

50 multiple-choice questions

Question 1 (Level 1) — *Meaning of a logarithm*

What does $\log_2 8$ equal?

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

Question 2 (Level 1) — *Evaluate log base 10*

Evaluate $\log_{10} 100$.

- (A) 2
- (B) 10
- (C) 100
- (D) 1

Question 3 (Level 1) — *Log of 1*

Evaluate $\log_5 1$.

- (A) 0
- (B) 1
- (C) 5
- (D) Undefined

Question 4 (Level 1) — *Log of the base*

Evaluate $\log_7 7$.

- (A) 1
- (B) 0
- (C) 7
- (D) 49

Question 5 (Level 1) — *Convert exponential to log form*

Write $3^4 = 81$ in logarithmic form.

- (A) $\log_3 81 = 4$
- (B) $\log_4 81 = 3$
- (C) $\log_{81} 3 = 4$

- (D) $\log_3 4 = 81$

Question 6 (Level 1) — *Convert log to exponential form*

Write $\log_2 32 = 5$ in exponential form.

- (A) $2^5 = 32$
(B) $5^2 = 32$
(C) $32^2 = 5$
(D) $2^{32} = 5$

Question 7 (Level 1) — *Evaluate log base 3*

Evaluate $\log_3 27$.

- (A) 3
(B) 9
(C) 27
(D) 2

Question 8 (Level 1) — *Log of a fraction*

Evaluate $\log_2 \frac{1}{4}$.

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

Question 9 (Level 1) — *Evaluate*

What is $\log_{10} 1000$?

- (A) 3
(B) 4
(C) 30
(D) 10

Question 10 (Level 1) — *Evaluate*

Evaluate $\log_4 16$.

- (A) 2
(B) 4

- (C) 8
- (D) 1

Question 11 (Level 2) — *Product rule for logs*

Simplify $\log_2 4 + \log_2 8$.

- (A) 5
- (B) 12
- (C) 6
- (D) 32

Question 12 (Level 2) — *Quotient rule for logs*

Simplify $\log_3 54 - \log_3 2$.

- (A) 3
- (B) 27
- (C) 52
- (D) 9

Question 13 (Level 2) — *Power rule for logs*

Simplify $\log_5 25^3$.

- (A) 6
- (B) 75
- (C) 15
- (D) 3

Question 14 (Level 2) — *Solve simple log equation*

Solve $\log_2 x = 5$.

- (A) $x = 32$
- (B) $x = 10$
- (C) $x = 25$
- (D) $x = 64$

Question 15 (Level 2) — *Evaluate with log law*

If $\log_{10} 2 \approx 0.301$, find $\log_{10} 8$.

- (A) 0.903

- (B) 0.602
- (C) 2.408
- (D) 0.801

Question 16 (Level 2) — *Solve for base*

If $\log_b 64 = 3$, find b .

- (A) $b = 4$
- (B) $b = 8$
- (C) $b = 3$
- (D) $b = 16$

Question 17 (Level 2) — *X-intercept of log graph*

What is the x -intercept of $y = \log_3 x$?

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

Question 18 (Level 2) — *Asymptote of log graph*

What is the vertical asymptote of $y = \log_2 x$?

- (A) $x = 0$
- (B) $y = 0$
- (C) $x = 1$
- (D) $x = 2$

Question 19 (Level 2) — *Combine log expressions*

Write $2\log_3 x + \log_3 y$ as a single logarithm.

- (A) $\log_3(x^2y)$
- (B) $\log_3(2xy)$
- (C) $\log_3(x^2 + y)$
- (D) $\log_9(xy)$

Question 20 (Level 2) — *Evaluate*

Evaluate $\log_2 \sqrt{8}$.

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

Question 21 (Level 3) — *Change of base formula*

Evaluate $\log_3 20$ using the change of base formula (to 2 decimal places).

- (A) 2.73
- (B) 6.67
- (C) 1.73
- (D) 3.73

Question 22 (Level 3) — *Solve log equation*

Solve $\log_2(x - 3) = 4$.

- (A) $x = 19$
- (B) $x = 16$
- (C) $x = 13$
- (D) $x = 7$

Question 23 (Level 3) — *Inverse relationship*

If $f(x) = 3^x$, what is $f^{-1}(x)$?

- (A) $\log_3 x$
- (B) 3^{-x}
- (C) $\frac{1}{3^x}$
- (D) $\log_x 3$

Question 24 (Level 3) — *Solve with log on both sides*

Solve $\log_5 x = \log_5 3 + \log_5 4$.

- (A) $x = 12$
- (B) $x = 7$
- (C) $x = 60$
- (D) $x = \frac{3}{4}$

Question 25 (Level 3) — *Graph of transformed log*

What is the vertical asymptote of $y = \log_2(x - 3)$?

- (A) $x = 3$
- (B) $x = 0$
- (C) $x = -3$
- (D) $x = 2$

Question 26 (Level 3) — *Expand a logarithm*

Expand $\log_2 \frac{x^3}{y}$.

- (A) $3 \log_2 x - \log_2 y$
- (B) $3(\log_2 x - \log_2 y)$
- (C) $\log_2 3x - \log_2 y$
- (D) $3 \log_2 x + \log_2 y$

Question 27 (Level 3) — *Natural log evaluation*

If $\ln x = 2$, find x .

- (A) e^2
- (B) $2e$
- (C) 10^2
- (D) $\frac{2}{e}$

Question 28 (Level 3) — *Simplify*

Simplify $\log_a a^5$ where $a > 0, a \neq 1$.

- (A) 5
- (B) a^5
- (C) $5a$
- (D) $\frac{5}{a}$

Question 29 (Level 3) — *Domain of log function*

Find the domain of $f(x) = \log_3(2x - 6)$.

- (A) $(3, \infty)$
- (B) $[3, \infty)$
- (C) $(6, \infty)$
- (D) $(0, \infty)$

Question 30 (Level 3) — *Evaluate*

Evaluate $\ln e^4$.

(A) 4

(B) e^4

(C) $4e$

(D) $\frac{4}{e}$

Question 31 (Level 4) — *Solve equation with multiple logs*

Solve $\log_2 x + \log_2(x - 2) = 3$.

(A) $x = 4$

(B) $x = 4$ or $x = -2$

(C) $x = 8$

(D) $x = 2$

Question 32 (Level 4) — *Graph features of transformed log*

For $y = 2\log_3(x + 1) - 4$, find the x -intercept.

(A) $(8, 0)$

(B) $(9, 0)$

(C) $(2, 0)$

(D) $(80, 0)$

Question 33 (Level 4) — *Solve exponential using logs*

Solve $5 \cdot 3^{x-1} = 45$.

(A) $x = 3$

(B) $x = 2$

(C) $x = 9$

(D) $x = \log_3 45$

Question 34 (Level 4) — *Prove a log identity*

Simplify $\log_a b \cdot \log_b a$.

(A) 1

(B) 0

(C) $\log_a b + \log_b a$

(D) ab

Question 35 (Level 4) — *Log equation with coefficient*

Solve $2 \log_{10} x - \log_{10}(x + 6) = 1$.

(A) $x = 5 + \sqrt{85}$

(B) $x = 5 - \sqrt{85}$

(C) $x = 10$

(D) $x = 5 \pm \sqrt{85}$

Question 36 (Level 4) — *Derivative of ln*

Find $\frac{d}{dx}[\ln(3x + 1)]$.

(A) $\frac{3}{3x+1}$

(B) $\frac{1}{3x+1}$

(C) $\frac{3}{x}$

(D) $\frac{1}{3(3x+1)}$

Question 37 (Level 4) — *Solve*

Solve $\ln(2x) = 1$.

(A) $x = \frac{e}{2}$

(B) $x = e$

(C) $x = 2e$

(D) $x = \frac{1}{2}$

Question 38 (Level 4) — *Graph of*

The graph of $y = -\log_2 x$ is a reflection of $y = \log_2 x$ in which axis?

(A) The x -axis

(B) The y -axis

(C) The line $y = x$

(D) The origin

Question 39 (Level 4) — *Solve*

Solve $e^{2x} = 7$, giving an exact answer.

(A) $x = \frac{\ln 7}{2}$

(B) $x = \ln \frac{7}{2}$

(C) $x = 2 \ln 7$

(D) $x = \frac{7}{2e}$

Question 40 (Level 4) — *Simplify*

Evaluate $\log_4 8$ as a fraction.

(A) $\frac{3}{2}$

(B) 2

(C) $\frac{2}{3}$

(D) $\frac{4}{3}$

Question 41 (Level 5) — *Solve log equation with quadratic*

Solve $(\log_2 x)^2 - 5 \log_2 x + 6 = 0$.

(A) $x = 4$ or $x = 8$

(B) $x = 2$ or $x = 3$

(C) $x = 32$

(D) $x = 4$ only

Question 42 (Level 5) — *Integral involving ln*

Evaluate $\int_1^e \frac{1}{x} dx$.

(A) 1

(B) e

(C) $e - 1$

(D) 0

Question 43 (Level 5) — *Log equation with different bases*

Solve $\log_2 x + \log_4 x = 6$.

(A) $x = 16$

(B) $x = 64$

(C) $x = 8$

(D) $x = 12$

Question 44 (Level 5) — *Derivative of*

Find $\frac{d}{dx}(x \ln x - x)$.

(A) $\ln x$

(B) $\ln x + 1$

- (C) $\frac{1}{x}$
 (D) $x \ln x$

Question 45 (Level 5) — *Functional equation*

If $f(x) = \log_a x$ and $f(27) = 3$, find $f(81)$.

- (A) 4
 (B) 3
 (C) 27
 (D) 5

Question 46 (Level 5) — *Integral of*

Evaluate $\int_0^1 \frac{2x}{x^2+1} dx$.

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

Question 47 (Level 5) — *Tangent to log curve*

Find the equation of the tangent to $y = \ln x$ at $x = e$.

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

Question 48 (Level 5) — *Logarithmic differentiation*

If $y = x^x$ for $x > 0$, find $\frac{dy}{dx}$.

- (A) $x^x(\ln x + 1)$
 (B) $x \cdot x^{x-1}$
 (C) $x^x \ln x$
 (D) x^{x+1}

Question 49 (Level 5) — *Solve*

Solve $\ln x + \ln(x+2) = \ln 3$.

- (A) $x = 1$

- (B) $x = 1$ or $x = -3$
- (C) $x = 3$
- (D) $x = -3$

Question 50 (Level 5) — *Area between log and line*

Find the area enclosed between $y = \ln x$, the x -axis, and the line $x = e^2$.

- (A) $e^2 + 1$
- (B) $2e^2 - 1$
- (C) e^2
- (D) $e^2 - 1$

Solutions

Q1: (A)

$$2^3 = 8, \text{ so } \log_2 8 = 3.$$

Q2: (A)

$$\log_{10} 100 = 2.$$

Q3: (A)

$$5^0 = 1, \text{ so } \log_5 1 = 0.$$

Q4: (A)

$$\log_7 7 = 1.$$

Q5: (A)

$$\log_3 81 = 4.$$

Q6: (A)

$$2^5 = 32.$$

Q7: (A)

$$\log_3 27 = 3.$$

Q8: (A)

$$\log_2 \frac{1}{4} = \log_2 2^{-2} = -2.$$

Q9: (A)

$$\log_{10} 1000 = 3.$$

Q10: (A)

$$\log_4 16 = 2.$$

Q11: (A)

$$\log_2 4 + \log_2 8 = \log_2(4 \times 8) = \log_2 32 = 5.$$

Q12: (A)

$$\log_3 54 - \log_3 2 = \log_3 \frac{54}{2} = \log_3 27 = 3.$$

Q13: (A)

$$\log_5 25^3 = 3 \log_5 25 = 3 \times 2 = 6.$$

Q14: (A)

$$x = 2^5 = 32.$$

Q15: (A)

$$\log_{10} 8 = 3 \times 0.301 = 0.903.$$

Q16: (A)

$$b^3 = 64 \Rightarrow b = \sqrt[3]{64} = 4.$$

Q17: (A)

$$\log_3 x = 0 \Rightarrow x = 3^0 = 1. \text{ The } x\text{-intercept is } (1, 0).$$

Q18: (A)

The vertical asymptote is $x = 0$.

Q19: (A)

$$2 \log_3 x + \log_3 y = \log_3 x^2 + \log_3 y = \log_3(x^2y).$$

Q20: (A)

$$\log_2 2^{\frac{3}{2}} = \frac{3}{2}.$$

Q21: (A)

$$\log_3 20 = \frac{\log 20}{\log 3} = \frac{1.3010}{0.4771} \approx 2.73.$$

Q22: (A)

$$x - 3 = 16, \text{ so } x = 19.$$

Q23: (A)

$$f^{-1}(x) = \log_3 x.$$

Q24: (A)

$$\log_5 x = \log_5(3 \times 4) = \log_5 12. \text{ So } x = 12.$$

Q25: (A) $x - 3 > 0 \Rightarrow x > 3$. The vertical asymptote is $x = 3$.**Q26:** (A)

$$\log_2 \frac{x^3}{y} = \log_2 x^3 - \log_2 y = 3 \log_2 x - \log_2 y.$$

Q27: (A)

$$x = e^2 \approx 7.389.$$

Q28: (A)

$$\log_a a^5 = 5.$$

Q29: (A)

$$2x - 6 > 0 \Rightarrow x > 3. \text{ Domain: } (3, \infty).$$

Q30: (A)

$$\ln e^4 = 4.$$

Q31: (A)

$$x^2 - 2x = 8 \Rightarrow x^2 - 2x - 8 = 0 \Rightarrow (x - 4)(x + 2) = 0. x = 4 \text{ or } x = -2. \text{ Since we need}$$

$$x > 2, x = 4.$$

Q32: (A)

$$\log_3(x + 1) = 2 \Rightarrow x + 1 = 9 \Rightarrow x = 8. \text{ The } x\text{-intercept is } (8, 0).$$

Q33: (A)

$$3^{x-1} = 9 = 3^2 \Rightarrow x - 1 = 2 \Rightarrow x = 3.$$

Q34: (A)

$$\log_a b \cdot \log_b a = \frac{\ln b}{\ln a} \cdot \frac{\ln a}{\ln b} = 1.$$

Q35: (A)

$$\frac{x^2}{x+6} = 10 \Rightarrow x^2 = 10x + 60 \Rightarrow x^2 - 10x - 60 = 0. x = \frac{10 \pm \sqrt{100+240}}{2} = \frac{10 \pm \sqrt{340}}{2} = 5 \pm \sqrt{85}.$$

Since $x > 0$: $x = 5 + \sqrt{85}$.

Q36: (A)

$$\frac{d}{dx} [\ln(3x + 1)] = \frac{3}{3x + 1}.$$

Q37: (A)

$$2x = e \Rightarrow x = \frac{e}{2}.$$

Q38: (A)

$y = -\log_2 x$ reflects $y = \log_2 x$ in the x -axis.

Q39: (A)

$$2x = \ln 7 \Rightarrow x = \frac{\ln 7}{2}.$$

Q40: (A)

$$\frac{3 \log 2}{2 \log 2} = \frac{3}{2}.$$

Q41: (A)

$$(u - 2)(u - 3) = 0. u = 2 \Rightarrow x = 4; u = 3 \Rightarrow x = 8.$$

Q42: (A)

$$\int_1^e \frac{1}{x} dx = [\ln x]_1^e = \ln e - \ln 1 = 1 - 0 = 1.$$

Q43: (A)

Let $u = \log_2 x$: $u + \frac{u}{2} = 6 \Rightarrow \frac{3u}{2} = 6 \Rightarrow u = 4$. So $x = 2^4 = 16$.

Q44: (A)

$$\frac{d}{dx}(x \ln x - x) = (\ln x + x \cdot \frac{1}{x}) - 1 = \ln x + 1 - 1 = \ln x.$$

Q45: (A)

$$a = 3. f(81) = \log_3 81 = \log_3 3^4 = 4.$$

Q46: (A)

$$\int_0^1 \frac{2x}{x^2+1} dx = [\ln(x^2 + 1)]_0^1 = \ln 2 - \ln 1 = \ln 2.$$

Q47: (A)

Slope = $\frac{1}{e}$, point $(e, 1)$. Tangent: $y - 1 = \frac{1}{e}(x - e)$, i.e. $y = \frac{x}{e}$.

Q48: (A)

$$\ln y = x \ln x. \frac{1}{y} \frac{dy}{dx} = \ln x + 1. \frac{dy}{dx} = x^x(\ln x + 1).$$

Q49: (A)

$$x^2 + 2x - 3 = 0 \Rightarrow (x+3)(x-1) = 0. \quad x = 1 \text{ or } x = -3. \quad \text{Since } x > 0: \quad x = 1.$$

Q50: (A)

$$\int_1^{e^2} \ln x \, dx = [x \ln x - x]_1^{e^2} = (e^2 \cdot 2 - e^2) - (0 - 1) = e^2 + 1.$$