

ALGEBRA 1 & GEOMETRY

Key Concepts Worksheet | 20 Problems | Step-by-Step Practice

Name: _____	Date: _____	Score: _____ / 20	Time: _____
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Instructions: Each problem has 3 steps. Read the concept and example, then answer all three questions. Circle the letter of your answer. All 3 must be correct to earn full credit for the problem.

■ ALGEBRA 1

Q 1

Solving Linear Equations

CONCEPT: To solve an equation, isolate the variable by doing the same operation on both sides.

FORMULA: $ax + b = c \Rightarrow x = (c - b) / a$

EXAMPLE: Solve: $2x + 3 = 11 \Rightarrow 2x = 8 \Rightarrow x = 4$ ✓ $x = 4$

Step 1 of 3

Solve for x: $3x + 5 = 20$

A) $x = 3$ B) $x = 5$

C) $x = 8$ D) $x = 15$

Work space:

Answer Key — Step 1: B) $x = 5$ | $3x=15, x=5$

Step 2 of 3

Solve for x: $2x - 7 = 11$

A) $x = 2$ B) $x = 7$

C) $x = 9$ D) $x = 12$

Work space:

Answer Key — Step 2: C) $x = 9$ | $2x=18, x=9$

Step 3 of 3

Solve for x: $4x + 1 = 17$

A) $x = 4$ B) $x = 5$

C) $x = 6$ D) $x = 8$

Work space:

Answer Key — Step 3: A) $x = 4$ | $4x=16, x=4$

Q 2

Slope of a Line

CONCEPT: Slope measures steepness (rise over run) between two points.

FORMULA: $m = (y_2 - y_1) / (x_2 - x_1)$

EXAMPLE: Points (1,2) and (3,8): $m = (8-2)/(3-1) = 6/2 = 3$ ✓ $m = 3$

Step 1 of 3

Find slope between (0,0) and (4,8)

A) 0.5 B) 2

C) 4 D) 8

Work space:

Answer Key — Step 1: B) 2 | $m=8/4=2$

Step 2 of 3

Find slope between (2,3) and (6,11)

A) 1 B) 2

C) 3 D) 4

Work space:

Answer Key — Step 2: B) 2 | $m=8/4=2$

Step 3 of 3

What is the slope of $y = 5x - 3$?

A) -3 B) 3

C) 5 D) 15

Work space:

Answer Key — Step 3: C) 5 | Coefficient of x: $m=5$

**Q
3****Systems of Equations**

CONCEPT: Find values satisfying BOTH equations. Use substitution: replace one variable in the other.

FORMULA: Substitute y into the second equation and solve.

EXAMPLE: $y=2x$, $x+y=6 \Rightarrow x+2x=6 \Rightarrow x=2$, $y=4$ ✓ $(x,y) = (2,4)$

Step 1 of 3

$y = x+1$ and $x+y=7$. Find x .

A) 2 B) 3

C) 4 D) 6

Work space:

Answer Key — Step 1: B) 3 | $x+(x+1)=7 \Rightarrow 2x=6 \Rightarrow x=3$

Step 2 of 3

$2x+y=10$ and $y=2$. Find x .

A) 2 B) 3

C) 4 D) 6

Work space:

Answer Key — Step 2: C) 4 | $2x+2=10 \Rightarrow x=4$

Step 3 of 3

$x-y=4$ and $x+y=10$. Find x .

A) 3 B) 5

C) 7 D) 10

Work space:

Answer Key — Step 3: C) 7 | Add equations: $2x=14 \Rightarrow x=7$

Q 4

Factoring Quadratics

CONCEPT: Factor x^2+bx+c by finding two numbers with product= c and sum= b .

FORMULA: $x^2 + bx + c = (x+p)(x+q)$ where $p*q=c$ and $p+q=b$

EXAMPLE: x^2+5x+6 : need $p*q=6$, $p+q=5 \Rightarrow p=2, q=3 \Rightarrow (x+2)(x+3)$ ✓ $(x+2)(x+3)$

Step 1 of 3

Factor: $x^2 + 7x + 12$

A) $(x+1)(x+12)$ B) $(x+2)(x+6)$

C) $(x+3)(x+4)$ D) $(x+4)(x+4)$

Work space:

Answer Key — Step 1: C) $(x+3)(x+4)$ | $p*q=12$, $p+q=7 \Rightarrow 3,4$

Step 2 of 3

Factor: $x^2 - 5x + 6$

A) $(x-1)(x-6)$ B) $(x-2)(x-3)$

C) $(x+2)(x+3)$ D) $(x-6)(x+1)$

Work space:

Answer Key — Step 2: B) $(x-2)(x-3)$ | $p*q=6$, $p+q=-5 \Rightarrow -2,-3$

Step 3 of 3

Zeros of $x^2 + x - 6 = 0$?

A) $x=2$, $x=-3$ B) $x=-2$, $x=3$

C) $x=1$, $x=-6$ D) $x=3$, $x=2$

Work space:

Answer Key — Step 3: A) $x=2$, $x=-3$ | $(x+3)(x-2)=0 \Rightarrow x=2,-3$

5Q

Inequalities

CONCEPT: Solve like equations BUT flip the inequality sign when multiplying or dividing by a **NEGATIVE** number!

FORMULA: If $-ax > b \Rightarrow x < -b/a$ (sign **FLIPS!**)

EXAMPLE: Solve $-2x > 8 \Rightarrow x < -4$ (divided by -2 , sign flipped) ✓ $x < -4$

Step 1 of 3

Solve: $3x - 2 > 7$

A) $x < 3$ B) $x > 3$

C) $x < 5$ D) $x > 5$

Work space:

Answer Key — Step 1: B) $x > 3$ | $3x > 9 \Rightarrow x > 3$ (no flip)

Step 2 of 3

Solve: $-4x \leq 12$

A) $x \leq -3$ B) $x \geq -3$

C) $x \leq 3$ D) $x \geq 3$

Work space:

Answer Key — Step 2: B) $x \geq -3$ | Divide by -4 , FLIP: $x \geq -3$

Step 3 of 3

Which value satisfies $2x+1 < 9$?

A) $x=5$ B) $x=4$

C) $x=3$ D) $x=6$

Work space:

Answer Key — Step 3: C) $x=3$ | $2x < 8 \Rightarrow x < 4$. Only $x=3$ works

**Q
6**

Exponent Rules

CONCEPT: Product Rule: $x^a * x^b = x^{(a+b)}$ | Power Rule: $(x^a)^b = x^{(ab)}$ | Zero: $x^0 = 1$

FORMULA: $x^a * x^b = x^{(a+b)}$ | $x^a/x^b = x^{(a-b)}$ | $(x^a)^b = x^{(ab)}$

EXAMPLE: $x^3 * x^4 = x^7$ ✓ x^7

Step 1 of 3

Simplify: $x^5 * x^3$

A) x^2 B) x^8

C) x^{15} D) x^{53}

Work space:

Answer Key — Step 1: B) x^8 | $x^{(5+3)}=x^8$

Step 2 of 3

Simplify: $(x^3)^4$

A) x^7 B) x^{12}

C) x^{34} D) x^{43}

Work space:

Answer Key — Step 2: B) x^{12} | $x^{(3*4)}=x^{12}$

Step 3 of 3

What is x^0 (x not equal to 0)?

A) 0 B) 1

C) x D) undefined

Work space:

Answer Key — Step 3: B) 1 | Any nonzero number to power 0 = 1

Q 7

Functions & Function Notation

CONCEPT: $f(x)$ means "function of x ." To evaluate $f(a)$, substitute $x = a$ into the expression.

FORMULA: $f(x) = \text{expression} \Rightarrow f(a) = \text{substitute } x \text{ with } a$

EXAMPLE: $f(x)=2x+3$, find $f(4)$: $f(4)=2(4)+3=11$ ✓ $f(4) = 11$

Step 1 of 3

If $f(x) = x^2 - 1$, what is $f(3)$?

A) 5 B) 7

C) 8 D) 9

Work space:

Answer Key — Step 1: C) 8 | $f(3)=9-1=8$

Step 2 of 3

If $g(x) = 3x - 4$, what is $g(2)$?

A) 1 B) 2

C) 3 D) 10

Work space:

Answer Key — Step 2: B) 2 | $g(2)=6-4=2$

Step 3 of 3

If $h(x) = x^2 + 2x$, what is $h(-1)$?

A) -3 B) -1

C) 0 D) 1

Work space:

Answer Key — Step 3: B) -1 | $h(-1)=1-2=-1$

Q
8

Quadratic Formula

CONCEPT: Use when you cannot easily factor. The discriminant b^2-4ac determines the number of solutions.

FORMULA: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
for $ax^2 + bx + c = 0$

EXAMPLE: $x^2-5x+6=0: x=(5\pm\sqrt{1})/2 \Rightarrow x=3$ or $x=2$ ✓ $x = 3$ or $x = 2$

Step 1 of 3

For $x^2+4x+3=0$, what is b^2-4ac ?

A) 4 B) 7

C) 13 D) 28

Work space:

Answer Key — Step 1: A) 4 | $16-12=4$

Step 2 of 3

Solve $x^2 - 4 = 0$

A) $x=\pm 1$ B) $x=\pm 2$

C) $x=\pm 4$ D) $x=0$

Work space:

Answer Key — Step 2: B) $x=\pm 2$ | $x^2=4 \Rightarrow x=\pm 2$

Step 3 of 3

If $b^2-4ac < 0$, how many real solutions?

A) None B) One

C) Two D) Three

Work space:

Answer Key — Step 3: A) None | Neg. discriminant = no real solutions

Q
9

Proportions & Percent

CONCEPT: A proportion states two ratios are equal. Cross-multiply to solve.

FORMULA: $a/b = c/d \Rightarrow a*d = b*c$
(Cross-Multiplication)

EXAMPLE: $3/4 = x/20 \Rightarrow 4x=60 \Rightarrow x=15 \checkmark x = 15$

Step 1 of 3

Solve: $5/8 = x/40$

A) $x=20$ B) $x=25$

C) $x=32$ D) $x=64$

Work space:

Answer Key — Step 1: B) $x=25$ | $8x=200 \Rightarrow x=25$

Step 2 of 3

What is 30% of 80?

A) 18 B) 24

C) 26 D) 30

Work space:

Answer Key — Step 2: B) 24 | $0.30*80=24$

Step 3 of 3

Price: \$40 to \$50. What is the % increase?

A) 10% B) 20%

C) 25% D) 30%

Work space:

Answer Key — Step 3: C) 25% | $10/40*100=25\%$

**Q
10****Absolute Value Equations**

CONCEPT: $|x| = a$ has TWO solutions: $x = a$ or $x = -a$ (both have the same absolute value).

FORMULA: $|x| = a \Rightarrow x = a$ OR $x = -a$

EXAMPLE: $|x-3|=5 \Rightarrow x-3=5 \Rightarrow x=8$, or $x-3=-5 \Rightarrow x=-2$ ✓ $x = 8$ or $x = -2$

Step 1 of 3

Solve: $|x| = 7$

A) $x=7$ only B) $x=-7$ only

C) $x=7$ or $x=-7$ D) $x=0$

Work space:

Answer Key — Step 1: C) $x=7$ or $x=-7$ | Both $+7$ and -7

Step 2 of 3

$|x+2|=6$. Find the positive solution.

A) $x=4$ B) $x=6$

C) $x=8$ D) $x=10$

Work space:

Answer Key — Step 2: A) $x=4$ | $x+2=6 \Rightarrow x=4$

Step 3 of 3

How many solutions: $|2x-1| = -3$?

A) None B) One

C) Two D) Three

Work space:

Answer Key — Step 3: A) None | $| \cdot | \geq 0$, cannot equal -3

■ GEOMETRY

Q
11

Pythagorean Theorem

CONCEPT: In a right triangle, the square of the hypotenuse equals the sum of squares of the two legs.

FORMULA: $a^2 + b^2 = c^2$ (c = hypotenuse, the longest side)

EXAMPLE: Legs 3 and 4: $9+16=25 \Rightarrow c=5$ ✓ $c = 5$

Step 1 of 3

Right triangle legs 6 and 8. Hypotenuse?

A) 9 B) 10

C) 12 D) 14

Work space:

Answer Key — Step 1: B) 10 | $36+64=100$, $c=10$

Step 2 of 3

Hypotenuse=13, one leg=5. Other leg?

A) 8 B) 10

C) 12 D) 14

Work space:

Answer Key — Step 2: C) 12 | $25+b^2=169 \Rightarrow b=12$

Step 3 of 3

Which is a Pythagorean triple?

A) 2,3,4 B) 5,12,13

C) 6,7,8 D) 4,5,6

Work space:

Answer Key — Step 3: B) 5,12,13 | $25+144=169=13^2$

Q 12

Area of Triangles

CONCEPT: Triangle area uses base and HEIGHT (the perpendicular height, NOT the slant side!).

FORMULA: $\text{Area} = (1/2) \times \text{base} \times \text{height}$

EXAMPLE: Base=8, Height=5: $\text{Area} = 0.5 \times 8 \times 5 = 20 \text{ cm}^2$ ✓ 20 cm^2

Step 1 of 3

Triangle: base=10, height=6. Area?

A) 30 B) 60

C) 15 D) 24

Work space:

Answer Key — Step 1: A) 30 | $0.5 \times 10 \times 6 = 30$

Step 2 of 3

Area=24, height=8. Base?

A) 3 B) 4

C) 6 D) 8

Work space:

Answer Key — Step 2: C) 6 | $24 = 0.5 \times b \times 8 \Rightarrow b = 6$

Step 3 of 3

Same area as rectangle 4x6?

A) Base4,h6 B) Base8,h6

C) Base12,h4 D) Base6,h8

Work space:

Answer Key — Step 3: B) Base8,h6 | $\text{Rect} = 24$. $0.5 \times 8 \times 6 = 24$

Q 13

Circle: Area & Circumference

CONCEPT: Circles use pi (~3.14159). Area involves r^2 ; Circumference involves the diameter.

FORMULA: Area = $\pi \cdot r^2$ | Circumference = $2 \cdot \pi \cdot r = \pi \cdot d$

EXAMPLE: $r=5$: Area= $25\pi \approx 78.5$, $C=10\pi \approx 31.4$ ✓ Area= 25π , $C=10\pi$

Step 1 of 3

Area of circle, $r=3$? (in terms of pi)

A) 3π B) 6π

C) 9π D) 12π

Work space:

Answer Key — Step 1: C) 9π | $\pi \cdot 9 = 9\pi$

Step 2 of 3

Circumference, $d=10$? ($\pi \approx 3.14$)

A) 15.7 B) 31.4

C) 62.8 D) 78.5

Work space:

Answer Key — Step 2: B) 31.4 | $3.14 \cdot 10 = 31.4$

Step 3 of 3

Area= 16π . What is the radius?

A) 2 B) 4

C) 8 D) 16

Work space:

Answer Key — Step 3: B) 4 | $r^2 = 16 \Rightarrow r = 4$

Q 14

Angle Relationships

CONCEPT: Complementary = sum 90 deg.
Supplementary = sum 180 deg. Vertical angles are EQUAL.

FORMULA: Complementary: $A+B=90$ deg |
Supplementary: $A+B=180$ deg

EXAMPLE: Supplement of 35 deg = $180-35=145$ deg ✓ 145 degrees

Step 1 of 3

Angle A=42 deg. Complement?

A) 38 B) 42

C) 48 D) 138

Work space:

Answer Key — Step 1: C) 48 | $90-42=48$

Step 2 of 3

Angle B=115 deg. Supplement?

A) 65 B) 75

C) 90 D) 245

Work space:

Answer Key — Step 2: A) 65 | $180-115=65$

Step 3 of 3

Vertical angle to 68 deg is...

A) 22 B) 68

C) 112 D) 180

Work space:

Answer Key — Step 3: B) 68 | Vertical angles are equal: 68

Q
15

Parallel Lines & Transversals

CONCEPT: Transversal through parallel lines: Alternate Interior angles are equal. Co-interior angles sum to 180 deg.

FORMULA: Alternate Interior: equal | Corresponding: equal | Co-interior: 180 deg

EXAMPLE: If one angle=70 deg, its alternate interior angle=70 deg. ✓ Alternate angles are always equal

Step 1 of 3

Parallel lines, transversal. Angle=55 deg. Alternate interior angle?

A) 35 B) 55

C) 125 D) 180

Work space:

Answer Key — Step 1: B) 55 | Alternate interior = equal = 55

Step 2 of 3

Co-interior angle to 70 deg?

A) 70 B) 90

C) 110 D) 120

Work space:

Answer Key — Step 2: C) 110 | $180 - 70 = 110$

Step 3 of 3

Corresponding angle to 130 deg?

A) 50 B) 130

C) 180 D) 230

Work space:

Answer Key — Step 3: B) 130 | Corresponding = equal = 130

Q 16

Triangle Congruence & Similarity

CONCEPT: Congruent: same shape AND size. Similar: same shape, proportional sides (different size).

FORMULA: Congruence: SSS, SAS, ASA, AAS | Similarity: AA, SAS, SSS

EXAMPLE: Two triangles with same three angles => SIMILAR (AA). ✓ Similar by AA

Step 1 of 3

Two triangles, two equal angles. They are...

A) Congruent B) Similar

C) Neither D) Identical

Work space:

Answer Key — Step 1: B) Similar | AA => similar

Step 2 of 3

Triangle ABC = Triangle DEF. AB=5. DE=?

A) 2.5 B) 5

C) 10 D) Unknown

Work space:

Answer Key — Step 2: B) 5 | Congruent => equal sides. DE=5

Step 3 of 3

Similar triangles ratio 1:3. Side=4. Other side?

A) 4 B) 7

C) 12 D) 16

Work space:

Answer Key — Step 3: C) 12 | $4 \cdot 3 = 12$

Q 17

Volume of 3D Shapes

CONCEPT: Volume measures how much 3D space a shape occupies. Units are cubed (cm^3 , in^3 , etc).

FORMULA: Cube: s^3 | Box: $l \cdot w \cdot h$ |
Cylinder: $\pi \cdot r^2 \cdot h$ | Cone: $(1/3) \cdot \pi \cdot r^2 \cdot h$

EXAMPLE: Box $4 \times 3 \times 5 = 60 \text{ cm}^3$ ✓ 60 cm^3

Step 1 of 3

Volume of cube, side=4 cm

A) 16 B) 24

C) 48 D) 64

Work space:

Answer Key — Step 1: D) 64 | $4^3=64$

Step 2 of 3

Cylinder $r=3$, $h=5$ ($\pi \sim 3.14$)

A) 47.1 B) 94.2

C) 141.3 D) 188.4

Work space:

Answer Key — Step 2: C) 141.3 | $3.14 \cdot 9 \cdot 5 = 141.3$

Step 3 of 3

Cone vs cylinder (same r and h): Cone volume is...

A) Same B) Double

C) $1/3$ D) $1/2$

Work space:

Answer Key — Step 3: C) $1/3$ | Cone = $(1/3) \cdot$ Cylinder

**Q
18****Coordinate Geometry: Distance & Midpoint**

CONCEPT: Distance Formula is the Pythagorean Theorem on a coordinate plane.

FORMULA: Distance = $\sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$ | Midpoint = $((x_1+x_2)/2, (y_1+y_2)/2)$

EXAMPLE: (0,0) to (3,4): $\sqrt{9+16}=5$ ✓ 5 units

Step 1 of 3

Distance: (1,1) to (4,5)?

A) 3 B) 4

C) 5 D) 6

Work space:

Answer Key — Step 1: C) 5 | $\sqrt{9+16}=5$

Step 2 of 3

Midpoint of (2,4) and (8,10)?

A) (4,6) B) (5,7)

C) (6,7) D) (10,14)

Work space:

Answer Key — Step 2: B) (5,7) | $(10/2, 14/2)=(5,7)$

Step 3 of 3

A=(0,0), M=(3,4) is midpoint. B=?

A) (3,4) B) (4,6)

C) (6,8) D) (6,4)

Work space:

Answer Key — Step 3: C) (6,8) | $B_x=6, B_y=8$

Q 19

Transformations

CONCEPT: Rigid motions preserve shape and size.
Translation shifts, reflection flips, rotation turns.

FORMULA: Translate: $(x+a, y+b)$ | Reflect
x-axis: $(x, -y)$ | Reflect y-axis: $(-x, y)$

EXAMPLE: Translate $(3,2)$ by $(+4,-1) \Rightarrow (7,1)$ ✓ $(7, 1)$

Step 1 of 3

(3,5) reflected over x-axis. New point?

A) $(-3,5)$ B) $(3,-5)$

C) $(-3,-5)$ D) $(5,3)$

Work space:

Answer Key — Step 1: B) $(3,-5)$ | $y \Rightarrow -y$: $(3,-5)$

Step 2 of 3

(-2,4) reflected over y-axis. New point?

A) $(2,4)$ B) $(-2,-4)$

C) $(4,-2)$ D) $(2,-4)$

Work space:

Answer Key — Step 2: A) $(2,4)$ | $x \Rightarrow -x$: $(2,4)$

Step 3 of 3

(1,3) translated by (+2,-4). New point?

A) $(-1,7)$ B) $(3,1)$

C) $(3,-1)$ D) $(2,7)$

Work space:

Answer Key — Step 3: C) $(3,-1)$ | $(1+2, 3-4)=(3,-1)$

**Q
20****Special Right Triangles (30-60-90 & 45-45-90)**

CONCEPT: Memorize the fixed side ratios — no Pythagorean Theorem needed for these special triangles!

FORMULA: 45-45-90: 1 : 1 : $\sqrt{2}$ |
30-60-90: 1 : $\sqrt{3}$: 2

EXAMPLE: 45-45-90, leg=5: hyp= $5\sqrt{2}$. 30-60-90, short leg=4: hyp=8 ✓ Use ratios!

Step 1 of 3**45-45-90 triangle, leg=6. Hypotenuse?**A) 6 B) $6\sqrt{2}$ C) $6\sqrt{3}$ D) 12

Work space:

Answer Key — Step 1: B) $6\sqrt{2}$ | Ratio 1:1: $\sqrt{2}$ => $6\sqrt{2}$

Step 2 of 3**30-60-90 triangle, short leg=5. Hypotenuse?**A) $5\sqrt{2}$ B) $5\sqrt{3}$

C) 10 D) 15

Work space:

Answer Key — Step 2: C) 10 | Ratio 1: $\sqrt{3}$:2 => hyp=10

Step 3 of 3**30-60-90 triangle, hypotenuse=12. Longer leg?**A) 6 B) $6\sqrt{2}$ C) $6\sqrt{3}$ D) $12\sqrt{3}$

Work space:

Answer Key — Step 3: C) $6\sqrt{3}$ | Short leg=6, long leg= $6\sqrt{3}$