$ ANSWER	D) $(10, 2)$

SOLUTION: $(2 + x_2)/2 = 5 \rightarrow x_2 = 8$. $(-4 + y_2)/2 = 1 \rightarrow y_2 = 6$. B = $(8, 6)$.

G · 09 Surface Area — Rectangular Prism [Hard]

★ KEY: $SA = 2(lw + lh + wh)$ — SIX faces, THREE pairs

A gift box is 8 cm × 5 cm × 3 cm. How many cm² of wrapping paper are needed?

■ Mistake: Multiplying $8 \times 5 \times 3 = 120 \rightarrow$ that's VOLUME, not surface area!

EXAMPLE FIRST

EXAMPLE: $2 \times 3 \times 4$ box: $SA = 2(6 + 8 + 12) = 52 \text{ cm}^2$

A) 120 cm ²	B) 158 cm ² ← ANSWER
C) 240 cm ²	D) 316 cm ²

SOLUTION: $SA = 2(8 \cdot 5 + 8 \cdot 3 + 5 \cdot 3) = 2(40 + 24 + 15) = 2(79) = 158 \text{ cm}^2$.

G · 10 45-45-90 Special Triangle [Hard]

★ KEY: 45-45-90 ratios = $x : x : x\sqrt{2}$ (hyp = leg × $\sqrt{2}$)

An isosceles right triangle has hypotenuse $10\sqrt{2}$ cm. What is the length of each leg?

■ Mistake: Dividing by 2 instead of $\sqrt{2}$, or multiplying instead of dividing.

EXAMPLE FIRST

EXAMPLE: hyp = $6\sqrt{2} \rightarrow$ leg = $6\sqrt{2} \div \sqrt{2} = 6$

A) 5 cm	B) 10 cm ← ANSWER
C) $5\sqrt{2}$ cm	D) $10\sqrt{2}$ cm

SOLUTION: leg = hyp $\div \sqrt{2} = 10\sqrt{2} \div \sqrt{2} = 10$ cm. Memorize: 45-45-90 = 1:1: $\sqrt{2}$.

ANSWER KEY

ALGEBRA 1

A · 01 → Answer: C | Setup: $47 + 8h = 103 \rightarrow 8h = 56 \rightarrow h = 7$

A · 02 → Answer: B | Available: $20 - 5 = \$15$. $3n \leq 15 \rightarrow n \leq 5$. Max = 5 notebooks.

A · 03 → Answer: C | Let b = Ben's. $(b+6) + b = 34 \rightarrow 2b = 28 \rightarrow b = 14$. (Ava has 20 — trap!)

A · 04 → Answer: B | Discount = $0.25 \times 40 = \$10$. Sale price = $40 - 10 = \$30$.

A · 05 → Answer: C | Head start: 45 mi. Closing rate: 15 mph. Time: $45 \div 15 = 3$ hours.

A · 06 → Answer: C | $C = 50 + 75(4) = 50 + 300 = \350 .

A · 07 → Answer: D | $P = 50 \cdot 2^5 = 50 \cdot 32 = 1,600$.

A · 08 → Answer: B | $(w + 8)(w - 5) = 0 \rightarrow w = 5$ or $w = -8$. Reject negative. Width = 5 m.

A · 09 → Answer: B | $6 + x = 0.5(20 + x) \rightarrow 6 + x = 10 + 0.5x \rightarrow 0.5x = 4 \rightarrow x = 8$ L.

A · 10 → Answer: C | Denominator = 0: $x - 4 = 0 \rightarrow x = 4$. Domain is all reals except $x = 4$.

GEOMETRY

G · 01 → Answer: B | $(3x+10) + (x+20) = 180 \rightarrow 4x + 30 = 180 \rightarrow 4x = 150 \rightarrow x = 37.5$.

G · 02 → Answer: C | $5^2 + h^2 = 13^2 \rightarrow 25 + h^2 = 169 \rightarrow h^2 = 144 \rightarrow h = 12$ ft. (5-12-13 triple!)

G · 03 → Answer: B | $A = \frac{1}{2}(18)(10) = 90$ m². Cost = $90 \times \$4 = \360 . Trap C: forgetting $\frac{1}{2}$.

G · 04 → Answer: C | Arc = $(\frac{120}{360}) \times 2(3.14)(9) = (\frac{1}{3}) \times 56.52 \approx 18.84$ cm.

G · 05 → Answer: C | Scale = $10/4 = 2.5$. Longest side = $8 \times 2.5 = 20$.

G · 06 → Answer: B | $r = 6/2 = 3$. $V = \pi(3^2)(10) = 90\pi \approx 282.6$ ft³. Trap C: using $r=6$.

G · 07 → Answer: C | Third interior = $180 - 55 - 70 = 55^\circ$. Exterior = $180 - 55 = 125^\circ$. Or: $55 + 70 = 125^\circ$.

G · 08 → Answer: C | $(2 + x)/2 = 5 \rightarrow x = 8$. $(-4 + y)/2 = 1 \rightarrow y = 6$. B = (8, 6).

G · 09 → Answer: B | $SA = 2(8 \cdot 5 + 8 \cdot 3 + 5 \cdot 3) = 2(40 + 24 + 15) = 2(79) = 158$ cm².

G · 10 → Answer: B | leg = hyp $\div \sqrt{2} = 10\sqrt{2} \div \sqrt{2} = 10$ cm. Memorize: 45-45-90 = 1:1: $\sqrt{2}$.

Score: _____ / 20 Name: _____ Date: _____