

50 multiple-choice questions

Question 1 (Level 1) — *Solving a one-step equation*

Solve $x + 9 = 14$.

- (A) $x = 5$
- (B) $x = 23$
- (C) $x = -5$
- (D) $x = 9$

Question 2 (Level 1) — *Evaluating an expression*

If $a = 3$, find the value of $2a + 7$.

- (A) 12
- (B) 13
- (C) 10
- (D) 27

Question 3 (Level 1) — *Collecting like terms*

Simplify $3x + 5x - 2x$.

- (A) $6x$
- (B) $8x$
- (C) $10x$
- (D) $4x$

Question 4 (Level 1) — *Solving a multiplication equation*

Solve $3x = 21$.

- (A) $x = 18$
- (B) $x = 24$
- (C) $x = 7$
- (D) $x = 63$

Question 5 (Level 1) — *Simple expansion*

Expand $3(x + 4)$.

- (A) $3x + 4$
- (B) $3x + 12$
- (C) $3x + 7$

(D) $x + 12$

Question 6 (Level 1) — *Solving a subtraction equation*

Solve $x - 8 = 3$.

(A) $x = 11$

(B) $x = -5$

(C) $x = 5$

(D) $x = -11$

Question 7 (Level 1) — *Common factor*

Factorise $6x + 12$.

(A) $6(x + 2)$

(B) $6(x + 12)$

(C) $3(2x + 4)$

(D) $2(3x + 12)$

Question 8 (Level 1) — *Substitution with two variables*

If $x = 2$ and $y = 5$, evaluate $3x + y$.

(A) 10

(B) 11

(C) 35

(D) 13

Question 9 (Level 1) — *Division equation*

Solve $\frac{x}{4} = 5$.

(A) $x = 1$

(B) $x = 9$

(C) $x = 20$

(D) $x = \frac{5}{4}$

Question 10 (Level 1) — *Simplifying with unlike terms*

Simplify $4a + 3b - 2a + b$.

(A) $2a + 4b$

- (B) $6a + 4b$
- (C) $2a + 2b$
- (D) $6ab$

Question 11 (Level 2) — *Two-step equation*

Solve $2x + 5 = 17$.

- (A) $x = 6$
- (B) $x = 11$
- (C) $x = 7$
- (D) $x = 4$

Question 12 (Level 2) — *Expanding two brackets*

Expand $(x + 3)(x + 5)$.

- (A) $x^2 + 8x + 15$
- (B) $x^2 + 15x + 8$
- (C) $x^2 + 8x + 8$
- (D) $2x + 8$

Question 13 (Level 2) — *Factorising a simple quadratic*

Factorise $x^2 + 7x + 12$.

- (A) $(x + 3)(x + 4)$
- (B) $(x + 2)(x + 6)$
- (C) $(x + 1)(x + 12)$
- (D) $(x - 3)(x - 4)$

Question 14 (Level 2) — *Equation with brackets*

Solve $3(x - 2) = 15$.

- (A) $x = 5$
- (B) $x = 7$
- (C) $x = 3$
- (D) $x = \frac{17}{3}$

Question 15 (Level 2) — *Simplifying algebraic fractions*

Simplify $\frac{4x}{2}$.

- (A) $4x$
- (B) $2x$
- (C) 2
- (D) $\frac{x}{2}$

Question 16 (Level 2) — *Variables on both sides*
Solve $5x - 3 = 2x + 9$.

- (A) $x = 4$
- (B) $x = 3$
- (C) $x = 2$
- (D) $x = 6$

Question 17 (Level 2) — *Perfect square expansion*
Expand $(x + 4)^2$.

- (A) $x^2 + 16$
- (B) $x^2 + 4x + 16$
- (C) $x^2 + 8x + 16$
- (D) $x^2 + 8x + 8$

Question 18 (Level 2) — *Factorising with a negative constant*
Factorise $x^2 - 5x + 6$.

- (A) $(x - 2)(x - 3)$
- (B) $(x + 2)(x + 3)$
- (C) $(x - 1)(x - 6)$
- (D) $(x + 2)(x - 3)$

Question 19 (Level 2) — *Index law — multiplication*
Simplify $x^3 \times x^4$.

- (A) x^7
- (B) x^{12}
- (C) $2x^7$
- (D) x^1

Question 20 (Level 2) — *Equation with fractions*

Solve $\frac{x+1}{3} = 4$.

- (A) $x = 12$
- (B) $x = 11$
- (C) $x = \frac{11}{3}$
- (D) $x = 13$

Question 21 (Level 3) — *Difference of two squares*

Factorise $x^2 - 49$.

- (A) $(x - 7)(x + 7)$
- (B) $(x - 7)^2$
- (C) $(x + 7)^2$
- (D) $(x - 49)(x + 1)$

Question 22 (Level 3) — *Solving a quadratic by factoring*

Solve $x^2 - 3x - 10 = 0$.

- (A) $x = 5$ or $x = -2$
- (B) $x = -5$ or $x = 2$
- (C) $x = 10$ or $x = -1$
- (D) $x = 5$ or $x = 2$

Question 23 (Level 3) — *Adding algebraic fractions*

Simplify $\frac{2}{x} + \frac{3}{x}$.

- (A) $\frac{5}{x}$
- (B) $\frac{5}{2x}$
- (C) $\frac{6}{x^2}$
- (D) $\frac{5}{x^2}$

Question 24 (Level 3) — *Expanding difference of squares*

Expand $(2x - 3)(2x + 3)$.

- (A) $4x^2 - 9$

- (B) $4x^2 + 9$
- (C) $4x^2 - 6x - 9$
- (D) $2x^2 - 9$

Question 25 (Level 3) — *Solving with the null factor law*

Solve $x(x - 6) = 0$.

- (A) $x = 6$ only
- (B) $x = 0$ or $x = 6$
- (C) $x = 0$ or $x = -6$
- (D) $x = -6$ only

Question 26 (Level 3) — *Rearranging a formula*

Make r the subject of $A = \pi r^2$.

- (A) $r = \sqrt{\frac{A}{\pi}}$
- (B) $r = \frac{A}{\pi}$
- (C) $r = \frac{\sqrt{A}}{\pi}$
- (D) $r = \sqrt{A - \pi}$

Question 27 (Level 3) — *Factorising with a leading coefficient*

Factorise $2x^2 + 7x + 3$.

- (A) $(2x + 1)(x + 3)$
- (B) $(2x + 3)(x + 1)$
- (C) $(x + 1)(x + 3)$
- (D) $2(x + 1)(x + 3)$

Question 28 (Level 3) — *Simplifying an algebraic fraction*

Simplify $\frac{x^2 - 9}{x + 3}$.

- (A) $x - 3$
- (B) $x + 3$
- (C) $x^2 - 3$
- (D) $x - 9$

Question 29 (Level 3) — *Index law — negative exponent*

Simplify $\frac{x^5}{x^8}$.

- (A) x^{-3}
- (B) x^3
- (C) x^{13}
- (D) $\frac{1}{x^{-3}}$

Question 30 (Level 3) — *Equation with algebraic fractions*

Solve $\frac{x}{2} + \frac{x}{3} = 5$.

- (A) $x = 6$
- (B) $x = 5$
- (C) $x = 10$
- (D) $x = 3$

Question 31 (Level 4) — *Completing the square*

Write $x^2 + 6x + 1$ in the form $(x + a)^2 + b$.

- (A) $(x + 3)^2 - 8$
- (B) $(x + 3)^2 + 8$
- (C) $(x + 6)^2 - 35$
- (D) $(x + 3)^2 - 10$

Question 32 (Level 4) — *Quadratic formula*

Solve $2x^2 - 5x - 3 = 0$ using the quadratic formula.

- (A) $x = 3$ or $x = -\frac{1}{2}$
- (B) $x = -3$ or $x = \frac{1}{2}$
- (C) $x = 3$ or $x = \frac{1}{2}$
- (D) $x = \frac{5 \pm \sqrt{49}}{2}$

Question 33 (Level 4) — *Discriminant analysis*

How many real solutions does $x^2 + 4x + 5 = 0$ have?

- (A) Two

- (B) One
- (C) None
- (D) Cannot be determined

Question 34 (Level 4) — *Algebraic fraction equation*

Solve $\frac{2}{x-1} = \frac{3}{x+2}$.

- (A) $x = 7$
- (B) $x = -7$
- (C) $x = 1$
- (D) $x = \frac{7}{5}$

Question 35 (Level 4) — *Factorising a cubic*

Factorise $x^3 - 8$.

- (A) $(x-2)(x^2+2x+4)$
- (B) $(x-2)(x^2-2x+4)$
- (C) $(x-2)^3$
- (D) $(x+2)(x^2-2x+4)$

Question 36 (Level 4) — *Solving a surd equation*

Solve $\sqrt{2x+1} = 5$.

- (A) $x = 12$
- (B) $x = 13$
- (C) $x = 2$
- (D) $x = \frac{24}{5}$

Question 37 (Level 4) — *Simultaneous equations — substitution*

Solve $y = 2x + 1$ and $y = x^2$ simultaneously.

- (A) $x = 1 \pm \sqrt{2}$
- (B) $x = 2 \pm \sqrt{2}$
- (C) $x = -1$ or $x = 1$
- (D) $x = \pm\sqrt{3}$

Question 38 (Level 4) — *Index equation*Solve $3^{2x} = 81$.

- (A) $x = 2$
- (B) $x = 4$
- (C) $x = 3$
- (D) $x = \frac{3}{2}$

Question 39 (Level 4) — *Adding algebraic fractions with different denominators*Simplify $\frac{1}{x+1} + \frac{1}{x-1}$.

- (A) $\frac{2x}{x^2 - 1}$
- (B) $\frac{2}{x^2 - 1}$
- (C) $\frac{2x}{2x}$
- (D) $\frac{1}{x^2 - 1}$

Question 40 (Level 4) — *Finding k for equal roots*Find the value of k so that $x^2 + kx + 9 = 0$ has exactly one solution.

- (A) $k = 6$ only
- (B) $k = \pm 6$
- (C) $k = 3$
- (D) $k = \pm 3$

Question 41 (Level 5) — *Nested algebraic fractions*Simplify $\frac{\frac{1}{x} - \frac{1}{y}}{\frac{1}{x} + \frac{1}{y}}$.

- (A) $\frac{y-x}{y+x}$
- (B) $\frac{x-y}{x+y}$
- (C) $\frac{1}{xy}$
- (D) $\frac{y+x}{y-x}$

Question 42 (Level 5) — *Solving an absolute value equation*

Solve $|2x - 3| = 7$.

- (A) $x = 5$ or $x = -2$
- (B) $x = 5$ only
- (C) $x = 2$ or $x = -5$
- (D) $x = 5$ or $x = 2$

Question 43 (Level 5) — *Quadratic inequality*

Solve $x^2 - 4x - 5 < 0$.

- (A) $-1 < x < 5$
- (B) $x < -1$ or $x > 5$
- (C) $-5 < x < 1$
- (D) $x < 5$

Question 44 (Level 5) — *Partial fractions*

Express $\frac{5x + 1}{(x - 1)(x + 2)}$ in partial fractions.

- (A) $\frac{2}{x - 1} + \frac{3}{x + 2}$
- (B) $\frac{3}{x - 1} + \frac{2}{x + 2}$
- (C) $\frac{1}{x - 1} + \frac{4}{x + 2}$
- (D) $\frac{2}{x + 1} + \frac{3}{x - 2}$

Question 45 (Level 5) — *Rational equation leading to a quadratic*

Solve $\frac{x}{x - 2} + \frac{x}{x + 2} = \frac{8}{x^2 - 4}$.

- (A) $x = 2$
- (B) $x = -2$
- (C) $x = \pm 2$
- (D) No solution

Question 46 (Level 5) — *Parameter in a quadratic*

For what values of m does $mx^2 + 2x + 1 = 0$ have two distinct real solutions?

- (A) $m < 1$

- (B) $m < 1$, $m \neq 0$
- (C) $0 < m < 1$
- (D) $m \leq 1$

Question 47 (Level 5) — *Simultaneous non-linear equations*

Solve $x + y = 5$ and $xy = 6$.

- (A) $(2, 3)$ or $(3, 2)$
- (B) $(1, 6)$ or $(6, 1)$
- (C) $(2, 3)$ only
- (D) $(5, 1)$ or $(1, 5)$

Question 48 (Level 5) — *Exponential equation via substitution*

Solve $4^x - 3 \cdot 2^x - 4 = 0$.

- (A) $x = 2$
- (B) $x = 4$
- (C) $x = 2$ or $x = -1$
- (D) $x = 1$

Question 49 (Level 5) — *Algebraic proof*

If $a + b = 1$, what is the value of $a^3 + b^3 + 3ab$?

- (A) 1
- (B) 0
- (C) $3ab$
- (D) Cannot be determined

Question 50 (Level 5) — *System with absolute values*

How many solutions does $|x - 1| + |x + 1| = 4$ have?

- (A) 0
- (B) 1
- (C) 2
- (D) Infinitely many

Solutions

Q1: (A)

$$x + 9 = 14 \Rightarrow x = 14 - 9 = 5.$$

Q2: (B)

$$2(3) + 7 = 6 + 7 = 13.$$

Q3: (A)

$$3x + 5x - 2x = (3 + 5 - 2)x = 6x.$$

Q4: (C)

$$3x = 21 \Rightarrow x = \frac{21}{3} = 7.$$

Q5: (B)

$$3(x + 4) = 3x + 12.$$

Q6: (A)

$$x - 8 = 3 \Rightarrow x = 3 + 8 = 11.$$

Q7: (A)

$$6x + 12 = 6(x + 2).$$

Q8: (B)

$$3(2) + 5 = 6 + 5 = 11.$$

Q9: (C)

$$\frac{x}{4} = 5 \Rightarrow x = 5 \times 4 = 20.$$

Q10: (A)

$$(4a - 2a) + (3b + b) = 2a + 4b.$$

Q11: (A)

$$2x + 5 = 17 \Rightarrow 2x = 12 \Rightarrow x = 6.$$

Q12: (A)

$$(x + 3)(x + 5) = x^2 + 5x + 3x + 15 = x^2 + 8x + 15.$$

Q13: (A)

The numbers are 3 and 4. So $x^2 + 7x + 12 = (x + 3)(x + 4)$.

Q14: (B)

$$3(x - 2) = 15 \Rightarrow x - 2 = 5 \Rightarrow x = 7.$$

Q15: (B)

$$\frac{4x}{2} = 2x.$$

Q16: (A)

$$5x - 2x = 9 + 3 \Rightarrow 3x = 12 \Rightarrow x = 4.$$

Q17: (C)

$$(x + 4)^2 = x^2 + 2(x)(4) + 16 = x^2 + 8x + 16.$$

Q18: (A)

Numbers: -2 and -3 . So $x^2 - 5x + 6 = (x - 2)(x - 3)$.

Q19: (A)

$$x^3 \times x^4 = x^{3+4} = x^7.$$

Q20: (B)

$$x + 1 = 12 \Rightarrow x = 11.$$

Q21: (A)

$$x^2 - 49 = x^2 - 7^2 = (x - 7)(x + 7).$$

Q22: (A)

$$x^2 - 3x - 10 = (x - 5)(x + 2) = 0, \text{ so } x = 5 \text{ or } x = -2.$$

Q23: (A)

$$\frac{2}{x} + \frac{3}{x} = \frac{2+3}{x} = \frac{5}{x}.$$

Q24: (A)

$$(2x - 3)(2x + 3) = (2x)^2 - 3^2 = 4x^2 - 9.$$

Q25: (B)

$$x = 0 \text{ or } x - 6 = 0 \Rightarrow x = 6.$$

Q26: (A)

$$r^2 = \frac{A}{\pi} \Rightarrow r = \sqrt{\frac{A}{\pi}} \text{ (taking positive root).}$$

Q27: (A)

$$2x^2 + 7x + 3 = 2x^2 + 6x + x + 3 = 2x(x + 3) + 1(x + 3) = (2x + 1)(x + 3).$$

Q28: (A)

$$\frac{x^2 - 9}{x + 3} = \frac{(x - 3)(x + 3)}{x + 3} = x - 3, \text{ for } x \neq -3.$$

Q29: (A)

$$\frac{x^5}{x^8} = x^{5-8} = x^{-3} = \frac{1}{x^3}.$$

Q30: (A)

$$3x + 2x = 30 \Rightarrow 5x = 30 \Rightarrow x = 6.$$

Q31: (A)

$$x^2 + 6x + 1 = (x^2 + 6x + 9) - 9 + 1 = (x + 3)^2 - 8.$$

Q32: (A)

$$x = \frac{5 \pm \sqrt{25 + 24}}{4} = \frac{5 \pm 7}{4}. \text{ So } x = 3 \text{ or } x = -\frac{1}{2}.$$

Q33: (C)

$$\Delta = 16 - 20 = -4 < 0, \text{ so there are no real solutions.}$$

Q34: (A)

$$2(x + 2) = 3(x - 1) \Rightarrow 2x + 4 = 3x - 3 \Rightarrow x = 7.$$

Q35: (A)

$$x^3 - 8 = (x - 2)(x^2 + 2x + 4).$$

Q36: (A)

$$2x + 1 = 25 \Rightarrow 2x = 24 \Rightarrow x = 12. \text{ Check: } \sqrt{25} = 5 \checkmark.$$

Q37: (A)

$$x^2 - 2x - 1 = 0. \text{ By the quadratic formula, } x = \frac{2 \pm \sqrt{4 + 4}}{2} = 1 \pm \sqrt{2}.$$

Q38: (A)

$$3^{2x} = 3^4 \Rightarrow 2x = 4 \Rightarrow x = 2.$$

Q39: (A)

$$\frac{(x - 1) + (x + 1)}{(x + 1)(x - 1)} = \frac{2x}{x^2 - 1}.$$

Q40: (B)

$$\Delta = k^2 - 4(1)(9) = k^2 - 36 = 0 \Rightarrow k = \pm 6.$$

Q41: (A)

$$\text{Multiply top and bottom by } xy: \frac{y - x}{y + x}.$$

Q42: (A)

$$\text{Case 1: } 2x = 10 \Rightarrow x = 5. \text{ Case 2: } 2x = -4 \Rightarrow x = -2.$$

Q43: (A)

$$(x - 5)(x + 1) < 0. \text{ The parabola is negative between the roots: } -1 < x < 5.$$

Q44: (A)

$$5x + 1 = A(x + 2) + B(x - 1). \text{ Put } x = 1: 6 = 3A \Rightarrow A = 2. \text{ Put } x = -2: -9 = -3B \Rightarrow B = 3. \text{ Answer: } \frac{2}{x - 1} + \frac{3}{x + 2}.$$

Q45: (D)

$x(x+2) + x(x-2) = 8 \Rightarrow 2x^2 = 8 \Rightarrow x^2 = 4 \Rightarrow x = \pm 2$. But $x \neq \pm 2$ (denominators). So there is no solution.

Q46: (B)

$\Delta = 4 - 4m > 0 \Rightarrow m < 1$. Also $m \neq 0$. So $m < 1, m \neq 0$.

Q47: (A)

$t^2 - 5t + 6 = (t-2)(t-3) = 0$. So $(x, y) = (2, 3)$ or $(3, 2)$.

Q48: (A)

$u^2 - 3u - 4 = 0 \Rightarrow (u-4)(u+1) = 0$. Since $u = 2^x > 0$, $u = 4 \Rightarrow 2^x = 4 \Rightarrow x = 2$.

Q49: (A)

$a^3 + b^3 = (a+b)(a^2 - ab + b^2) = 1 \cdot (a^2 - ab + b^2)$. Now $a^2 + b^2 = (a+b)^2 - 2ab = 1 - 2ab$. So $a^3 + b^3 = 1 - 3ab$. Therefore $a^3 + b^3 + 3ab = 1$.

Q50: (C)

For $x < -1$: $-(x-1) - (x+1) = -2x = 4 \Rightarrow x = -2 \checkmark$. For $-1 \leq x \leq 1$: $(1-x) + (x+1) = 2 \neq 4$, no solution. For $x > 1$: $(x-1) + (x+1) = 2x = 4 \Rightarrow x = 2 \checkmark$. So there are exactly 2 solutions.