

Algebra 2 & Geometry

Advanced Core Problems — Multiple Choice Worksheet

Name: _____ Date: _____ Score: _____ / 20

PART 1 — ALGEBRA 2

Quadratics · Polynomials · Logarithms · Complex Numbers · Sequences

01 QUADRATIC FORMULA

Solve: $2x^2 - 5x - 3 = 0$

KEY: QUADRATIC FORMULA: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ | Identify a, b, c FIRST

A. $x = 3$ or $x = 1/2$

B. $x = -3$ or $x = 1/2$

C. $x = 3$ or $x = -1/2$

D. $x = 2$ or $x = -3/2$

02 DISCRIMINANT

For $3x^2 + kx + 3 = 0$ to have exactly ONE real solution, find k.

KEY: DISCRIMINANT = $b^2 - 4ac$ | One solution $\rightarrow \Delta = 0$ | Two solutions $\rightarrow \Delta > 0$

A. $k = 3$

B. $k = 6$ or $k = -6$

C. $k = 9$

D. $k = 0$

03 REMAINDER THEOREM

Remainder when $f(x) = x^3 - 4x^2 + 2x + 5$ is divided by $(x - 3)$?

KEY: REMAINDER THEOREM: divide by $(x - c) \rightarrow$ just compute $f(c)$

A. -4

B. 2

C. 5

D. 8

04 LOGARITHMS

Solve: $\log_2(x+3) + \log_2(x-1) = 5$

KEY: LOG PRODUCT RULE: $\log M + \log N = \log(MN)$ | ALWAYS CHECK DOMAIN (argument > 0)!

A. $x = 4$

B. $x = -7$ or $x = 5$

C. $x = 7$

D. $x = 5$

05 EXPONENTIAL EQUATIONS

Solve: $4^{(x+1)} = 8^{(x-1)}$

KEY: SAME BASE TRICK: rewrite both sides as powers of 2, then set exponents equal

A. $x = 3$

B. $x = 4$

C. $x = 5$

D. $x = 7$

06 COMPLEX NUMBERSSimplify: $(3 + 2i)(1 - 4i)$ **KEY:** FOIL then REPLACE $i^2 = -1$ | Real part: subtract i^2 terms

A. $3 - 10i$

B. $11 - 10i$

C. $-5 - 10i$

D. $11 + 2i$

07 RATIONAL EXPONENTSSimplify: $27^{(2/3)} \times 4^{(1/2)}$ **KEY:** $x^{(m/n)} = (\text{nth root of } x)^m$ | Denominator = ROOT | Numerator = POWER

A. 18

B. 36

C. 12

D. 24

08 GEOMETRIC SEQUENCE SUMSum of first 6 terms of geometric sequence: $a_1 = 2$, common ratio $r = 3$.**KEY:** GEOMETRIC SUM: $S_n = a_1(1 - r^n) / (1 - r)$ | Use when r is not 1

A. 364

B. 486

C. 244

D. 728

09 VERTEX FORM OF PARABOLA $y = 2(x - 3)^2 + 5$. Find vertex and direction of opening.**KEY:** VERTEX FORM $y = a(x-h)^2 + k \rightarrow$ Vertex = (h, k) | $a > 0$: UP $a < 0$: DOWNA. Vertex $(3,5)$, opens upwardB. Vertex $(-3,5)$, opens upwardC. Vertex $(3,-5)$, opens downwardD. Vertex $(3,5)$, opens downward**10** INVERSE FUNCTIONSFind the inverse of: $f(x) = (2x - 4) / 3$ **KEY:** INVERSE: SWAP x and y , then SOLVE FOR y | f^{-1} undoes what f does

A. $f^{-1}(x) = (3x+4)/2$

B. $f^{-1}(x) = 3x+4$

C. $f^{-1}(x) = (3x+4)/2$

D. $f^{-1}(x) = (2x+4)/3$

PART 2 — GEOMETRY

3D Solids · Coordinate Geometry · Trigonometry · Transformations · Circles

11 VOLUME OF A CONE

Cone: radius = 6 cm, height = 9 cm. Find volume. (use $\pi = 3.14$)**KEY:** CONE VOLUME = $(1/3)\pi r^2 h$ | Cone = one-third of a cylinder

- A. 508.68 cm³ B. 339.12 cm³
C. 1017.36 cm³ D. 226.08 cm³

12 PERPENDICULAR BISECTOR

A(-2, 3) and B(6, -1). Find the equation of the perpendicular bisector of AB.

KEY: PERP BISECTOR: (1) Midpoint (2) Slope of AB (3) Perp slope = $-1/m$

- A. $y = 2x - 3$ B. $y = -1/2 x + 1$
C. $y = 2x + 1$ D. $y = -2x + 3$

13 RIGHT TRIANGLE TRIGONOMETRY

Right triangle: opposite = 7, hypotenuse = 25. Find adjacent and $\cos(\theta)$.**KEY:** SOH-CAH-TOA: $\sin=O/H$ $\cos=A/H$ $\tan=O/A$ | Use Pythagoras first!

- A. adj=20, $\cos=4/5$ B. adj=18, $\cos=18/25$
C. adj=24, $\cos=24/25$ D. adj=22, $\cos=22/25$

14 STANDARD EQUATION OF A CIRCLE

 $(x+2)^2 + (y-5)^2 = 49$. Find the center and radius.**KEY:** STANDARD CIRCLE $(x-h)^2+(y-k)^2=r^2 \rightarrow$ Center=(h,k), $r=\sqrt{r^2}$ WATCH SIGNS!

- A. Center (2,-5), $r=49$ B. Center (2,-5), $r=7$
C. Center (-2,5), $r=49$ D. Center (-2,5), $r=7$

15 REFLECTIONS

Triangle ABC is reflected over the y-axis. If A = (3, -4), find image A'.

KEY: Over y-axis: $(x,y) \rightarrow (-x, y)$ | Over x-axis: $(x,y) \rightarrow (x, -y)$ Only ONE coord flips!

- A. A' = (-3, -4) B. A' = (3, 4)
C. A' = (-3, 4) D. A' = (4, -3)

16 SURFACE AREA OF A SPHERE

Sphere: radius = 5 cm. Find surface area. (use $\pi = 3.14$)

KEY: SPHERE SURFACE AREA = $4\pi r^2$ | NOT πr^2 ! Multiply by 4.

- A. 157 cm^2 B. 314 cm^2
C. 523.33 cm^3 D. 628 cm^2

17 ANGLE OF ELEVATION

Standing 40 m from a building. Angle of elevation = 55 degrees. Height? ($\tan 55 = 1.428$)

KEY: $\tan(\text{angle}) = \text{OPPOSITE/ADJACENT}$ -> height = distance x $\tan(\text{angle})$

- A. $\sim 28.0 \text{ m}$ B. $\sim 48.0 \text{ m}$
C. $\sim 57.1 \text{ m}$ D. $\sim 65.3 \text{ m}$

18 SUPPLEMENTARY ANGLES

Angle 1 = $3x+10$ and Angle 2 = $5x-2$ are supplementary. Find both angles.

KEY: SUPPLEMENTARY = 180 degrees | Set up: $\text{angle1} + \text{angle2} = 180$, solve for x

- A. $\text{angle1}=85, \text{angle2}=95$ B. $\text{angle1}=70, \text{angle2}=110$
C. $\text{angle1}=90, \text{angle2}=90$ D. $\text{angle1}=100, \text{angle2}=80$

19 DILATION

Dilate point (2, -4) with scale factor $k = 3$ centered at the origin.

KEY: DILATION from origin: $(x, y) \rightarrow (kx, ky)$ Multiply BOTH coordinates by k

- A. (5, -7) B. (6, -12)
C. $(2/3, -4/3)$ D. (3, -4)

20 SECTOR AREA

Circle: radius = 10 cm, central angle = 72 degrees. Find sector area. ($\pi = 3.14$)

KEY: SECTOR AREA = $(\text{theta} / 360) \times \pi r^2$ | Fraction of full circle area

- A. 18.84 cm^2 B. 157 cm^2
C. 62.8 cm^2 D. 31.4 cm^2

ANSWER KEY

Cut along dotted line before distributing

| | | | | | | | |
|-----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|-----------------|
| Q# Q01 | ANS C | Q# Q02 | ANS B | Q# Q03 | ANS B | Q# Q04 | ANS D |
| Q05 | C | Q06 | B | Q07 | A | Q08 | D |
| Q09 | A | Q10 | A | Q11 | B | Q12 | A |
| Q13 | C | Q14 | D | Q15 | A | Q16 | B |
| Q17 | C | Q18 | A | Q19 | B | Q20 | C |

Quick Solution Notes

- Q01:** $a=2, b=-5, c=-3 \rightarrow D=49 \rightarrow x=(5+/-7)/4 \rightarrow x=3$ or $-1/2$
- Q02:** $k^2-36=0 \rightarrow k=+/-6$
- Q03:** $f(3)=27-36+6+5=2$
- Q04:** $(x+3)(x-1)=32 \rightarrow x^2+2x-35=0 \rightarrow x=5$ ($x=-7$ rejected, log domain)
- Q05:** $2^{2x+2}=2^{3x-3} \rightarrow 2x+2=3x-3 \rightarrow x=5$
- Q06:** $3-12i+2i-8i^2 = 3+8-10i = 11-10i$
- Q07:** $27^{2/3}=(\text{cbrt}27)^2=9; 4^{1/2}=2; 9 \times 2=18$
- Q08:** $S_6=2(1-729)/(1-3)=2(-728)/(-2)=728$
- Q09:** $h=3, k=5, a=2 > 0 \rightarrow$ vertex(3,5) opens up
- Q10:** swap: $x=(2y-4)/3 \rightarrow 3x+4=2y \rightarrow y=(3x+4)/2$
- Q11:** $(1/3)(3.14)(36)(9)=339.12 \text{ cm}^3$
- Q12:** midpt=(2,1); slope_AB=-1/2; perp_slope=2; $y-1=2(x-2) \rightarrow y=2x-3$
- Q13:** $\text{adj}=\sqrt{625-49}=\sqrt{576}=24; \cos=24/25$
- Q14:** $(x+2)=(x-(-2)) \rightarrow h=-2; k=5; r^2=49 \rightarrow r=7$
- Q15:** y-axis reflection: negate x $\rightarrow (-3,-4)$
- Q16:** $4(3.14)(25)=314 \text{ cm}^2$
- Q17:** $h=40 \tan 55=40 \times 1.428=57.1 \text{ m}$
- Q18:** $8x+8=180 \rightarrow x=21.5; A_1=85, A_2=95$
- Q19:** $k=3; (2 \times 3, -4 \times 3)=(6,-12)$
- Q20:** $(72/360)(3.14)(100)=0.2 \times 314=62.8 \text{ cm}^2$