

ALGEBRA 2 & GEOMETRY

Core Practice Problems — Self-Study Worksheet

20 Problems · Multiple Choice · Answer Key on Last Page

PART 1 — ALGEBRA 2 (Questions 1–10)

Q1 QUADRATICS — VERTEX

■ VERTEX = $(-b/2a, f(-b/2a))$ | If $a < 0$ → opens down → MAX

A ball is launched upward. Its height (feet) after t seconds is:

$$h(t) = -16t^2 + 64t + 5$$

What is the MAXIMUM height the ball reaches?

A) 64 feet

B) 69 feet

C) 80 feet

D) 5 feet

Q2 SYSTEMS OF EQUATIONS

■ SET equal when you want the BREAK-EVEN point | Always CHECK your answer

Two car rental companies:

Company A: \$30 flat + \$0.25/mile Company B: \$10 flat + \$0.45/mile

At how many miles do both companies cost the SAME?

A) 80 miles

B) 150 miles

C) 100 miles

D) 200 miles

Q3 EXPONENTIAL GROWTH

■ GROWTH: $A = P(1+r)^t$ | 'Doubles every k hours' → exponent = t/k

A bacteria culture starts with 500 cells and doubles every 3 hours.

Which expression gives the number of cells after t hours?

A) $500 \cdot 2^t$

B) $500 \cdot 2^{(t/3)}$

C) $500 \cdot 3^{(t/2)}$

D) $500 \cdot (1.5)^t$

Q4 LOGARITHMS — NATURAL LOG

■ $\log_b(x) = y$ means $b^y = x$ | $\ln = \log$ base e | $\ln(e^x) = x$

An investment grows: $A = 1000 \cdot e^{(0.05t)}$. When does it reach \$2000?

$$2 = e^{(0.05t)} \rightarrow \ln 2 = 0.05t$$

Approximately how many years?

A) 10 years	B) 20 years
C) ≈ 13.9 years	D) ≈ 7 years

Q5 REMAINDER THEOREM

■ Remainder when $P(x) \div (x-a) = P(a)$ | If $P(a) = 0$, then $(x-a)$ is a FACTOR

$P(x) = x^3 - 4x^2 + x + 6$ is divided by $(x - 2)$.

What is the remainder?

A) 6	B) 0
C) 4	D) -2

Q6 RATIONAL FUNCTIONS — ASYMPTOTES

■ HORIZONTAL asymptote: compare degrees | Same degree \rightarrow ratio of leading coefficients

Factory cost per unit: $C(x) = (500x + 2000) / x$

As production $x \rightarrow \infty$, what does cost per unit approach?

A) \$0	B) \$2000
C) \$500	D) Infinity

Q7 COMPLEX NUMBERS

■ $i^2 = -1$ | $i^3 = -i$ | $i^4 = 1$ | FOIL, then replace i^2 with -1

Expand and simplify: $(3 + 2i)(1 - 4i)$

What is the result?

A) $3 - 10i$	B) $-5 - 10i$
C) $11 - 10i$	D) $11 + 10i$

Q8 INFINITE GEOMETRIC SERIES

■ $S = a/(1-r)$ only when $|r| < 1$ | Bouncing ball: count DOWN separately from UP+DOWN

A ball drops from 10 ft, each bounce = 60% of previous height.

What is the TOTAL vertical distance traveled (infinite bounces)?

A) 25 ft	B) 40 ft
C) 60 ft	D) 70 ft

Q9 MATRICES — APPLICATIONS

■ Matrix multiply: ROW \times COLUMN | $(m \times n)(n \times p) = (m \times p)$ | ORDER MATTERS

Apples: \$1.20, Bananas: \$0.50. Tuesday: sold 15 apples, 40 bananas.

$$[15 \ 40] \cdot [1.20 \ / \ 0.50] = ?$$

What was Tuesday's total revenue?

A) \$28.00	B) \$38.00
C) \$40.00	D) \$33.00

Q10 RADICAL EQUATIONS — EXTRANEIOUS SOLUTIONS

■ After squaring both sides, ALWAYS CHECK answers in the ORIGINAL equation!

Solve: $\sqrt{3x + 4} = x - 2$

What is the solution? (Watch for extraneous roots!)

A) $x = 0$ only	B) $x = 0$ and $x = 7$
C) $x = 7$ only	D) No solution

PART 2 — GEOMETRY (Questions 11–20)

Q11 PYTHAGOREAN THEOREM

■ $a^2 + b^2 = c^2$ | c = HYPOTENUSE (longest side, opposite the right angle)

A 26-ft ladder leans against a wall. Its base is 10 ft from the wall.

How high up the wall does the ladder reach?

A) 20 feet	B) 24 feet
C) 28 feet	D) 16 feet

Q12 CIRCLES — INSCRIBED ANGLES

■ INSCRIBED ANGLE = $\frac{1}{2}$ × intercepted ARC | Central angle = arc (same measure)

In circle O, arc AB = 140°. An inscribed angle intercepts arc AB.

What is the measure of the inscribed angle?

A) 140°	B) 70°
C) 80°	D) 40°

Q13 SIMILAR TRIANGLES — SHADOW PROBLEMS

■ Same sun angle → AA similarity | Set up PROPORTION: height/shadow = height/shadow

A 6-ft person casts a 4-ft shadow. A flagpole casts a 22-ft shadow.

$$6/4 = h/22$$

How tall is the flagpole?

A) 24 ft	B) 30 ft
C) 33 ft	D) 36 ft

Q14 COORDINATE GEOMETRY — MIDPOINT

■ MIDPOINT = $((x_1+x_2)/2, (y_1+y_2)/2)$ | To find endpoint: DOUBLE the midpoint, subtract known point

M(3, -1) is the midpoint of segment AB. A = (1, 5). Find B.

$$(1 + xB)/2 = 3 \text{ and } (5 + yB)/2 = -1$$

What are the coordinates of point B?

A) (4, 2)	B) (2, -7)
C) (5, -7)	D) (-1, 3)

Q15 VOLUME — CYLINDER

■ $V = \pi r^2 h$ | RADIUS not diameter! | $r = \text{diameter} \div 2$

Cylindrical tank: radius = 5 m, height = 12 m. ($\pi \approx 3.14$)

$$V = \pi \times r^2 \times h$$

How much water (in m^3) does it hold?

A) 376.8 m^3

B) 628 m^3

C) 942 m^3

D) 1884 m^3

Q16 TRIGONOMETRY — ANGLE OF ELEVATION

■ SOH-CAH-TOA | $\tan = \text{Opposite/Adjacent}$ | Elevation/depression \rightarrow draw the RIGHT triangle first

From 50 m away, angle of elevation to building top = 62° . ($\tan 62^\circ \approx 1.88$)

$$\tan(62^\circ) = h / 50$$

How tall is the building?

A) 26.6 m

B) 94 m

C) 56.6 m

D) 188 m

Q17 TRIANGLE CONGRUENCE — ASA vs AAS

■ ASA: side is BETWEEN the 2 angles | AAS: side is NOT between | SSA is NOT valid

Two angles and the INCLUDED side of one triangle equal those of another.

Which congruence postulate applies?

A) SSS

B) SAS

C) ASA

D) AAS

Q18 PARALLEL LINES — CO-INTERIOR ANGLES

■ CO-INTERIOR (same-side interior) = SUPPLEMENTARY (sum = 180°) | Alternate interior = EQUAL

Parallel lines cut by transversal. Co-interior angles: $(3x + 15)^\circ$ and $(2x + 25)^\circ$

$$(3x + 15) + (2x + 25) = 180$$

Find x.

A) $x = 20$

B) $x = 28$

C) $x = 35$

D) $x = 14$

Q19 TRANSFORMATIONS — ROTATION

■ 90° CCW: $(x,y) \rightarrow (-y, x)$ | 180°: $(x,y) \rightarrow (-x,-y)$ | 90° CW: $(x,y) \rightarrow (y,-x)$

Point P(4, -3) is rotated 90° counterclockwise about the origin.

$$(x, y) \rightarrow (-y, x)$$

What are the new coordinates?

A) (-3, 4)

B) (-4, 3)

C) (3, 4)

D) (-3, -4)

Q20 COMPOSITE FIGURES — AREA

■ DRAW IT and split into simple shapes | Two semicircles = ONE full circle

Running track: rectangle 100 m × 60 m with semicircles on each short end. ($\pi \approx 3.14$)

$$\text{Area} = \text{Rectangle} + \text{Full Circle } (r = 30)$$

What is the total enclosed area?

A) 6,000 m²

B) 7,827 m²

C) 8,826 m²

D) 9,420 m²

ANSWER KEY

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
B	C	B	C	B	C	C	B	B	C

Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
B	B	C	C	C	B	C	B	C	C

QUICK EXPLANATIONS

Q1 (B) — Vertex at $t = -64/(2x-16) = 2$ sec. $h(2) = -64+128+5 = 69$ ft.

Q2 (C) — $30+0.25m = 10+0.45m \rightarrow 20 = 0.20m \rightarrow m = 100$ miles.

Q3 (B) — 'Doubles every 3 hours' \rightarrow exponent must be $t/3$, not t .

Q4 (C) — $2 = e^{(0.05t)} \rightarrow \ln 2 = 0.05t \rightarrow t \approx 0.693/0.05 \approx 13.86$ years.

Q5 (B) — $P(2) = 8-16+2+6 = 0$. Remainder = 0, so $(x-2)$ is a factor.

Q6 (C) — $C(x) = 500 + 2000/x$. As $x \rightarrow \infty$, $2000/x \rightarrow 0$, so $C \rightarrow 500$.

Q7 (C) — FOIL: $3-12i+2i-8i^2 = 3-10i+8 = 11-10i$ (since $i^2=-1$).

Q8 (B) — Initial fall: 10. Up+down bounces: $2 \times 6/(1-0.6)=30$. Total=40 ft.

Q9 (B) — $15 \times 1.20 + 40 \times 0.50 = 18+20 = \38 .

Q10 (C) — Square: $x=0$ or $x=7$. Check: $x=0$ fails ($\sqrt{4} \neq -2$). Only $x=7$.

Q11 (B) — $a^2+100=676 \rightarrow a^2=576 \rightarrow a=24$. ($10-24-26 = 5-12-13 \times 2$)

Q12 (B) — Inscribed angle = $\frac{1}{2} \times$ arc = $\frac{1}{2} \times 140^\circ = 70^\circ$.

Q13 (C) — $6/4 = h/22 \rightarrow h = 132/4 = 33$ ft.

Q14 (C) — $(1+xB)/2=3 \rightarrow xB=5$; $(5+yB)/2=-1 \rightarrow yB=-7$. $B=(5,-7)$.

Q15 (C) — $V = 3.14 \times 25 \times 12 = 942$ m³. (Trap: don't use diameter!)

Q16 (B) — $\tan 62^\circ = h/50 \rightarrow h = 50 \times 1.88 = 94$ m.

Q17 (C) — Side is BETWEEN the two angles \rightarrow ASA (not AAS).

Q18 (B) — Co-interior: $3x+15+2x+25=180 \rightarrow 5x=140 \rightarrow x=28$.

Q19 (C) — 90° CCW: $(x,y) \rightarrow (-y,x)$. $P(4,-3) \rightarrow (3,4)$.

Q20 (C) — Rectangle: $6000 +$
Circle($r=30$): $3.14 \times 900 = 2826 \rightarrow$ Total=8826 m².