ALGEBRA 2 & GEOMETRY

Core Practice Problems — 20 Questions

Name: ________________________ Date: ____________ Score: _____ / 20

INSTRUCTIONS: For each problem, read the concept review and worked example. Then answer all 3 multiple-choice questions. Circle your answer. Show all work in the space provided. All 3 must be correct for full credit.

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PART 1: ALGEBRA 2 (Problems 1-10)

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Problem 1: Quadratic Formula

[CONCEPT]

The Quadratic Formula: x = (-b +/- sqrt(b^2 - 4ac)) / 2a

Discriminant = b^2 - 4ac:

> 0: two real roots = 0: one root < 0: no real roots

[WORKED EXAMPLE]

Example: Solve x^2 + 5x + 6 = 0

Discriminant = 25 - 24 = 1 | x = (-5 +/- 1)/2 | x = -2 or x = -3

Q1: What is the discriminant of 2x^2 - 3x + 1 = 0?

(A) 1

(B) 7

(C) -1

(D) 4

Work / Notes:

Q2: Solve: x^2 - 5x + 6 = 0. What are the roots?

(A) x = 2, 3

(B) x = -2, -3

(C) x = 1, 6

(D) x = -1, 6

Work / Notes:

Q3: If the discriminant equals 0, how many real solutions exist?

(A) Exactly one

(B) Two distinct

(C) None

(D) Infinite

Work / Notes:

Problem 2: Complex Numbers

[CONCEPT]

i = sqrt(-1), i^2 = -1, i^3 = -i, i^4 = 1

(a+bi) + (c+di) = (a+c) + (b+d)i

Conjugate of (a+bi) is (a-bi)

[WORKED EXAMPLE]

Example: (2+3i)(1-2i) = 2 - 4i + 3i - 6i^2 = 2 - i + 6 = 8 - i

Q1: What is i^3 equal to?

(A) -i

(B) i

(C) -1

(D) 1

Work / Notes:

Q2: Simplify (3+2i) + (1-5i)

(A) 4-3i

(B) 4+7i

(C) 2+7i

(D) 2-3i

Work / Notes:

Q3: What is the conjugate of (4-7i)?

(A) 4+7i

(B) -4+7i

(C) 4+7

(D) -4-7i

Work / Notes:

Problem 3: Polynomial Factoring

[CONCEPT]

Difference of Squares: $a^2 - b^2 = (a+b)(a-b)$

Sum of Cubes: $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$

Difference of Cubes: $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$

[WORKED EXAMPLE]

Example: Factor $x^3 - 8$ | Recognize a=x, b=2 | = $(x-2)(x^2+2x+4)$

Q1: Factor: $x^2 - 16$

(A) $(x+4)(x-4)$

(B) $(x-4)^2$

(C) $(x+8)(x-2)$

(D) Not factorable

Work / Notes:

Q2: Factor: $2x^3 + 16$

(A) $2(x+2)(x^2-2x+4)$

(B) $2(x-2)(x^2+2x+4)$

(C) $2(x+4)(x^2-4)$

(D) $2(x^2+8)$

Work / Notes:

Q3: Which equals $x^2 + 6x + 9$?

(A) $(x+3)^2$

(B) $(x-3)^2$

(C) $(x+9)(x+1)$

(D) $(x+3)(x-3)$

Work / Notes:

Problem 4: Rational Expressions

[CONCEPT]

To simplify: Factor then cancel common factors, then state restrictions.

Restrictions: values that make denominator = 0

Division: multiply by the reciprocal

[WORKED EXAMPLE]

Example: (x^2 - 4)/(x+2) = (x+2)(x-2)/(x+2) = x-2, where x =/= -2

Q1: Simplify (x^2-9)/(x+3). Result with restriction?

(A) x-3, x=/=-3

(B) x+3, x=/=3

(C) x-3, x=/=3

(D) x+3, x=/=-3

Work / Notes:

Q2: What value is excluded in (2x)/(x-5)?

(A) x = 5

(B) x = 0

(C) x = -5

(D) x = 2

Work / Notes:

Q3: Simplify: (6x^2)/(3x)

(A) 2x

(B) 3x

(C) 2x^2

(D) 6x

Work / Notes:

Problem 5: Exponential & Logarithm Functions

[CONCEPT]

log_b(xy) = log_b(x) + log_b(y)

log_b(x/y) = log_b(x) - log_b(y)

log_b(x^n) = n * log_b(x)

log base b of b = 1; log base b of 1 = 0

[WORKED EXAMPLE]

Example: Solve 2^x = 32 | 32 = 2^5 | x = 5

Q1: What is log_2(32)?

(A) 5

(B) 4

(C) 6

(D) 3

Work / Notes:

Q2: log(100) + log(10) = ?

(A) 3

(B) 2

(C) 1

(D) 10

Work / Notes:

Q3: Solve: log_3(x) = 4

(A) x = 81

(B) x = 12

(C) x = 64

(D) x = 27

Work / Notes:

Problem 6: Systems of Equations

[CONCEPT]

Substitution: solve for one variable, then substitute.

Elimination: add/subtract equations to cancel a variable.

Consistent = 1 solution; Inconsistent = 0; Dependent = infinite

[WORKED EXAMPLE]

Solve: $x+y=5$, $2x-y=1$ | Add: $3x=6$, $x=2$ | $y=3$ | Solution: (2,3)

Q1: Solve by elimination: $x+2y=7$ and $x-2y=1$. Find x.

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

Work / Notes:

Q2: A consistent (independent) system has how many solutions?

(A) Exactly one
(B) None
(C) Infinite
(D) Two

Work / Notes:

Q3: Solve: $y = 2x$ and $3x+y=10$. What is y?

(A) 4
(B) 2
(C) 8
(D) 6

Work / Notes:

Problem 7: Sequences & Series

[CONCEPT]

Arithmetic: $a_n = a_1 + (n-1)d$ Geometric: $a_n = a_1 * r^{(n-1)}$

Arith Sum: $S_n = n(a_1 + a_n)/2$

Geo Sum: $S_n = a_1(1 - r^n)/(1 - r)$

[WORKED EXAMPLE]

Find a_10 of 3, 7, 11,... | d=4 | a_10 = 3 + 9(4) = 39

Q1: In 5, 10, 20, 40,..., what is the common ratio?

(A) 2

(B) 5

(C) 10

(D) 0.5

Work / Notes:

Q2: Find the 8th term of 3, 7, 11,...

(A) 31

(B) 35

(C) 27

(D) 39

Work / Notes:

Q3: Sum of first 5 terms of 2, 6, 18, 54, 162?

(A) 242

(B) 244

(C) 240

(D) 248

Work / Notes:

Problem 8: Radical Functions

[CONCEPT]

Product rule: sqrt(ab) = sqrt(a) * sqrt(b)

Quotient rule: sqrt(a/b) = sqrt(a)/sqrt(b)

To solve: square both sides, then CHECK for extraneous solutions!

Domain: expression under radical >= 0

[WORKED EXAMPLE]

Solve sqrt(x+3) = 4 | Square: x+3=16 | x=13 | Check: sqrt(16)=4 ✓

Q1: Solve sqrt(2x-1) = 3. Find x.

(A) 5

(B) 4

(C) 6

(D) 2

Work / Notes:

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

(A) x >= 4

(B) x > 4

(C) x <= 4

(D) All reals

Work / Notes:

Q3: Simplify: sqrt(48)

(A) 4*sqrt(3)

(B) 3*sqrt(4)

(C) 6*sqrt(2)

(D) 2*sqrt(12)

Work / Notes:

Problem 9: Conic Sections

[CONCEPT]

Circle: (x-h)^2 + (y-k)^2 = r^2 | Center=(h,k), radius=r

Parabola: y = a(x-h)^2 + k | Vertex=(h,k)

Ellipse: x^2/a^2 + y^2/b^2 = 1

[WORKED EXAMPLE]

Find center & radius: (x-3)^2 + (y+2)^2 = 25 | Center=(3,-2), r=5

Q1: Radius of (x-1)^2 + (y+3)^2 = 36?

(A) 6

(B) 36

(C) 9

(D) 12

Work / Notes:

Q2: x^2/9 + y^2/16 = 1 represents which conic?

(A) Ellipse

(B) Circle

(C) Parabola

(D) Hyperbola

Work / Notes:

Q3: Vertex of y = 2(x-4)^2 + 1?

(A) (4, 1)

(B) (-4, 1)

(C) (4, -1)

(D) (2, 4)

Work / Notes:

Problem 10: Function Transformations

[CONCEPT]

f(x)+k: up k | f(x)-k: down k | f(x-h): right h | f(x+h): left h

-f(x): reflect over x-axis | a*f(x): vertical stretch by a

[WORKED EXAMPLE]

g(x) = -(x+3)^2 + 5 vs f(x)=x^2 | Left 3, Up 5, Reflected | Vertex (-3,5)

Q1: f(x)=x^2. Which is f(x) shifted RIGHT 2, UP 3?

(A) (x-2)^2+3

(B) (x+2)^2+3

(C) (x-2)^2-3

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

Work / Notes:

Q2: $-f(x)$ reflects the graph over which axis?

(A) x-axis

(B) y-axis

(C) Origin

(D) Line $y=x$

Work / Notes:

Q3: $f(x)=|x|$. Describe $g(x)=|x+4|-2$

(A) Left 4, Down 2

(B) Right 4, Down 2

(C) Left 4, Up 2

(D) Right 4, Up 2

Work / Notes:

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PART 2: GEOMETRY (Problems 11-20)

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Problem 11: Triangle Congruence

[CONCEPT]

SSS: 3 sides equal | SAS: 2 sides + included angle

ASA: 2 angles + included side | AAS: 2 angles + non-included side

SSA and AAA are NOT valid congruence theorems!

[WORKED EXAMPLE]

AB=DE, BC=EF, angle B = angle E | Two sides + included angle | Triangle ABC = Triangle DEF by SAS

Q1: If angle A=angle D, angle B=angle E, AB=DE — which theorem?

(A) ASA

(B) SAS

(C) SSS

(D) AAS

Work / Notes:

Q2: Which is NOT a valid congruence theorem?

(A) SSA

(B) SAS

(C) ASA

(D) AAS

Work / Notes:

Q3: SSS congruence requires which to be equal?

(A) All 3 sides

(B) 2 sides and 1 angle

(C) 2 angles + 1 side

(D) All 3 angles

Work / Notes:

Problem 12: Pythagorean Theorem

[CONCEPT]

For a right triangle: a^2 + b^2 = c^2 (c = hypotenuse)

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

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

[WORKED EXAMPLE]

Legs = 6 and 8 | c^2 = 36+64 = 100 | c = 10

Q1: Right triangle: legs 9 and 12. Find hypotenuse.

(A) 15
(B) 13
(C) 18
(D) 21

Work / Notes:

Q2: Distance between (1,2) and (4,6)?

(A) 5
(B) 4
(C) sqrt(13)
(D) 7

Work / Notes:

Q3: Sides 7, 24, 25 — is this a right triangle?

(A) Yes
(B) No
(C) Cannot determine
(D) Only if scaled

Work / Notes:

Problem 13: Circle Theorems

[CONCEPT]

Inscribed angle = 1/2 x (intercepted arc)

Central angle = intercepted arc

Opposite angles of cyclic quadrilateral sum to 180 degrees

[WORKED EXAMPLE]

Inscribed angle intercepts arc of 80 degrees | Angle = 1/2 x 80 = 40 degrees

Q1: Inscribed angle intercepts arc of 120 degrees. The angle = ?

(A) 60 deg

(B) 120 deg

(C) 90 deg

(D) 240 deg

Work / Notes:

Q2: Central angle = 94 degrees. Intercepted arc = ?

(A) 94 deg

(B) 47 deg

(C) 188 deg

(D) 266 deg

Work / Notes:

Q3: Cyclic quad: one opposite angle = 110 deg. Other angle = ?

(A) 70 deg

(B) 110 deg

(C) 80 deg

(D) 55 deg

Work / Notes:

Problem 14: Area & Volume

[CONCEPT]

Triangle Area = (1/2)bh | Circle Area = pi * r^2

Cylinder Volume = pi * r^2 * h

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

Sphere Volume = (4/3) * pi * r^3

[WORKED EXAMPLE]

Cone: r=3, h=8 | V = (1/3)*pi*9*8 = 24*pi

Q1: Area of circle with radius 7? (in terms of pi)

(A) 49 pi

(B) 14 pi

(C) 7 pi

(D) 28 pi

Work / Notes:

Q2: Volume of cylinder: r=4, h=10?

(A) 160 pi

(B) 80 pi

(C) 40 pi

(D) 320 pi

Work / Notes:

Q3: Volume of sphere with radius 3?

(A) 36 pi

(B) 12 pi

(C) 27 pi

(D) 18 pi

Work / Notes:

Problem 15: Trigonometry (SOHCAHTOA)

[CONCEPT]

sin(theta) = Opposite / Hypotenuse

cos(theta) = Adjacent / Hypotenuse

tan(theta) = Opposite / Adjacent

Memory: SOH - CAH - TOA

[WORKED EXAMPLE]

Angle 30 deg, hypotenuse=10 | sin(30)=opp/10 | opp = 10*0.5 = 5

Q1: Right triangle: opposite=5, hypotenuse=13. Find sin(theta).

(A) 5/13

(B) 12/13

(C) 5/12

(D) 13/5

Work / Notes:

Q2: tan(theta)=3/4, adjacent=8. Find opposite.

(A) 6

(B) 4

(C) 8

(D) 12

Work / Notes:

Q3: cos(60 degrees) = ?

(A) 0.5

(B) sqrt(3)/2

(C) 1

(D) sqrt(2)/2

Work / Notes:

Problem 16: Similar Triangles

[CONCEPT]

AA: 2 pairs of equal angles -> triangles are similar

SSS~: all 3 sides proportional

SAS~: 2 proportional sides + included angle equal

Corresponding sides are proportional; corresponding angles are equal

[WORKED EXAMPLE]

ABC ~ DEF, AB=4, DE=6, BC=5 | Ratio=6/4=3/2 | EF=5*(3/2)=7.5

Q1: Minimum info needed to prove similarity by AA?

(A) 2 pairs of equal angles

(B) 3 pairs of equal sides

(C) 2 sides proportional

(D) 1 angle + 1 side

Work / Notes:

Q2: Similar triangles, ratio 2:5, small perimeter=14. Large perimeter?

(A) 35

(B) 28

(C) 42

(D) 56

Work / Notes:

Q3: Triangle ABC ~ DEF, angle A=40, angle B=60. Find angle F.

(A) 80 deg

(B) 60 deg

(C) 40 deg

(D) 100 deg

Work / Notes:

Problem 17: Parallel Lines & Angles

[CONCEPT]

Lines cut by transversal:

Corresponding angles: EQUAL

Alternate interior angles: EQUAL

Alternate exterior angles: EQUAL

Co-interior (same-side interior) angles: sum = 180 degrees

[WORKED EXAMPLE]

Alternate interior angle = 65 deg | Other alternate interior angle = 65 deg

Q1: Corresponding angle = 115 degrees. Other corresponding angle?

(A) 115 deg

(B) 65 deg

(C) 180 deg

(D) 75 deg

Work / Notes:

Q2: Co-interior angles sum to?

(A) 180 deg

(B) 90 deg

(C) 360 deg

(D) 270 deg

Work / Notes:

Q3: Alternate exterior angles (parallel lines) are...

(A) Equal

(B) Supplementary

(C) Complementary

(D) Vertical

Work / Notes:

Problem 18: Coordinate Geometry

[CONCEPT]

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

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

Parallel lines: same slope (m1=m2)

Perpendicular lines: m1 * m2 = -1

[WORKED EXAMPLE]

Slope between (2,3) and (6,7): m = (7-3)/(6-2) = 4/4 = 1

Q1: Midpoint of (-2,4) and (6,-8)?

(A) (2, -2)

(B) (4, 4)

(C) (2, 2)

(D) (-2, 2)

Work / Notes:

Q2: Line slope = 3. Perpendicular slope?

(A) -1/3

(B) 1/3

(C) 3

(D) -3

Work / Notes:

Q3: Slope of line through (0,0) and (5,10)?

(A) 2

(B) 5

(C) 10

(D) 1/2

Work / Notes:

Problem 19: Surface Area

[CONCEPT]

Rectangular prism: SA = 2(lw + lh + wh)

Cylinder: SA = 2*pi*r^2 + 2*pi*r*h

Cone: SA = pi*r^2 + pi*r*l (l = slant height)

Sphere: SA = 4*pi*r^2

[WORKED EXAMPLE]

Sphere r=5: SA = 4*pi*25 = 100*pi

Q1: SA of cylinder: r=3, h=7 (in terms of pi)?

(A) 60 pi

(B) 42 pi

(C) 30 pi

(D) 66 pi

Work / Notes:

Q2: SA of sphere with r=6?

(A) 144 pi

(B) 36 pi

(C) 72 pi

(D) 288 pi

Work / Notes:

Q3: Rectangular prism: l=4, w=3, h=5. SA?

(A) 94

(B) 60

(C) 47

(D) 120

Work / Notes:

Problem 20: Angle Sum & Polygons

[CONCEPT]

Interior angle SUM = (n-2) x 180 degrees

Each interior angle (regular polygon) = (n-2)*180/n

Exterior angle sum = ALWAYS 360 degrees

[WORKED EXAMPLE]

Regular hexagon (n=6): Sum = 720 deg | Each angle = 720/6 = 120 deg

Q1: Sum of interior angles of pentagon (5 sides)?

(A) 540 deg

(B) 360 deg

(C) 720 deg

(D) 900 deg

Work / Notes:

Q2: Each exterior angle of regular octagon (8 sides)?

- (A) 45 deg
- (B) 135 deg
- (C) 40 deg
- (D) 360 deg

Work / Notes:

Q3: Each interior angle of regular 10-gon?

- (A) 144 deg
- (B) 36 deg
- (C) 108 deg
- (D) 160 deg

Work / Notes:

ANSWER KEY

Problem	Topic	Q1	Q2	Q3
#1	Quadratic Formula	A	A	A
#2	Complex Numbers	A	A	A
#3	Polynomial Factoring	A	A	A
#4	Rational Expressions	A	A	A
#5	Exponential & Logarithm Functions	A	A	A
#6	Systems of Equations	A	A	A
#7	Sequences & Series	A	A	A
#8	Radical Functions	A	A	A
#9	Conic Sections	A	A	A
#10	Function Transformations	A	A	A
#11	Triangle Congruence	A	A	A
#12	Pythagorean Theorem	A	A	A
#13	Circle Theorems	A	A	A
#14	Area & Volume	A	A	A
#15	Trigonometry (SOHCAHTOA)	A	A	A
#16	Similar Triangles	A	A	A
#17	Parallel Lines & Angles	A	A	A
#18	Coordinate Geometry	A	A	A
#19	Surface Area	A	A	A
#20	Angle Sum & Polygons	A	A	A

All answers are (A) for this practice set. Review the worked examples and explanations.