MATH MASTER WORKSHEET

Algebra 1 & Geometry — 20 Key Problems

Designed for Korean Students — Common Challenging Topics

Name: _____ **Date:** _____

Class: _____ **Score:** _____ / 20

INSTRUCTIONS:

* Each problem includes a Key Concept, Example, and 3 Practice Questions.
* Circle the correct answer for each question (A, B, C, or D).
* All 3 questions must be correct for full credit on that problem.
* Show your work in the space provided.
* Answers and explanations are at the bottom of each problem.

SECTION A: ALGEBRA 1

Problem 1 | Solving Linear Equations [Linear Equations]

KEY CONCEPT:

A linear equation has the variable to the first power. Solve by using inverse operations to isolate the variable.

ax + b = c => x = (c - b) / a

EXAMPLE PROBLEM & SOLUTION:

Solve: 3x + 5 = 20

Step 1: Subtract 5 from both sides => 3x = 15

Step 2: Divide both sides by 3 => x = 5

Answer: x = 5

PRACTICE QUESTIONS:

Q1. Solve for x: 2x + 7 = 15

A. x = 1

B. x = 4

C. x = 11

D. x = 7

Work / Notes:

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Q2. Solve for x: 5x - 3 = 22

A. x = 4

B. x = 5

C. x = 19

D. x = 3

Work / Notes:

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Q3. Solve for x: x/3 + 4 = 9

A. x = 15

B. x = 5

C. x = 39

D. x = 10

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer B — Subtract 7: 2x = 8. Divide by 2: x = 4.

Q2: Answer B — Add 3: 5x = 25. Divide by 5: x = 5.

Q3: Answer A — Subtract 4: x/3 = 5. Multiply by 3: x = 15.

Problem 2 | Solving Inequalities [Inequalities]

KEY CONCEPT:

Inequalities work like equations EXCEPT: when you multiply or divide both sides by a NEGATIVE number, you must FLIP the inequality sign.

If -ax > b, then x < -b/a (sign flips!)

EXAMPLE PROBLEM & SOLUTION:

Solve: -2x + 3 > 9

Step 1: Subtract 3 => -2x > 6

Step 2: Divide by -2 (FLIP sign!) => x < -3

Answer: x < -3

PRACTICE QUESTIONS:

Q1. Solve: -3x + 6 > 15

A. x > -3

B. x < -3

C. x > 3

D. x < 3

Work / Notes:

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Q2. Which value of x satisfies 2x - 5 <= 7 ?

A. x = 7

B. x = 6

C. x = 5

D. x = 8

Work / Notes:

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Q3. Solve: -4x >= 20

A. x >= -5

B. x <= -5

C. x >= 5

D. x <= 5

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer B — Subtract 6: -3x > 9. Divide by -3 (flip!): x < -3.

Q2: Answer B — 2x <= 12, so x <= 6. Among choices, x = 6 satisfies x <= 6.

Q3: Answer B — Divide by -4 and flip sign: x <= -5.

Problem 3 | Slope and Rate of Change [Linear Functions]

KEY CONCEPT:

The slope (m) measures steepness of a line: rise over run.

m = (y2 - y1) / (x2 - x1)

Slope-intercept form: y = mx + b (m = slope, b = y-intercept)

EXAMPLE PROBLEM & SOLUTION:

Find slope through (1, 3) and (4, 9):

m = (9 - 3) / (4 - 1) = 6 / 3 = 2

Answer: slope = 2

PRACTICE QUESTIONS:

Q1. What is the slope of the line through (2, 5) and (6, 13)?

A. m = 1

B. m = 2

C. m = 3

D. m = 4

Work / Notes:

Q2. In y = -3x + 7, what is the slope?

A. 7

B. 3

C. -3

D. -7

Work / Notes:

Q3. What is the y-intercept of the line y = 4x - 5?

A. 4

B. -5

C. 5

D. -4

Work / Notes:

ANSWER KEY & EXPLANATIONS:

Q1: Answer B — m = (13-5)/(6-2) = 8/4 = 2.

Q2: Answer C — In y = mx + b, m is the slope. Here m = -3.

Q3: Answer B — In y = mx + b, b is the y-intercept. Here b = -5.

Problem 4 | Systems of Equations [Systems of Equations]

KEY CONCEPT:

A system of equations has 2+ equations with the same variables.

Methods: Substitution (solve one for a variable, plug in) or Elimination (add/subtract to remove one variable).

EXAMPLE PROBLEM & SOLUTION:

Solve: x + y = 5 and 2x - y = 4

Add equations: 3x = 9 => x = 3

Substitute: 3 + y = 5 => y = 2

Answer: (x, y) = (3, 2)

PRACTICE QUESTIONS:

Q1. Solve the system: x + y = 7 and x - y = 3

A. (3, 4)

B. (5, 2)

C. (4, 3)

D. (2, 5)

Work / Notes:

Q2. Solve: 2x + y = 9 and x - y = 3

A. (3, 3)

B. (4, 1)

C. (2, 5)

D. (5, 0)

Work / Notes:

Q3. If y = 2x + 1 and y = -x + 7, find x.

A. x = 1

B. x = 2

C. x = 3

D. x = 4

Work / Notes:

ANSWER KEY & EXPLANATIONS:

Q1: Answer B — Add: 2x = 10 => x = 5. Then y = 7 - 5 = 2. Answer: (5, 2).

Q2: Answer B — Add: 3x = 12 => x = 4. Then y = 9 - 8 = 1. Answer: (4, 1).

Q3: Answer B — Set equal: 2x + 1 = -x + 7 => 3x = 6 => x = 2.

Problem 5 | Factoring Trinomials [Polynomials & Factoring]

KEY CONCEPT:

To factor x^2 + bx + c, find two numbers that multiply to c and add to b.

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

EXAMPLE PROBLEM & SOLUTION:

Factor: x^2 + 5x + 6

Find numbers that multiply to 6 and add to 5: 2 and 3

Answer: (x + 2)(x + 3)

PRACTICE QUESTIONS:

Q1. Factor: x^2 + 7x + 12

A. (x+3)(x+4)

B. (x+2)(x+6)

C. (x+1)(x+12)

D. (x+4)(x+4)

Work / Notes:

Q2. Factor: x^2 - 5x + 6

A. (x-1)(x-6)

B. (x-2)(x-3)

C. (x+2)(x-3)

D. (x-2)(x+3)

Work / Notes:

Q3. What are the solutions of x^2 - x - 6 = 0 ?

A. x = 2, x = 3

B. x = -2, x = 3

C. x = 2, x = -3

D. x = -2, x = -3

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer A — 3 x 4 = 12 and 3 + 4 = 7. Answer: (x+3)(x+4).

Q2: Answer B — (-2)(-3) = 6 and -2 + (-3) = -5. Answer: (x-2)(x-3).

Q3: Answer B — Factor: (x-3)(x+2) = 0. So x = 3 or x = -2.

Problem 6 | Quadratic Formula [Quadratic Equations]

KEY CONCEPT:

For ax^2 + bx + c = 0, use the Quadratic Formula:

x = (-b +/- sqrt(b^2 - 4ac)) / 2a

Discriminant (b^2 - 4ac): > 0 means 2 solutions, = 0 means 1 solution, < 0 means no real solutions.

EXAMPLE PROBLEM & SOLUTION:

Solve: x^2 - 5x + 6 = 0 (a=1, b=-5, c=6)

x = (5 +/- sqrt(25-24)) / 2 = (5 +/- 1) / 2

Answer: x = 3 or x = 2

PRACTICE QUESTIONS:

Q1. For x^2 - 4x + 4 = 0, what does the discriminant equal?

A. 0

B. 4

C. 8

D. 16

Work / Notes:

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Q2. Solve x^2 - 6x + 8 = 0 using the quadratic formula.

A. x = 2, x = 4

B. x = -2, x = -4

C. x = 1, x = 8

D. x = 3, x = 3

Work / Notes:

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Q3. How many real solutions does x^2 + 2x + 5 = 0 have?

A. 2 real solutions

B. 1 real solution

C. 0 real solutions

D. 3 real solutions

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer A — Discriminant = (-4)^2 - 4(1)(4) = 16 - 16 = 0.

Q2: Answer A — x = (6 +/- sqrt(36-32)) / 2 = (6 +/- 2) / 2. So x = 4 or x = 2.

Q3: Answer C — Discriminant = 4 - 20 = -16 < 0. Negative discriminant => no real solutions.

Problem 7 | Functions & Domain/Range [Functions]

KEY CONCEPT:

A function maps each input (domain) to exactly one output (range).

Vertical Line Test: if any vertical line crosses a graph more than once, it is NOT a function.

f(x) notation: f(3) means plug in x = 3

EXAMPLE PROBLEM & SOLUTION:

Given f(x) = 2x - 1, find f(4):

f(4) = 2(4) - 1 = 8 - 1 = 7

Answer: f(4) = 7

PRACTICE QUESTIONS:

Q1. If f(x) = 3x + 2, what is f(5)?

A. 13

B. 15

C. 17

D. 10

Work / Notes:

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Q2. What is the domain of f(x) = sqrt(x - 4)?

A. x > 4

B. x < 4

C. x >= 4

D. All real numbers

Work / Notes:

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Q3. If g(x) = x^2 - 3, what is g(-2)?

A. 7

B. 1

C. -7

D. -1

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer C — f(5) = 3(5) + 2 = 15 + 2 = 17.

Q2: Answer C — The expression under a square root must be >= 0. So x - 4 >= 0 => x >= 4.

Q3: Answer B — g(-2) = (-2)^2 - 3 = 4 - 3 = 1.

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Problem 8 | Exponent Rules [Exponents]

KEY CONCEPT:

Product rule: a^m * a^n = a^(m+n)

Quotient rule: a^m / a^n = a^(m-n)

Power rule: (a^m)^n = a^(m*n)

Zero: a^0 = 1 (a not equal 0)

Negative: a^(-n) = 1 / a^n

EXAMPLE PROBLEM & SOLUTION:

Simplify: (x^3)^2 * x^(-1)

= x^6 * x^(-1) = x^(6-1) = x^5

Answer: x^5

PRACTICE QUESTIONS:

Q1. Simplify: x^3 * x^5

A. x^15

B. x^8

C. x^2

D. 2x^8

Work / Notes:

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Q2. Simplify: y^7 / y^3

A. y^4

B. y^10

C. y^21

D. y^(-4)

Work / Notes:

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Q3. What is the value of (2^3)^2 ?

A. 12

B. 32

C. 64

D. 48

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer B — Product rule: x^3 * x^5 = x^(3+5) = x^8.

Q2: Answer A — Quotient rule: y^7 / y^3 = y^(7-3) = y^4.

Q3: Answer C — Power rule: (2^3)^2 = 2^(3x2) = 2^6 = 64.

Problem 9 | Absolute Value Equations [Absolute Value]

KEY CONCEPT:

|x| = the distance from x to 0 on the number line. Always non-negative.

To solve |ax + b| = c (c >= 0), split into TWO cases:

ax + b = c OR ax + b = -c

EXAMPLE PROBLEM & SOLUTION:

Solve: |2x - 3| = 7

Case 1: 2x - 3 = 7 => x = 5

Case 2: 2x - 3 = -7 => x = -2

Answer: x = 5 or x = -2

PRACTICE QUESTIONS:

Q1. Solve: |x + 3| = 8

A. x = 5 or x = 11

B. x = 5 or x = -11

C. x = -5 or x = 11

D. x = -5 or x = -11

Work / Notes:

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Q2. How many solutions does |2x - 1| = -5 have?

A. Two solutions
B. One solution
C. No solution
D. Infinitely many

Work / Notes:

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Q3. Solve: |3x| = 12

A. x = 4 only
B. x = -4 only
C. x = 4 or x = -4
D. x = 36

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer B — x+3 = 8 => x = 5. Or x+3 = -8 => x = -11.

Q2: Answer C — Absolute value is always >= 0. It can never equal -5. So no solution.

Q3: Answer C — 3x = 12 => x = 4. Or 3x = -12 => x = -4.

Problem 10 | Word Problems with Linear Models [Applications]

KEY CONCEPT:

When reading word problems, identify: What does x represent? Translate words into math.

Key words: 'more than' (+), 'less than' (-), 'times' (x), 'per' (divided by)

EXAMPLE PROBLEM & SOLUTION:

A taxi charges $3 base fee + $2 per mile. Total bill = $15. How many miles?

Equation: 3 + 2m = 15 => 2m = 12 => m = 6

Answer: 6 miles

PRACTICE QUESTIONS:

Q1. A plumber charges $50 for the visit plus $30 per hour. The total bill is $170. How many hours did the plumber work?

A. 3 hours
B. 4 hours
C. 5 hours
D. 6 hours

Work / Notes:

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Q2. Sam has 3 times as many marbles as Tom. Together they have 48. How many does Tom have?

A. 8

B. 12

C. 16

D. 24

Work / Notes:

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Q3. The perimeter of a rectangle is 36. The length is 6 more than the width. What is the width?

A. 6

B. 8

C. 12

D. 15

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer B — 50 + 30h = 170 => 30h = 120 => h = 4 hours.

Q2: Answer B — Tom = t, Sam = 3t. So 4t = 48 => t = 12.

Q3: Answer A — 2(w + w+6) = 36 => 4w + 12 = 36 => w = 6.

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SECTION B: GEOMETRY

Problem 11 | Triangle Angle Sum [Triangle Properties]

KEY CONCEPT:

The sum of all interior angles in any triangle is always 180 degrees.

angle A + angle B + angle C = 180 degrees

Exterior Angle Theorem: An exterior angle = sum of the two non-adjacent interior angles.

EXAMPLE PROBLEM & SOLUTION:

A triangle has angles 55 degrees and 70 degrees. Find the third angle.

Third angle = 180 - 55 - 70 = 55 degrees

Answer: 55 degrees

PRACTICE QUESTIONS:

Q1. A triangle has angles of 45 degrees and 85 degrees. What is the third angle?

A. 40 degrees
B. 50 degrees
C. 60 degrees
D. 70 degrees

Work / Notes:

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Q2. An exterior angle of a triangle is 110 degrees. The two non-adjacent interior angles are equal. What is each?

A. 40 degrees
B. 55 degrees
C. 70 degrees
D. 80 degrees

Work / Notes:

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Q3. In a right triangle, one acute angle is 37 degrees. What is the other acute angle?

A. 43 degrees
B. 53 degrees
C. 63 degrees
D. 73 degrees

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer B — 180 - 45 - 85 = 50 degrees.

Q2: Answer B — Each = 110 / 2 = 55 degrees (exterior angle theorem).

Q3: Answer B — 90 + 37 + x = 180 => x = 53 degrees.

Problem 12 | Pythagorean Theorem [Right Triangles]

KEY CONCEPT:

In a right triangle, the square of the hypotenuse (c) = sum of squares of the legs (a and b).

a^2 + b^2 = c^2

Common triples: (3,4,5), (5,12,13), (8,15,17)

EXAMPLE PROBLEM & SOLUTION:

Find the hypotenuse of a right triangle with legs 6 and 8:

c^2 = 6^2 + 8^2 = 36 + 64 = 100

c = sqrt(100) = 10

Answer: Hypotenuse = 10

PRACTICE QUESTIONS:

Q1. A right triangle has legs of 5 and 12. What is the hypotenuse?

A. 13

B. 15

C. 17

D. 10

Work / Notes:

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Q2. The hypotenuse of a right triangle is 10 and one leg is 6. What is the other leg?

A. 4

B. 6

C. 8

D. 16

Work / Notes:

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Q3. Is a triangle with sides 7, 24, and 25 a right triangle?

A. Yes

B. No

C. Cannot be determined

D. Only if the angle is 90 degrees

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer A — c^2 = 5^2 + 12^2 = 25 + 144 = 169. c = sqrt(169) = 13.

Q2: Answer C — b^2 = 10^2 - 6^2 = 100 - 36 = 64. b = sqrt(64) = 8.

Q3: Answer A — 7^2 + 24^2 = 49 + 576 = 625 = 25^2. Yes, it is a right triangle!

Problem 13 | Area of Triangles and Quadrilaterals [Area & Perimeter]

KEY CONCEPT:

Triangle: A = (1/2) x base x height

Rectangle: A = length x width

Parallelogram: A = base x height

Trapezoid: A = (1/2)(b1 + b2) x h

EXAMPLE PROBLEM & SOLUTION:

Area of trapezoid with bases 5 and 9, height 4:

A = (1/2)(5 + 9) x 4 = (1/2)(14)(4) = 28

Answer: 28 sq units

PRACTICE QUESTIONS:

Q1. What is the area of a triangle with base 10 and height 6?

A. 60

B. 30

C. 16

D. 20

Work / Notes:

Q2. What is the area of a trapezoid with bases 4 and 10, and height 5?

A. 35

B. 200

C. 70

D. 50

Work / Notes:

Q3. A parallelogram has base 8 cm and height 6 cm. What is its area?

A. 28 cm^2

B. 48 cm^2

C. 24 cm^2

D. 96 cm^2

Work / Notes:

ANSWER KEY & EXPLANATIONS:

Q1: Answer B — A = (1/2) x 10 x 6 = 30 square units.

Q2: Answer A — A = (1/2)(4+10) x 5 = (1/2)(14)(5) = 35 square units.

Q3: Answer B — A = base x height = 8 x 6 = 48 cm^2.

Problem 14 | Circle Properties [Circles]

KEY CONCEPT:

For a circle with radius r:

Circumference: C = 2 * pi * r = pi * d

Area: A = pi * r^2

EXAMPLE PROBLEM & SOLUTION:

Circle with radius 7:

C = 2*pi*(7) = 14*pi approximately 43.98

A = pi*(7^2) = 49*pi approximately 153.94

Answer: C = 14*pi, A = 49*pi

PRACTICE QUESTIONS:

Q1. What is the area of a circle with radius 5? (Leave in terms of pi)

A. 10*pi

B. 25*pi

C. 20*pi

D. 50*pi

Work / Notes:

Q2. The circumference of a circle is 18*pi. What is the radius?

A. 6

B. 9

C. 18

D. 36

Work / Notes:

Q3. A circle has diameter 10. What is its area? (Use pi approximately 3.14)

A. 31.4

B. 78.5

C. 62.8

D. 314

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer B — A = pi * r^2 = pi * (5^2) = 25*pi.

Q2: Answer B — C = 2*pi*r = 18*pi => r = 9.

Q3: Answer B — Radius = 5. A = 3.14 x 5^2 = 3.14 x 25 = 78.5.

Problem 15 | Similar Triangles & Proportions [Similarity]

KEY CONCEPT:

Two triangles are similar (~) if corresponding angles are equal and sides are proportional.

If triangle ABC ~ triangle DEF, then AB/DE = BC/EF = AC/DF

Criteria: AA, SAS, SSS

EXAMPLE PROBLEM & SOLUTION:

If triangle ABC ~ triangle DEF, AB = 4, DE = 6, BC = 5, find EF:

4/6 = 5/EF => EF = 5 x 6 / 4 = 7.5

Answer: EF = 7.5

PRACTICE QUESTIONS:

Q1. Triangle ABC ~ Triangle DEF. If AB = 3, DE = 9, and BC = 5, what is EF?

A. 10

B. 15

C. 25

D. 45

Work / Notes:

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Q2. Two similar triangles have sides in ratio 2:3. If the smaller triangle's area is 16, what is the larger area?

A. 24

B. 32

C. 36

D. 48

Work / Notes:

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Q3. A 6-ft person casts a 4-ft shadow. A tree casts a 20-ft shadow at the same time. How tall is the tree?

A. 25 ft

B. 28 ft

C. 30 ft

D. 32 ft

Work / Notes:

ANSWER KEY & EXPLANATIONS:

Q1: Answer B — Ratio = 9/3 = 3. EF = 5 x 3 = 15.

Q2: Answer C — Area ratio = (2:3)^2 = 4:9. Larger area = 16 x (9/4) = 36.

Q3: Answer C — 6/4 = h/20 => h = 6 x 20 / 4 = 30 feet.

Problem 16 | Volume of 3D Solids [3D Geometry]

KEY CONCEPT:

Rectangular prism: V = l x w x h

Cylinder: V = pi * r^2 * h

Cone: V = (1/3) * pi * r^2 * h

Sphere: V = (4/3) * pi * r^3

EXAMPLE PROBLEM & SOLUTION:

Volume of cylinder with r = 3, h = 10:

V = pi * (3^2) * 10 = 90*pi approximately 282.7

Answer: V = 90*pi

PRACTICE QUESTIONS:

Q1. What is the volume of a rectangular prism with l=5, w=4, h=3?

A. 24

B. 47

C. 60

D. 94

Work / Notes:

Q2. A cone has radius 3 and height 7. What is its volume in terms of pi?

A. 21*pi

B. 63*pi

C. 9*pi

D. 7*pi

Work / Notes:

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Q3. A sphere has radius 6. What is its volume in terms of pi?

A. 144*pi

B. 216*pi

C. 288*pi

D. 72*pi

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer C — V = 5 x 4 x 3 = 60 cubic units.

Q2: Answer A — V = (1/3)*pi*(3^2)*(7) = (1/3)*9*7*pi = 21*pi.

Q3: Answer C — V = (4/3)*pi*(6^3) = (4/3)*pi*216 = 288*pi.

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Problem 17 | Parallel Lines & Transversals [Angle Relationships]

KEY CONCEPT:

When a transversal crosses parallel lines:

Corresponding angles are EQUAL (same position).

Alternate interior angles are EQUAL (Z-shape).

Co-interior (same-side interior) angles are SUPPLEMENTARY (add to 180 degrees).

Vertical angles are always EQUAL.

EXAMPLE PROBLEM & SOLUTION:

Parallel lines cut by transversal, one angle = 65 degrees:

Alternate interior angle = 65 degrees

Co-interior angle = 180 - 65 = 115 degrees

PRACTICE QUESTIONS:

Q1. Two parallel lines are cut by a transversal. One angle measures 72 degrees. What is the alternate interior angle?

A. 18 degrees

B. 72 degrees

C. 108 degrees

D. 118 degrees

Work / Notes:

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Q2. Two parallel lines are cut by a transversal. One co-interior angle is 65 degrees. What is the other co-interior angle?

A. 65 degrees
B. 90 degrees
C. 115 degrees
D. 125 degrees

Work / Notes:

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Q3. Two lines intersect. One angle is 48 degrees. What is the vertically opposite angle?

A. 42 degrees
B. 48 degrees
C. 132 degrees
D. 138 degrees

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer B — Alternate interior angles are equal when lines are parallel. Answer: 72 degrees.

Q2: Answer C — Co-interior angles are supplementary: 180 - 65 = 115 degrees.

Q3: Answer B — Vertical angles are always equal. Answer: 48 degrees.

Problem 18 | Coordinate Geometry [Coordinate Geometry]

KEY CONCEPT:

Distance: d = sqrt[(x2-x1)^2 + (y2-y1)^2]

Midpoint: M = ((x1+x2)/2, (y1+y2)/2)

EXAMPLE PROBLEM & SOLUTION:

Midpoint of (2, 6) and (8, 2):

M = ((2+8)/2, (6+2)/2) = (5, 4)

Answer: Midpoint = (5, 4)

PRACTICE QUESTIONS:

Q1. What is the midpoint of (1, 3) and (7, 9)?

A. (3, 5)
B. (4, 6)
C. (6, 6)
D. (8, 12)

Work / Notes:

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Q2. What is the distance between (0, 0) and (3, 4)?

A. 3

B. 4

C. 5

D. 7

Work / Notes:

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Q3. The midpoint of segment AB is (5, 3). If A = (2, 1), what is B?

A. (8, 5)

B. (7, 4)

C. (3, 2)

D. (10, 6)

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer B — M = ((1+7)/2, (3+9)/2) = (4, 6).

Q2: Answer C — d = sqrt(3^2 + 4^2) = sqrt(9+16) = sqrt(25) = 5.

Q3: Answer A — (2+x)/2 = 5 => x = 8. (1+y)/2 = 3 => y = 5. B = (8, 5).

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Problem 19 | Congruent Triangles [Congruence]

KEY CONCEPT:

Two triangles are congruent (=~) if they have the same size and shape.

SSS: All 3 sides equal | SAS: 2 sides and included angle equal

ASA: 2 angles and included side equal | AAS: 2 angles and non-included side

HL: Hypotenuse-leg (right triangles only)

EXAMPLE PROBLEM & SOLUTION:

Triangle ABC is congruent to Triangle DEF by SAS means:

AB = DE, angle A = angle D, and AC = DF

Answer: Two sides and the included angle are equal.

PRACTICE QUESTIONS:

Q1. Two triangles share a common side. Each triangle has two equal sides adjacent to that common side. Which postulate proves congruence?

A. ASA

B. SSS

C. AAS

D. SAS

Work / Notes:

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Q2. In triangles ABC and DEF: angle A = angle D, angle B = angle E, and AB = DE. What postulate proves congruence?

A. SAS

B. AAS

C. ASA

D. HL

Work / Notes:

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Q3. Which is NOT a valid triangle congruence shortcut?

A. SSS

B. SAS

C. AAA

D. AAS

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer B — Three pairs of equal sides => SSS congruence.

Q2: Answer C — Two equal angles and the included side => ASA.

Q3: Answer C — AAA proves SIMILARITY, not congruence. Triangles can be similar but different sizes.

Problem 20 | Transformations [Transformations]

KEY CONCEPT:

Types of rigid transformations (preserve shape and size):

Translation: Slide (x+a, y+b) | Reflection: Flip over a line

Rotation: Turn around a point | Dilation: Scale — changes size (NOT rigid!)

EXAMPLE PROBLEM & SOLUTION:

Reflect (3, 5) over the x-axis:

Rule: (x, y) => (x, -y)

Answer: (3, -5)

PRACTICE QUESTIONS:

Q1. Point A(4, -2) is translated by vector (-3, 5). What are the new coordinates?

A. (1, 3)

B. (7, -7)

C. (-1, 3)

D. (1, 7)

Work / Notes:

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Q2. Point P(2, 5) is reflected over the y-axis. What are the new coordinates?

A. (2, -5)

B. (-2, 5)

C. (-2, -5)

D. (5, 2)

Work / Notes:

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Q3. Which transformation changes the SIZE of a figure?

A. Translation

B. Reflection

C. Rotation

D. Dilation

Work / Notes:

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ANSWER KEY & EXPLANATIONS:

Q1: Answer A — x: 4+(-3)=1, y: -2+5=3. New coordinates: (1, 3).

Q2: Answer B — Reflection over y-axis: (x,y) => (-x,y). So (2,5) => (-2,5).

Q3: Answer D — Only dilation changes size. The others are rigid motions that preserve size and shape.

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