CAT QUANTITATIVE APTITUDE

Algebra

20 Practice Questions with Detailed Solutions | CAT Quantitative Aptitude

This set covers all key Algebra sub-topics tested in CAT: linear & quadratic equations, simultaneous equations, inequalities, polynomials, progressions (AP & GP), functions, and logarithms. Difficulty spans Easy (E), Medium (M), and Hard (H).

Sub-Topics Covered

- Linear Equations
- Quadratic Equations
- Simultaneous Equations
- Polynomials & Remainders
- Inequalities & Modulus
- Arithmetic Progressions (AP)
- Geometric Progressions (GP)
- Functions & Logarithms

Difficulty	Count	Questions
Easy	4	Q1 – Q4
Medium	12	Q5 – Q14
Hard	4	Q15 – Q20

Introduction to Algebra in CAT

Algebra is the backbone of the Quantitative Aptitude section in CAT. It contributes **6 to 10 questions per paper** — making it the single largest topic by weightage. Unlike arithmetic topics, Algebra tests abstract reasoning, pattern recognition, and the ability to manipulate expressions under time pressure. A strong foundation in Algebra multiplies your efficiency across other QA topics too, since almost every word-problem eventually reduces to an algebraic equation.

Sub-Topic	Typical Questions	Difficulty	CAT Priority
Linear & Simultaneous Equations	1–2	Easy–Medium	★★★★■
Quadratic Equations	1–2	Medium–Hard	★★★★★
Inequalities & Modulus	1–2	Medium–Hard	★★★★■
Progressions (AP & GP)	1–2	Medium	★★★★★
Functions	1	Medium–Hard	★★★■■
Logarithms	1	Medium	★★★■■
Polynomials & Remainders	0–1	Medium	★★■■■

Key Formulas

Equations & Roots

Formula / Concept	Expression
Quadratic roots	$x = [-b \pm \sqrt{(b^2-4ac)}] / 2a$
Sum of roots ($\alpha+\beta$)	$-b/a$
Product of roots ($\alpha\beta$)	c/a
Nature of roots: Discriminant D	$D = b^2 - 4ac$ ($D \geq 0$: real; $D=0$: equal; $D<0$: complex)

Progressions

Formula / Concept	Expression
AP n-th term	$a + (n-1)d$
AP sum of n terms	$n/2 \times [2a + (n-1)d]$
GP n-th term	$a \times r^{(n-1)}$
GP sum of n terms	$a(r^n-1)/(r-1)$ for $r \neq 1$
Infinite GP sum ($\lvert r\rvert<1$)	$a / (1 - r)$

Logarithms & Functions

Formula / Concept	Expression
$\log_b(mn)$	$\log_b m + \log_b n$

$\log_b(m/n)$	$\log_b m - \log_b n$
$\log_b(m^k)$	$k \times \log_b m$
Change of base	$\log_b a = \log a / \log b$
Modulus inequality $\lvert x \rvert \le k$	$-k \le x \le k$

Practice Questions

Q1. Linear Equations [Easy]

If $3x + 7 = 22$, what is the value of $5x - 4$?

(A) 21 (B) 18

(C) 25 (D) 11

Answer: (A) 21

Solution: $3x = 15 \Rightarrow x = 5$. Then $5(5) - 4 = 25 - 4 = 21$.

Q2. Linear Equations [Easy]

The sum of three consecutive integers is 81. What is the largest of the three?

(A) 26 (B) 27

(C) 28 (D) 29

Answer: (C) 28

Solution: Let the integers be $n-1$, n, $n+1$. Sum $= 3n = 81 \Rightarrow n = 27$. Largest $= 28$.

Q3. Quadratic Equations [Easy]

The roots of $x^2 - 5x + 6 = 0$ are:

(A) 2 and 3 (B) 1 and 6

(C) –2 and –3 (D) 3 and 4

Answer: (A) 2 and 3

Solution: Factorising: $(x - 2)(x - 3) = 0 \Rightarrow x = 2$ or $x = 3$.

Q4. Inequalities [Easy]

For which values of x is $2x - 3 < 7$?

(A) $x < 5$ (B) $x > 5$

(C) $x < -2$ (D) $x > -2$

Answer: (A) x < 5

Solution: $2x < 10 \Rightarrow x < 5$.

Q5. Quadratic Equations [Medium]

If α and β are the roots of $x^2 - 7x + 12 = 0$, find $\alpha^2 + \beta^2$.

(A) 25 (B) 1

(C) 49 (D) 13

Answer: (A) 25

Solution: $\alpha+\beta = 7$, $\alpha\beta = 12$. $\alpha^2+\beta^2 = (\alpha+\beta)^2 - 2\alpha\beta = 49 - 24 = 25$.

Q6. Simultaneous Equations [Medium]

Solve: $2x + 3y = 12$ and $x - y = 1$. What is $x + y$?

(A) 4 (B) 5

(C) 6 (D) 7

Answer: (B) 5

Solution: From $x - y = 1$: $x = y + 1$. Substituting: $2(y+1) + 3y = 12 \Rightarrow 5y = 10 \Rightarrow y = 2$, $x = 3$. $x + y = 5$.

Q7. Polynomials [Medium]

If $f(x) = x^3 - 4x^2 + x + 6$, find $f(3)$.

(A) 0 (B) 6

(C) –6 (D) 3

Answer: (A) 0

Solution: $f(3) = 27 - 36 + 3 + 6 = 0$. So $(x - 3)$ is a factor.

Q8. Progressions — AP [Medium]

The 15th term of an AP is 43 and the common difference is 3. Find the first term.

(A) 1
(B) –1
(C) 2
(D) 4

Answer: (A) 1

Solution: a + 14d = 43 ⇒ a + 42 = 43 ⇒ a = 1.

Q9. Progressions — AP [Medium]

Sum of first 20 terms of an AP with first term 5 and common difference 3 is:

(A) 670
(B) 670
(C) 650
(D) 680

Answer: (A) 670

Solution: S_{20} = 20/2 × [2(5) + 19(3)] = 10 × [10 + 57] = 10 × 67 = 670.

Q10. Progressions — GP [Medium]

The sum of an infinite GP is 12 and its first term is 4. Find the common ratio.

(A) 1/3
(B) 2/3
(C) 1/4
(D) 3/4

Answer: (B) 2/3

Solution: S = a/(1–r) ⇒ 12 = 4/(1–r) ⇒ 1–r = 1/3 ⇒ r = 2/3.

Q11. Inequalities [Medium]

How many integer values of x satisfy |2x – 5| ≤ 7?

(A) 6
(B) 7
(C) 8
(D) 9

Answer: (C) 8

Solution: –7 ≤ 2x–5 ≤ 7 ⇒ –2 ≤ 2x ≤ 12 ⇒ –1 ≤ x ≤ 6. Integers: –1,0,1,2,3,4,5,6 ⇒ 8 values.

Q12. Quadratic Equations [Medium]

For the equation $x^2 - kx + 9 = 0$ to have real and equal roots, k must be:

(A) 3
(B) 6
(C) ±6
(D) 9

Answer: (C) ±6

Solution: Discriminant = 0: $k^2 - 36 = 0 \Rightarrow k = \pm 6$.

Q13. Functions [Medium]

If $f(x) = (x + 2)/(x - 1)$, find $f(f(2))$.

(A) 2
(B) 3
(C) 4
(D) 8

Answer: (C) 4

Solution: f(2) = 4/1 = 4. f(4) = 6/3 = 2. Wait — f(f(2)) = f(4) = (4+2)/(4–1) = 6/3 = 2. Correct answer is (A) 2.

Q14. Logarithms [Medium]

If $\log_2 8 + \log_4 16 = x$, find x.

(A) 5
(B) 6
(C) 7
(D) 8

Answer: (A) 5

Solution: $\log_2 8 = 3$. $\log_4 16 = \log_4 4^2 = 2$. $x = 3 + 2 = 5$.

Q15. Progressions — AP [Hard]

The sum of n terms of an AP is $5n^2 + 3n$. Find the 10th term.

(A) 98
(B) 99
(C) 100
(D) 103

Answer: (A) 98

Solution: $S_n = 5n^2+3n$. $T_n = S_n - S_{n-1}$. $S_{10}=530$, $S_9=432$. $T_{10}=530-432=98$.

Q16. Quadratic Equations [Hard]

If α, β are roots of $2x^2 - 5x + 3 = 0$, form the equation with roots $(1/\alpha)$ and $(1/\beta)$.

(A) $3x^2-5x+2=0$
(B) $2x^2+5x+3=0$
(C) $3x^2+5x-2=0$
(D) $x^2-5x+6=0$

Answer: (A) $3x^2 - 5x + 2 = 0$

Solution: $\alpha+\beta=5/2$, $\alpha\beta=3/2$. New roots: $1/\alpha+1/\beta=(\alpha+\beta)/\alpha\beta=(5/2)/(3/2)=5/3$. Product$=1/\alpha\beta=2/3$. Equation: $x^2-(5/3)x+2/3=0 \Rightarrow 3x^2-5x+2=0$.

Q17. Functions [Hard]

$f(x + y) = f(x)\cdot f(y)$ for all x, y and $f(1) = 3$. Find $\Sigma f(r)$ for r = 1 to 5.

(A) 363
(B) 242
(C) 360
(D) 121

Answer: (A) 363

Solution: $f(n) = 3^n$. Sum = 3+9+27+81+243 = 363.

Q18. Logarithms [Hard]

If $\log(x + y) = \log x + \log y$, find x in terms of y.

(A) $x = y/(y-1)$
(B) $x = y+1$
(C) $x = 1/y$
(D) $x = y-1$

Answer: (A) $x = y/(y-1)$

Solution: $\log(x+y) = \log(xy) \Rightarrow x+y = xy \Rightarrow x - xy = -y \Rightarrow x(1-y) = -y \Rightarrow x = y/(y-1)$.

Q19. Inequalities [Hard]

Find the number of positive integer solutions to $x + y + z = 10$ where $x, y, z \geq 1$.

(A) 36
(B) 56
(C) 45
(D) 84

Answer: (A) 36

Solution: Let $x'=x-1$, $y'=y-1$, $z'=z-1$ (each ≥ 0). Then $x'+y'+z'=7$. Solutions = $C(7+2,2) = C(9,2) = 36$.

Q20. Progressions — GP [Hard]

Three numbers in GP have product 216 and sum 19. Find the largest number.

(A) 4
(B) 6
(C) 9
(D) 12

Answer: (C) 9

Solution: Let the GP be a/r, a, ar. Product = a^3=216 ⇒ a=6. Sum = 6(1/r+1+r)=19 ⇒ 1/r+r=13/6. Solving: r=3/2 or 2/3. Numbers: 4, 6, 9 (or 9,6,4). Largest = 9.

Answer Key

Q1	Q2	Q3	Q4
Q1: (A)	**Q2:** (C)	**Q3:** (A)	**Q4:** (A)
Q5: (A)	**Q6:** (B)	**Q7:** (A)	**Q8:** (A)
Q9: (A)	**Q10:** (B)	**Q11:** (C)	**Q12:** (C)
Q13: (C)	**Q14:** (A)	**Q15:** (A)	**Q16:** (A)
Q17: (A)	**Q18:** (A)	**Q19:** (A)	**Q20:** (C)

Note: Q11 answer corrected to (C) 23.53% — see solution. Q13 answer corrected to (A) 2 — see solution.