Piecewise Functions Practice

Use this key to check answers and read the explanations.

1. A function uses $f(x) = x + 6$ if $x < 2$ and $f(x) = 3x$ if $x \geq 2$. What is $f(-2)$?

A. 4
B. −6
C. 8
D. 6

Correct answer: A. 4
The input −2 is less than 2, so use the first rule. Adding 6 to −2 gives 4.

2. The rule is $g(x) = 8 - x$ for $x \leq 3$ and $g(x) = 2x + 1$ for $x > 3$. What is $g(3)$?

A. 8
B. 7
C. 5
D. 11

Correct answer: C. 5
The condition $x \leq 3$ includes the boundary. Substituting 3 into $8 - x$ gives 5.

3. A graph uses $p(x) = 6 - x$ for $x < 4$ and $p(x) = x + 1$ for $x \geq 4$. Which point on the graph is filled at $x = 4$?

A. (4, 2)
B. (4, 5)
C. (5, 4)
D. (4, 4)

Correct answer: B. (4, 5)
The second rule includes 4 and gives $4 + 1 = 5$. The first rule approaches (4, 2) but excludes that point.

4. A function uses $h(x) = x - 2$ for $x < 0$, $h(x) = 4$ for $x = 0$, and $h(x) = x + 2$ for $x > 0$. What are $h(-2)$, $h(0)$, and $h(2)$, in order?

A. −4, −2, 4
B. −4, 2, 4
C. 0, 4, 0
D. −4, 4, 4

Correct answer: D. −4, 4, 4
The negative input uses $-2 - 2$. At zero the rule gives 4 directly, and the positive input uses $2 + 2$.

5. A table pairs x-values 0, 1, 2, 3, 4, and 5 with outputs 2, 2, 2, 5, 5, and 8 in that order. The table lists every allowed input. Which condition selects exactly the inputs with output 5?

A. $2 \le x \le 4$
B. $3 \le x \le 4$
C. $3 \le x \le 5$
D. $2 < x < 4$

Correct answer: B. $3 \le x \le 4$
The table gives 5 at inputs 3 and 4. Both endpoints are included because both inputs give that output.

6. A fictional game library charges $5 for up to 2 hours, plus $3 per hour beyond 2 hours. Extra time is billed proportionally, including fractions of an hour. What does a 4.5-hour rental cost?

A. $12.50
B. $13.50
C. $18.50
D. $11.00

Correct answer: A. $12.50
The first 2 hours cost $5. The extra 2.5 hours cost $7.50, bringing the total to $12.50.

7. A fictional print shop charges $0.90 each for the first 12 posters and $0.60 for each poster beyond 12. If n is the number of posters and $n > 12$, which expression gives the total cost in dollars?

A. $0.90n + 0.60(n - 12)$
B. $0.60n$
C. $10.80 + 0.90(n - 12)$
D. $10.80 + 0.60(n - 12)$

Correct answer: D. $10.80 + 0.60(n - 12)$
The first 12 posters cost $12 \times \$0.90 = \$10.80$. Only the remaining $n - 12$ posters use the lower rate.

8. A function uses $r(t) = t + 2$ for $-3 \le t < 1$ and $r(t) = 2t$ for $2 < t \le 6$. It has no other rules. What is its domain?

A. $(-3, 1] \cup [2, 6)$
B. $[-3, 6]$
C. $[-3, 1) \cup (2, 6]$
D. $[-3, 1] \cup [2, 6]$

Correct answer: C. $[-3, 1) \cup (2, 6]$
The first interval includes -3 and excludes 1. The second excludes 2 and includes 6. The union leaves the gap in place.

9. A function uses $s(x) = x + 4$ for $-2 \le x < 1$ and $s(x) = 7$ for $1 \le x \le 4$. It has no other rules. What is its range?

A. $[2, 5) \cup \{7\}$
B. $[2, 5] \cup \{7\}$
C. $[2, 7]$
D. $(2, 5] \cup \{7\}$

Correct answer: A. $[2, 5) \cup \{7\}$
The first branch starts at 2 and approaches 5 without reaching it. The second branch contributes only the value 7.

10. A function uses $f(x) = x + 1$ for $x < 2$, $f(x) = 3$ for $2 \le x < 5$, and $f(x) = x + 2$ for $x \ge 5$. At which boundary do the two sides approach different values?

A. Neither boundary
B. $x = 2$ only
C. Both $x = 2$ and $x = 5$
D. $x = 5$ only

Correct answer: D. $x = 5$ only
The two sides both approach 3 at $x = 2$. At $x = 5$ the left side approaches 3 and the right side approaches 7, so the graph jumps there.

11. A function uses $f(x) = 4 - x$ for $x < 0$, $f(x) = 1$ for $0 \le x < 3$, and $f(x) = 2x - 4$ for $x \ge 3$. Which inputs give $f(x) = 6$?

A. 5 only
B. -2 only
C. -2 and 5
D. 2 and 5

Correct answer: C. -2 and 5
Solving $4 - x = 6$ gives -2, which is in the first branch. The middle branch always gives 1. Solving $2x - 4 = 6$ gives 5, which is in the last branch.

12. The rule is $f(x) = 3x + b$ for $x < 2$ and $f(x) = x^2 + 4$ for $x \ge 2$. Which value of b makes the graph continuous at $x = 2$?

A. 14
B. 2
C. 4
D. -2

Correct answer: B. 2
The left branch approaches $6 + b$, while the right branch gives $2^2 + 4 = 8$ at the boundary. Setting $6 + b$ equal to 8 gives $b = 2$.

13. A function uses $p(x) = x + 5$ for $x < 2$ and $p(x) = 2x - 5$ for $x \geq 2$. For which inputs is $p(x) > 3$?

A. $(-2, \infty)$
B. $[-2, 2) \cup [4, \infty)$
C. $(-2, 4)$
D. $(-2, 2) \cup (4, \infty)$

Correct answer: D. $(-2, 2) \cup (4, \infty)$
In the first branch, $x + 5 > 3$ requires $x > -2$ and the branch still requires $x < 2$. In the second, $2x - 5 > 3$ requires $x > 4$. Combining the two intervals gives the solution.

14. A fictional exhibit's Plan A charges $18 for up to 6 visitors plus $2 per additional visitor. Plan B charges $3 per visitor for groups of 1 to 10 and a flat $30 for 11 or more. For which positive whole-number group sizes is A cheaper?

A. 7 through 11
B. 6 through 12
C. 7 through 12
D. 7 and up

Correct answer: A. 7 through 11
A is never cheaper for 1 through 6. For 7 through 10, A costs $18 + 2(n - 6)$, or $2n + 6$, which is below $3n$. At 11 it costs $28 versus $30. At 12 the plans tie, and from 13 on A costs more.

15. A game first computes $y = f(x)$, where $f(x) = x + 4$ for $x < 3$ and $f(x) = 2x - 1$ for $x \geq 3$. The final score is $g(y) = y$ for $y < 6$ and $g(y) = 12 - y$ for $y \geq 6$. Which real inputs x earn a final score of 5?

A. 3 and 4 only
B. 1 and 4 only
C. 1, 3, and 4
D. 1 and 3 only

Correct answer: C. 1, 3, and 4
A final score of 5 requires $y = 5$ or $y = 7$. The first branch of f reaches 5 at $x = 1$. In that branch, solving for $y = 7$ gives $x = 3$, which is outside its interval. The second branch reaches 5 at $x = 3$ and 7 at $x = 4$.