

# Algebra 2 & Geometry

Core Problems Study Sheet - 20 Questions - Answers Below

## ALGEBRA 2

Core Unit Problems - Commonly Missed Topics

### Unit 1 - Quadratic Functions

[ KEY ] VERTEX FORM:  $y = a(x-h)^2 + k \Rightarrow \text{vertex} = (h, k)$

**Q1. Convert  $f(x) = x^2 - 6x + 11$  to vertex form and find the vertex.**

- A.  $f(x) = (x-3)^2 + 2$ , vertex (3, 2)
- B.  $f(x) = (x+3)^2 + 2$ , vertex (-3, 2)
- C.  $f(x) = (x-3)^2 - 2$ , vertex (3, -2)
- D.  $f(x) = (x-3)^2 + 4$ , vertex (3, 4)

\* Hint: Complete the square. Remember to subtract what you add inside!

### Unit 2 - Polynomial End Behavior

[ KEY ] EVEN degree + NEGATIVE leading coeff  $\Rightarrow$  both ends go DOWN

**Q2. What is the end behavior of  $f(x) = -2x^4 + 5x^2 - 1$  ?**

- A. As  $x \rightarrow +/\infty$ ,  $f(x) \rightarrow +\infty$
- B. As  $x \rightarrow +\infty$ ,  $f(x) \rightarrow +\infty$ ; as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow -\infty$
- C. As  $x \rightarrow +/\infty$ ,  $f(x) \rightarrow -\infty$
- D. As  $x \rightarrow +\infty$ ,  $f(x) \rightarrow -\infty$ ; as  $x \rightarrow -\infty$ ,  $f(x) \rightarrow +\infty$

\* Only the leading term matters for end behavior.

### Unit 3 - Rational Exponents

[ KEY ] MULTIPLY same base: ADD exponents. DIVIDE: SUBTRACT exponents.

**Q3. Simplify:  $(x^{3/4}) * x^{(1/2)} / x^{(1/4)}$**

- A.  $x^{(1/2)}$
- B.  $x$
- C.  $x^{(5/4)}$
- D.  $x^{(3/2)}$

\*  $3/4 + 1/2 = 5/4$ , then  $5/4 - 1/4 = 1$ .

### Unit 4 - Logarithmic Equations

[ KEY ] LOG PRODUCT RULE:  $\log(M) + \log(N) = \log(MN)$ . Always check domain!

**Q4. Solve:  $\log_3(x-2) + \log_3(x+2) = 3$**

- A.  $x = 3$  only
- B.  $x = +/\sqrt{31}$
- C.  $x = 5$  only
- D.  $x = \sqrt{31}$  only

\* After solving  $x^2 = 31$ , check:  $x = -\sqrt{31}$  makes  $(x-2)$  negative  $\rightarrow$  invalid!

Unit 5 · Systems of Equations

[ KEY ] ELIMINATION: multiply to match coefficients, then add/subtract.

**Q5. Solve the system:  $2x + y = 7$  and  $x - 3y = -7$**

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

\* Multiply eq.2 by 2, subtract from eq.1 to eliminate x.

Unit 6 · Complex Numbers

[ KEY ]  $i^2=-1$   $i^3=-i$   $i^4=1$  (repeats every 4).  $(a+bi)(a-bi)=a^2+b^2$

**Q6. Simplify:  $(3 + 2i)(3 - 2i) + i^{15}$**

- A.  $13 + i$
- B.  $13 - i$
- C.  $5 - i$
- D.  $13 + i^3$

\*  $i^{15}$ :  $15 = 4 \times 3 + 3$ , so  $i^{15} = i^3 = -i$ . Conjugate product =  $3^2 + 2^2 = 13$ .

Unit 7 · Geometric Series

[ KEY ]  $S_n = a \frac{1-r^{n+1}}{1-r}$ , where  $r$  = common ratio,  $n$  = # terms

**Q7. Find the sum of the first 6 terms of:  $3 + 6 + 12 + 24 + \dots$**

- A. 93
- B. 126
- C. 189
- D. 381

\*  $a=3, r=2, n=6$ .  $S_6 = 3 \frac{1-2^7}{1-2} = 3 \cdot 63 = 189$ .

Unit 8 · Conic Sections (Parabola)

[ KEY ]  $(x-h)^2 = 4p(y-k) \Rightarrow$  vertex  $(h,k)$ , focus =  $(h, k+p)$

**Q8. Find the focus of the parabola:  $(x-1)^2 = 8(y+2)$**

- A.  $(1, -4)$
- B.  $(1, 0)$
- C.  $(1, 4)$
- D.  $(3, -2)$

\*  $4p=8$  so  $p=2$ . Vertex  $= (1, -2)$ . Focus  $= (1, -2+2) = (1, 0)$ .

Unit 9 · Binomial Probability

[ KEY ]  $P(X=k) = C(n,k) \cdot p^k \cdot (1-p)^{n-k}$

**Q9. A fair coin flipped 5 times.  $P(\text{exactly 3 heads}) = ?$**

- A.  $1/8$
- B.  $3/16$
- C.  $5/16$
- D.  $3/8$

\*  $C(5,3)=10$ .  $P = 10 \cdot (1/2)^5 = 10/32 = 5/16$ .

Unit 10 · Inverse Functions (Composition)

[ KEY ] INVERSE: swap  $x$  and  $y$ , solve for  $y$ . Apply  $f^{-1}$  step by step!

**Q10. If  $f(x) = 2x - 4$ , find  $f^{-1}(f^{-1}(6))$ .**

- A. 4
- B. 5
- C. 6
- D. 7

\*  $f^{-1}(x) = (x+4)/2$ . Step1:  $f^{-1}(6) = 5$ . Step2:  $f^{-1}(5) = 4.5$ .

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## GEOMETRY

Proofs, Circles, Triangles & Coordinate Geometry

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Unit 1 · Triangle Congruence

[ KEY ] SAS: angle must be BETWEEN the two sides. SSA is NOT valid!

**Q11. Which theorem? Given:  $AB=DE$ , angle  $B =$  angle  $E$ ,  $BC=EF$**

- A. SSS
- B. SAS
- C. ASA
- D. AAS

\* Angle  $B$  is between sides  $AB$  and  $BC$  -> that's the SAS pattern.

Unit 2 · Inscribed Angle Theorem

[ KEY ] INSCRIBED ANGLE =  $(1/2)$  x intercepted arc

**Q12. An inscribed angle intercepts an arc of 140 degrees. Find the inscribed angle.**

- A. 140 degrees
- B. 100 degrees
- C. 70 degrees
- D. 35 degrees

\* Central angle = arc. Inscribed angle = HALF the arc.

Unit 3 · Similar Triangles

[ KEY ] AA SIMILARITY -> corresponding sides are proportional

**Q13. Triangle  $ABC \sim$  Triangle  $DEF$ .  $AB=6$ ,  $DE=9$ ,  $BC=8$ . Find  $EF$ .**

- A.  $EF = 10$
- B.  $EF = 12$
- C.  $EF = 6$
- D.  $EF = 16$

\* Scale factor =  $9/6 = 3/2$ .  $EF = 8 \times (3/2) = 12$ .

Unit 4 - Right Triangle Trigonometry

[ KEY ] SOH-CAH-TOA:  $\text{Sin}=\text{Opp}/\text{Hyp}$ ,  $\text{Cos}=\text{Adj}/\text{Hyp}$ ,  $\text{Tan}=\text{Opp}/\text{Adj}$

**Q14. In right triangle ABC (right angle at C), AC=5 and AB=13. Find sin(angle A).**

- A. 5/13
- B. 5/12
- C. 12/13
- D. 13/12

\*  $BC = \sqrt{169-25} = 12$ . From angle A:  $\text{opp}=BC=12$ ,  $\text{hyp}=AB=13$ .

Unit 5 - Coordinate Geometry (Midpoint)

[ KEY ] REVERSE MIDPOINT:  $x_Q = 2 \cdot \text{mid}X - x_P$

**Q15. Midpoint M(3,-1), P=(1,4). Find point Q.**

- A. Q=(2,3)
- B. Q=(4,-3)
- C. Q=(5,-5)
- D. Q=(5,-6)

\*  $x_Q = 2(3)-1=5$ ,  $y_Q = 2(-1)-4=-6$ . Q=(5,-6).

Unit 6 - Parallel Lines & Transversals

[ KEY ] CO-INTERIOR (same-side interior) angles ADD to 180 degrees

**Q16. Co-interior angles are (3x+20) and (x+40). Find x.**

- A. x=20
- B. x=30
- C. x=25
- D. x=40

\*  $4x+60=180 \rightarrow 4x=120 \rightarrow x=30$ . Check:  $110+70=180$  correct.

Unit 7 - Volume (Cone vs Cylinder)

[ KEY ] CONE =  $(1/3) \times$  CYLINDER (same base, same height). Always!

**Q17. A cone and cylinder share the same base (r=6) and height (h=9). What is V\_cone : V\_cylinder ?**

- A. 1:3
- B. 1:2
- C. 3:1
- D. 2:3

\*  $\text{Cone} = (1/3)\pi r^2 h$ .  $\text{Cylinder} = \pi r^2 h$ . Ratio is always 1:3.

Unit 8 - Equation of a Circle

[ KEY ]  $(x-h)^2+(y-k)^2=r^2 \Rightarrow$  center(h,k). Complete the square for both x & y!

**Q18. Find center & radius:  $x^2 + y^2 - 6x + 4y - 3 = 0$**

- A. Center(-3, 2), r=4
- B. Center(3, -2), r=2
- C. Center(3, -2), r=4
- D. Center(3, -2), r=16

\* Add 9 and 4 to both sides:  $(x-3)^2+(y+2)^2=16$ .  $r=\sqrt{16}=4$ .

Unit 9 · Rotations

[ KEY ] 90 deg CCW:  $(x,y) \rightarrow (-y,x)$  | 90 deg CW:  $(x,y) \rightarrow (y,-x)$  | 180 deg:  $(x,y) \rightarrow (-x,-y)$

**Q19. Point P(4,-3) is rotated 90 degrees counterclockwise about the origin. New coordinates?**

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

\* Apply  $(x,y) \rightarrow (-y,x)$ :  $P(4,-3) \rightarrow (-(-3),4) = (3,4)$ .

Unit 10 · Exterior Angle Theorem

[ KEY ] EXTERIOR ANGLE = sum of the 2 NON-ADJACENT (remote) interior angles

**Q20. In triangle ABC, angle A=55 and angle B=72. Find the exterior angle at vertex C.**

- A. 53 degrees
- B. 117 degrees
- C. 127 degrees
- D. 180 degrees

\* Exterior angle =  $55+72 = 127$ . (Option A is the interior angle at C.)

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**ANSWER KEY**

<b>Q1</b>	<b>Q2</b>	<b>Q3</b>	<b>Q4</b>	<b>Q5</b>	<b>Q6</b>	<b>Q7</b>	<b>Q8</b>	<b>Q9</b>	<b>Q10</b>
<b>A</b>	<b>C</b>	<b>B</b>	<b>D</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>B</b>	<b>C</b>	<b>B</b>
<b>Q11</b>	<b>Q12</b>	<b>Q13</b>	<b>Q14</b>	<b>Q15</b>	<b>Q16</b>	<b>Q17</b>	<b>Q18</b>	<b>Q19</b>	<b>Q20</b>
<b>B</b>	<b>C</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>B</b>	<b>A</b>	<b>C</b>	<b>A</b>	<b>C</b>