50 multiple-choice questions

Question 1 (Level 1) — *Domain from set of points*
A function contains the points $\{(1,3), (2,5), (4,7)\}$. What is the domain?

(A) $\{1, 2, 4\}$

(B) $\{3, 5, 7\}$

(C) $\{1, 2, 3, 4, 5, 7\}$

(D) $\{(1,3), (2,5), (4,7)\}$

Question 2 (Level 1) — *Range from set of points*
A function contains the points $\{(1,3), (2,5), (4,7)\}$. What is the range?

(A) $\{3, 5, 7\}$

(B) $\{1, 2, 4\}$

(C) $\{1, 3, 5, 7\}$

(D) $[3, 7]$

Question 3 (Level 1) — *Domain of linear function*
What is the domain of $y = 3x + 1$?

(A) $\mathbb{R}$

(B) $[0, \infty)$

(C) $\{1, 3\}$

(D) $(0, \infty)$

Question 4 (Level 1) — *Range of*
What is the range of $y = x^2$?

(A) $[0, \infty)$

(B) $\mathbb{R}$

(C) $(0, \infty)$

(D) $(-\infty, 0]$

Question 5 (Level 1) — *Interval notation — closed*
Write "all real numbers from 2 to 5 inclusive" in interval notation.

(A) $[2, 5]$

(B) $(2, 5)$

(C) $[2, 5)$

(D) $\{2, 3, 4, 5\}$

Question 6 (Level 1) — *Interval notation — open*
Write "all real numbers greater than -1 and less than 4" in interval notation.

(A) $(-1, 4)$

(B) $[-1, 4]$

(C) $(-1, 4]$

(D) $\{-1, 4\}$

Question 7 (Level 1) — *Domain of (basic)*
What is the domain of $y = x^2$?

(A) $\mathbb{R}$

(B) $[0, \infty)$

(C) $(0, \infty)$

(D) $[-\infty, \infty]$

Question 8 (Level 1) — *Range of a constant function*
What is the range of $y = 5$?

(A) $\{5\}$

(B) $\mathbb{R}$

(C) $[0, 5]$

(D) $[5, \infty)$

Question 9 (Level 1) — *Meaning of*
If the domain is $x \geq 0$, which interval notation is correct?

(A) $[0, \infty)$

(B) $(0, \infty)$

(C) $[0, \infty]$

(D) $(-\infty, 0]$

Question 10 (Level 1) — *Range of*
What is the range of $y = 2x$?

(A) $\mathbb{R}$

(B) $[0, \infty)$

(C) $(0, \infty)$

(D) $[2, \infty)$

Question 11 (Level 2) — *Implied domain of*
What is the implied (maximal) domain of $y = \sqrt{x}$?

(A) $[0, \infty)$

(B) $\mathbb{R}$

(C) $(0, \infty)$

(D) $(-\infty, 0]$

Question 12 (Level 2) — *Implied domain of*
What is the implied domain of $y = \frac{1}{x}$?

(A) $\mathbb{R} \setminus \{0\}$

(B) $\mathbb{R}$

(C) $(0, \infty)$

(D) $[0, \infty)$

Question 13 (Level 2) — *Range of*
What is the range of $y = x^2 + 1$?

(A) $[1, \infty)$

(B) $[0, \infty)$

(C) $(1, \infty)$

(D) $\mathbb{R}$

Question 14 (Level 2) — *Domain of*
Find the implied domain of $y = \sqrt{x - 3}$.

(A) $[3, \infty)$

(B) $(3, \infty)$

(C) $[0, \infty)$

(D) $(-\infty, 3]$

Question 15 (Level 2) — *Range of*
What is the range of $y = -x^2$?

(A) $(-\infty, 0]$

(B) $[0, \infty)$

(C) $\mathbb{R}$

(D) $(-\infty, 0)$

Question 16 (Level 2) — *Domain of*
Find the implied domain of $y = \frac{1}{x-2}$.

(A) $\mathbb{R} \setminus \{2\}$

(B) $\mathbb{R}$

(C) $(2, \infty)$

(D) $\mathbb{R} \setminus \{0\}$

Question 17 (Level 2) — *Range from graph description*
A parabola has vertex at $(1, -3)$ and opens upward. What is its range?

(A) $[-3, \infty)$

(B) $(-\infty, -3]$

(C) $(-3, \infty)$

(D) $[1, \infty)$

Question 18 (Level 2) — *Union of intervals*
Write $x < -1$ or $x > 3$ in interval notation.

(A) $(-\infty, -1) \cup (3, \infty)$

(B) $(-1, 3)$

(C) $[-1, 3]$

(D) $(-\infty, -1] \cup [3, \infty)$

Question 19 (Level 2) — *Restricted domain range*
If $f(x) = x^2$ with domain $[0, 3]$, what is the range?

(A) $[0, 9]$

(B) $[0, \infty)$

(C) $[0, 3]$

(D) $[0, 6]$

Question 20 (Level 2) — *Domain of*
Find the implied domain of $y = \sqrt{4 - x}$.

(A) $(-\infty, 4]$

(B) $[4, \infty)$

(C) $(-\infty, 4)$

(D) $[0, 4]$

Question 21 (Level 3) — *Domain of*
Find the implied domain of $y = \frac{1}{x^2 - 4}$.

(A) $\mathbb{R} \setminus \{-2, 2\}$

(B) $\mathbb{R} \setminus \{4\}$

(C) $(2, \infty)$

(D) $\mathbb{R} \setminus \{2\}$

Question 22 (Level 3) — *Domain of*
Find the implied domain of $y = \sqrt{x^2 - 9}$.

(A) $(-\infty, -3] \cup [3, \infty)$

(B) $[-3, 3]$

(C) $[3, \infty)$

(D) $(-\infty, -3) \cup (3, \infty)$

Question 23 (Level 3) — *Range of*
Find the range of $y = (x - 1)^2 + 2$.

(A) $[2, \infty)$

(B) $(2, \infty)$

(C) $[1, \infty)$

(D) $[0, \infty)$

Question 24 (Level 3) — *Domain of log function*
Find the implied domain of $y = \log_2(x + 5)$.

(A) $(-5, \infty)$

(B) $[-5, \infty)$

(C) $(5, \infty)$

(D) $(0, \infty)$

Question 25 (Level 3) — *Range of exponential*
Find the range of $y = 2^x + 3$.

(A) $(3, \infty)$

(B) $[3, \infty)$

(C) $(0, \infty)$

(D) $\mathbb{R}$

Question 26 (Level 3) — *Restricted domain for 1-to-1*
The function $f(x) = x^2$ is restricted to $x \geq 0$ to make it one-to-one. What is the range?

(A) $[0, \infty)$

(B) $\mathbb{R}$

(C) $(0, \infty)$

(D) $[0, 1]$

Question 27 (Level 3) — *Domain of combined expression*
Find the implied domain of $y = \frac{\sqrt{x}}{x-1}$.

(A) $[0, 1) \cup (1, \infty)$

(B) $[0, \infty)$

(C) $(0, 1) \cup (1, \infty)$

(D) $\mathbb{R} \setminus \{1\}$

Question 28 (Level 3) — *Range with restricted domain*
If $f(x) = x^2 - 4x + 3$ with domain $[0, 5]$, find the range.

(A) $[-1, 8]$

(B) $[-1, 3]$

(C) $[0, 8]$

(D) $[-1, \infty)$

Question 29 (Level 3) — *Domain of*
What is the maximal domain of $y = \tan x$?

(A) $\mathbb{R} \setminus \left\{ \frac{\pi}{2} + n\pi : n \in \mathbb{Z} \right\}$

(B) $\mathbb{R}$

(C) $\mathbb{R} \setminus \{n\pi : n \in \mathbb{Z}\}$

(D) $[0, 2\pi]$

Question 30 (Level 3) — *Range of*
What is the range of $y = \frac{1}{x}$ on its maximal domain?

(A) $\mathbb{R} \setminus \{0\}$

(B) $\mathbb{R}$

(C) $(0, \infty)$

(D) $[0, \infty)$

Question 31 (Level 4) — *Maximal domain of*
Find the maximal domain of $y = \sqrt{6 - x - x^2}$.

(A) $[-3, 2]$

(B) $(-3, 2)$

(C) $[-2, 3]$

(D) $(-\infty, -3] \cup [2, \infty)$

Question 32 (Level 4) — *Range of transformed function*
Find the range of $y = -3(x - 1)^2 + 7$.

(A) $(-\infty, 7]$

(B) $[7, \infty)$

(C) $(-\infty, -3]$

(D) $(-\infty, 1]$

Question 33 (Level 4) — *Domain of*
Find the maximal domain of $y = \log(x^2 - 1)$.

(A) $(-\infty, -1) \cup (1, \infty)$

(B) $(1, \infty)$

(C) $(-1, 1)$

(D) $\mathbb{R} \setminus \{-1, 1\}$

Question 34 (Level 4) — *Range of*
Find the range of $y = \frac{1}{x-1} + 2$ on its maximal domain.

(A) $\mathbb{R} \setminus \{2\}$

(B) $\mathbb{R}$

(C) $(2, \infty)$

(D) $\mathbb{R} \setminus \{1\}$

Question 35 (Level 4) — *Domain for inverse to exist*
Find the largest domain containing $x = 0$ for which $f(x) = x^2 - 4x$ is one-to-one.

(A) $(-\infty, 2]$

(B) $[2, \infty)$

(C) $[0, 4]$

(D) $(-\infty, 0]$

Question 36 (Level 4) — *Range of on restricted domain*
If $f(x) = \sin x$ with domain $[0, \frac{\pi}{6}]$, find the range.

(A) $\left[0, \frac{1}{2}\right]$

(B) $[-1, 1]$

(C) $\left[0, \frac{\sqrt{3}}{2}\right]$

(D) $\left[\frac{1}{2}, 1\right]$

Question 37 (Level 4) — *Domain of composite function*
If $f(x) = \sqrt{x}$ and $g(x) = 4 - x^2$, find the domain of $f(g(x))$.

(A) $[-2, 2]$

(B) $[0, 2]$

(C) $(-2, 2)$

(D) $[0, 4]$

Question 38 (Level 4) — *Range of*
Find the range of $y = e^x - 2$.

(A) $(-2, \infty)$

(B) $[-2, \infty)$

(C) $(0, \infty)$

(D) $\mathbb{R}$

Question 39 (Level 4) — *Domain of*
Find the domain of $y = \ln(\sin x)$ for $x \in [0, 2\pi]$.

(A) $(0, \pi)$

(B) $[0, \pi]$

(C) $(0, 2\pi)$

(D) $\left(0, \frac{\pi}{2}\right)$

Question 40 (Level 4) — *Range of*
Find the range of $y = \frac{x}{x^2+1}$.

(A) $\left[-\frac{1}{2}, \frac{1}{2}\right]$

(B) $\mathbb{R}$

(C) $\left(-\frac{1}{2}, \frac{1}{2}\right)$

(D) $[-1, 1]$

Question 41 (Level 5) — *Domain of*
Find the maximal domain of $y = \frac{1}{\sqrt{x^2-5x+6}}$.

(A) $(-\infty, 2) \cup (3, \infty)$

(B) $(-\infty, 2] \cup [3, \infty)$

(C) $(2, 3)$

(D) $[2, 3]$

Question 42 (Level 5) — *Range of*
Find the range of $y = \sqrt{4 - x^2}$.

(A) $[0, 2]$

(B) $[0, 4]$

(C) $(0, 2)$

(D) $[-2, 2]$

Question 43 (Level 5) — *Range via calculus*
Find the range of $f(x) = xe^{-x}$ for $x \geq 0$.

(A) $\left[0, \frac{1}{e}\right]$

(B) $[0, e]$

(C) $\left(0, \frac{1}{e}\right)$

(D) $[0, 1]$

Question 44 (Level 5) — *Domain of inverse*
If $f : [0, \infty) \to \mathbb{R}$, $f(x) = x^2 + 2$, find the domain of f^{-1}.

(A) $[2, \infty)$

(B) $[0, \infty)$

(C) $(2, \infty)$

(D) $\mathbb{R}$

Question 45 (Level 5) — *Domain of composite*
Let $f : [-1, 3] \to \mathbb{R}$, $f(x) = 2x - 1$ and $g : (0, \infty) \to \mathbb{R}$, $g(x) = \ln x$. Find the domain of $g \circ f$.

(A) $\left(\frac{1}{2}, 3\right]$

(B) $[-1, 3]$

(C) $\left[\frac{1}{2}, 3\right]$

(D) $(0, 3]$

Question 46 (Level 5) — *Range of*
Find the range of $y = \frac{x^2+1}{x^2-1}$ on its maximal domain.

(A) $(-\infty, -1] \cup (1, \infty)$

(B) $\mathbb{R} \setminus \{1\}$

(C) $(-\infty, -1) \cup (1, \infty)$

(D) $\mathbb{R} \setminus [-1, 1]$

Question 47 (Level 5) — *Domain of*
Find the maximal domain of $y = \sqrt{\ln x}$.

(A) $[1, \infty)$

(B) $(0, \infty)$

(C) $(1, \infty)$

(D) $[e, \infty)$

Question 48 (Level 5) — *Range of*
Find the range of $y = 2\sin x + 3\cos x$.

(A) $[-\sqrt{13}, \sqrt{13}]$

(B) $[-5, 5]$

(C) $[-3, 3]$

(D) $[-\sqrt{5}, \sqrt{5}]$

Question 49 (Level 5) — *Domain of piecewise*

A function is defined as $f(x) = \begin{cases} \sqrt{x} & x \geq 0 \\ \frac{1}{x+1} & x < 0 \end{cases}$. What is the maximal domain?

(A) $\mathbb{R} \setminus \{-1\}$

(B) $\mathbb{R}$

(C) $[0, \infty)$

(D) $(-\infty, 0) \cup [0, \infty)$

Question 50 (Level 5) — *Range of*

Find the range of $y = \frac{e^x - 1}{e^x + 1}$.

(A) $(-1, 1)$

(B) $[-1, 1]$

(C) $(-1, 1]$

(D) $\mathbb{R}$

Solutions

Q1: (A)
Domain $= \{1, 2, 4\}$.
Q2: (A)
Range $= \{3, 5, 7\}$.
Q3: (A)
Domain $= \mathbb{R}$ (all real numbers).
Q4: (A)
Range $= [0, \infty)$.
Q5: (A)
$[2, 5]$.
Q6: (A)
$(-1, 4)$.
Q7: (A)
Domain $= \mathbb{R}$.
Q8: (A)
Range $= \{5\}$.
Q9: (A)
$[0, \infty)$.
Q10: (A)
Range $= \mathbb{R}$.
Q11: (A)
$x \geq 0$, so domain $= [0, \infty)$.
Q12: (A)
$x \neq 0$, so domain $= \mathbb{R} \setminus \{0\}$ or $(-\infty, 0) \cup (0, \infty)$.
Q13: (A)
Range $= [1, \infty)$.
Q14: (A)
$x \geq 3$, so domain $= [3, \infty)$.
Q15: (A)
Range $= (-\infty, 0]$.
Q16: (A)
$x \neq 2$, so domain $= \mathbb{R} \setminus \{2\}$.
Q17: (A)
Range $= [-3, \infty)$.
Q18: (A)
$(-\infty, -1) \cup (3, \infty)$.
Q19: (A)
Range $= [0, 9]$.
Q20: (A)
Domain $= (-\infty, 4]$.
Q21: (A)
Domain $= \mathbb{R} \setminus \{-2, 2\}$.
Q22: (A)
Domain $= (-\infty, -3] \cup [3, \infty)$.
Q23: (A)
Range $= [2, \infty)$.
Q24: (A)
$x > -5$, so domain $= (-5, \infty)$.

Q25: (A)
Range $= (3, \infty)$.
Q26: (A)
Range $= [0, \infty)$.
Q27: (A)
Domain $= [0, 1) \cup (1, \infty)$.
Q28: (A)
Minimum at vertex: -1. Maximum at $x = 5$: 8. Range $= [-1, 8]$.
Q29: (A)
$x \neq \frac{\pi}{2} + n\pi$ for integer n. Domain $= \mathbb{R} \setminus \left\{ \frac{\pi}{2} + n\pi : n \in \mathbb{Z} \right\}$.
Q30: (A)
Range $= \mathbb{R} \setminus \{0\}$.
Q31: (A)
$(x + 3)(x - 2) \leq 0 \Rightarrow -3 \leq x \leq 2$. Domain $= [-3, 2]$.
Q32: (A)
Maximum y-value is 7. Range $= (-\infty, 7]$.
Q33: (A)
Domain $= (-\infty, -1) \cup (1, \infty)$.
Q34: (A)
$\frac{1}{x-1} \in \mathbb{R} \setminus \{0\}$, so $y \in \mathbb{R} \setminus \{2\}$.
Q35: (A)
Domain $= (-\infty, 2]$.
Q36: (A)
Range $= [0, \frac{1}{2}]$.
Q37: (A)
$x^2 \leq 4 \Rightarrow -2 \leq x \leq 2$. Domain $= [-2, 2]$.
Q38: (A)
Range $= (-2, \infty)$.
Q39: (A)
Domain $= (0, \pi)$.
Q40: (A)
$\Delta = 1 - 4y^2 \geq 0 \Rightarrow y^2 \leq \frac{1}{4}$. Range $= \left[-\frac{1}{2}, \frac{1}{2} \right]$.
Q41: (A)
$(x - 2)(x - 3) > 0 \Rightarrow x < 2$ or $x > 3$. Domain $= (-\infty, 2) \cup (3, \infty)$.
Q42: (A)
Range $= [0, 2]$.
Q43: (A)
Max at $x = 1$: $f(1) = \frac{1}{e}$. $f(0) = 0$ and $f \to 0^+$. Range $= \left[0, \frac{1}{e} \right]$.
Q44: (A)
Range of $f = [2, \infty)$. Domain of $f^{-1} = [2, \infty)$.
Q45: (A)
Intersect $[-1, 3]$ and $(\frac{1}{2}, \infty)$: domain $= \left(\frac{1}{2}, 3 \right]$.
Q46: (A)
When $|x| > 1$: $y \in (1, \infty)$. When $|x| < 1$: $x^2 - 1 \in [-1, 0)$, so $\frac{2}{x^2-1} \in (-\infty, -2]$, giving $y \in (-\infty, -1]$. Range $= (-\infty, -1] \cup (1, \infty)$.
Q47: (A)
$\ln x \geq 0 \Rightarrow x \geq 1$. Domain $= [1, \infty)$.
Q48: (A)
$y = \sqrt{13} \sin(x + \alpha)$ for some α. Range $= [-\sqrt{13}, \sqrt{13}]$.

Q49: (A)
Domain $= (-\infty, -1) \cup (-1, 0) \cup [0, \infty) = \mathbb{R} \setminus \{-1\}$.
Q50: (A)
$u + 1 \in (1, \infty)$, so $\frac{2}{u+1} \in (0, 2)$, giving $y = 1 - \frac{2}{u+1} \in (-1, 1)$. Range $= (-1, 1)$.