CHAPTER 2.2–2.3

Graphs of Functions

Multiple-Choice Old Exam Questions

38 questions • 6 topics • options A–E • two questions per page

Topic 1 | Symmetry, Intercepts and Basic Properties

Symmetry of graphs, intercepts of piecewise functions, and function notation • Questions 1–4

Q **1**

The graph of the equation $xy = |x^3 - y|$ is

A) symmetric with respect to the x-axis only.

B) symmetric with respect to the x-axis and the y-axis.

C) symmetric with respect to the origin only.

D) symmetric with respect to the y-axis only.

E) not symmetric with respect to the x-axis, the y-axis, nor the origin.

Q **2**

If $f(x) = \frac{2}{3}x + 2$, then $f(x - 3) =$

A) $f(x) - 2$

B) $f(x) + 2$

C) $f(x) - 3$

D) $f(x) + 3$

E) $f(x) + \frac{2}{3}$

Q **3**

In the graph of $f(x) = \begin{cases} |x| - 1 & \text{if } x > -1 \\ x - 1 & \text{if } x \leq -1 \end{cases}$ we have

A) one x-intercept and one y-intercept

B) one x-intercept and two y-intercepts

C) two x-intercepts and one y-intercept

D) two x-intercepts and two y-intercepts

E) two x-intercepts only

Q **4**

If $f(x) = \begin{cases} 2x & \text{if } x \leq -2 \\ x^2 & \text{if } -2 < x < 1 \\ 4 - x & \text{if } x \geq 1 \end{cases}$, then f has

A) two x-intercepts and one y-intercept.

B) one x-intercept and one y-intercept.

C) one x-intercept and two y-intercepts.

D) two x-intercepts and two y-intercepts.

E) one x-intercept only.

Topic 2 | Is y a Function of x?

Identifying equations and sets of ordered pairs that do or do not define y as a function of x • Questions 5–14

Q **5**

Which one of the following represents y as a function of x?

A) $2|x| + y = 0$

B) $2x + |y| = 0$

C) $\sqrt{y^2} - x^4 = 0$

D) $x = 1$

E) $x^2 + (y-1)^2 = 4$

Q **6**

Identify the set of ordered pairs (x, y) or the relation that defines y as a function of x:

A) $5y + x = 2y + \sqrt{x^2 - 5}$

B) $(x-1)^2 + (y-2)^2 = 25$

C) $\{(\frac{1}{2}, 0), (2, -1), (3, 3), (\frac{1}{2}, \frac{1}{4})\}$

D) $|5y - 1| = 2x + 5$

E) $-4x^2 + y^2 = 9$

Q
7

Which one of the following relations defines y as a function of x?

A) $y = \sqrt{2x + 1}$

B) $x = y^4$

C) $\{(1, 10), (2, 15), (3, 19), (2, 19), (5, 27)\}$

D) $x^2 + y^2 = 4$

E) $x = 5$

Q
8

Which one of the following relations defines y as a function of x?

A) $y^3 + 3x = 1$

B) $x^2 + 4y^2 = 1$

C) $x = |y + 2|$

D) $y = \pm\sqrt{x - 3}$

E) $\{(x, y) \mid x = 2\}$

Q
9

Which one of the following equations or sets of ordered pairs defines y as a function of x?

A) $|5y - 1| = 3x$

B) $xy - y = 7$

C) $x + 2 = y^4$

D) $\{(x, y): x = 1\}$

E) $\{(-2, 4), (0, 6), (2, 5), (0, 8)\}$

Q
10

Which ONE of the following equations defines y as a function of x?

A) $|x| + y = 5$

B) $x^3 + y^2 = 1$

C) $\sqrt{y^2} - x = 5$

D) $y = 3 \pm \sqrt{x - 1}$

E) $x^2 + (y - 1)^2 = 4$

Q
11

Which one of the following relations does NOT represent a function?

A) $y^2 = 3x + 6$

B) $x + 5y = 7$

C) $y = x^2 - 4$

D) $y = \sqrt{2x - 1}$

E) $y = \frac{3}{x-2}$

Q
12

Which ONE of the following does NOT represent y as a function of x?

A) $y = 1$

B) $x^2 + (y - 1)^3 = 4$

C) $2y + |x| = 0$

D) $x^2 - \sqrt[3]{y} = 0$

E) $x + 2|y| = 0$

Q
13

Which one of the following equations does NOT represent y as a function of x?

A) $x^2 - |y| = 4$

B) $x^2 - 2y = 8$

C) $2x - y = -6$

D) $|x| - 3y = 4$

E) $x^4 - y^3 = 3$

Q
14

Which one of the following does NOT define y as a function of x?

A) $4x = \sqrt{y^2}$

B) $xy = 5$

C) $x^2 - 1 = \sqrt{y}$

D) $|x| - y = 3$

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

Topic 3 | Evaluating Piecewise Functions

Evaluating piecewise-defined functions, some involving the greatest integer function • Questions 15–22

Q **15**

If $f(x) = \begin{cases} [[2x+6]] & \text{if } x \le -1 \\ |3x-4| & \text{if } -1 < x \le 2 \\ 3 & \text{if } x > 2 \end{cases}$, where $[[\cdot]]$ is the greatest integer function, then $f(-\pi) + f(1) + f(4) =$

A) -3

B) $-2\pi + 9$

C) $-2\pi + 10$

D) 3

E) 4

Q **16**

If $f(x) = \begin{cases} -|-x| & \text{if } x < 0 \\ -2 & \text{if } 0 \le x < 4 \\ [[x-4]] & \text{if } x \ge 4 \end{cases}$, where $[[\cdot]]$ is the greatest integer function, then $f(-2) + f(0) + f(2\pi) =$

A) -2

B) -6

C) 2

D) -1

E) 6

Q
17

If $f(x) = \begin{cases} \sqrt{(1-5x)^2} & \text{if } x < 2 \\ [[2x+1]] & \text{if } x \geq 2 \end{cases}$, where $[[\cdot]]$ is the greatest integer function, then $f(\pi) + f(1) =$

A) 11

B) 7

C) -4

D) $5\pi + 2$

E) $2\pi + 5$

Q
18

If $f(x) = \begin{cases} -x^2 + 6 & \text{if } x < -3 \\ |2+5x| & \text{if } -3 \leq x < 1 \\ [[3x-4]] & \text{if } x \geq 1 \end{cases}$, where $[[\cdot]]$ is the greatest integer function, then $f(\pi) - f(-2) =$

A) -3

B) 13

C) 0

D) 7

E) -7

Q
19

Let $f(x) = \begin{cases} \frac{|x|}{x} & \text{if } x < 0 \\ 4 - x^2 & \text{if } x \geq 0 \end{cases}$ and let $k < 0$. Then $f(k) - \frac{1}{5}f(3) =$

A) 0

B) -2

C) -6

D) 2

E) 6

Q
20

If $f(x) = \begin{cases} [[3 - 2x]] & \text{if } 0 \leq x < 3 \\ |4x - 1| & \text{if } -3 \leq x < 0 \\ -2 & \text{if } x < -3 \end{cases}$, where $[[\cdot]]$ is the greatest integer function, then $f\left(\frac{11}{4}\right) + f(-2) + f(-5) =$

A) 4

B) -1

C) -20

D) -15

E) 5

Q
21

Given $f(x) = \begin{cases} 2x+1 & \text{if } x < 2 \\ [[2x+1]] & \text{if } x \geq 2 \end{cases}$, where $[[\cdot]]$ is the greatest integer function, then $f(-4) + f\left(\frac{7}{3}\right)$ is equal to

A) -2

B) $\frac{20}{3}$

C) -3

D) -9

E) $-\frac{4}{3}$

Q
22

For the function $f(x) = \begin{cases} [[x-1]] & \text{if } x > 0 \\ |2x-5| & \text{if } x \leq 0 \end{cases}$, where $[[\cdot]]$ is the greatest integer function, then $f(\pi) - f\left(-\frac{1}{2}\right) =$

A) -4

B) 3

C) -2

D) 4

E) -3

Topic 4 | Increasing and Decreasing Intervals

Determining where a function is increasing or decreasing, from formulas and from graphs • Questions 23–28

Q **23**

If $[a, b]$ is the largest interval on which the function $f(x) = \begin{cases} 4 & \text{if } x \leq -1 \\ x^2 & \text{if } -1 < x < 1 \\ -x + 5 & \text{if } x \geq 1 \end{cases}$ is increasing, then $a + b =$

A) 1

B) -1

C) 0

D) 2

E) 4

Q **24**

The graph of $f(x) = \begin{cases} 2 & \text{if } x < 0 \\ (x-1)^2 & \text{if } x \geq 0 \end{cases}$ is increasing on the interval

A) $(1, \infty)$

B) $(0, \infty)$

C) $(-\infty, 1)$

D) $(-\infty, 0)$

E) $(0, 1)$

Q
25

Let $f(x) = \begin{cases} -x+1 & \text{if } x \leq 0 \\ |x-1| & \text{if } 0 < x \leq 2 \\ 1 & \text{if } x > 2 \end{cases}$. Then the graph of f is increasing on the interval

A) $(2, \infty)$

B) $(1, 2)$

C) $(-\infty, 0)$

D) $(0, 1)$

E) $(0, 2)$

Q
26

The graph of the function $f(x) = \begin{cases} |x| & \text{if } x \leq 1 \\ 5 & \text{if } x > 1 \end{cases}$ is increasing on the interval

A) $(0, 1)$

B) $(1, \infty)$

C) $(-\infty, 0)$

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

E) $(0, \infty)$

Q
27

From the graph shown, the intervals over which the function is increasing are:

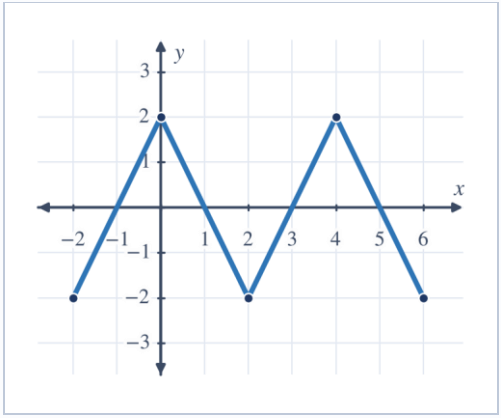
A) $[-2, 0] \cup [2, 4]$

B) $[0, 2] \cup [4, 6]$

C) $[-2, 2] \cup [4, 6]$

D) $[-2, 4]$

E) $[0, 4]$



Q
28

From the graph shown, the function is decreasing on the interval:

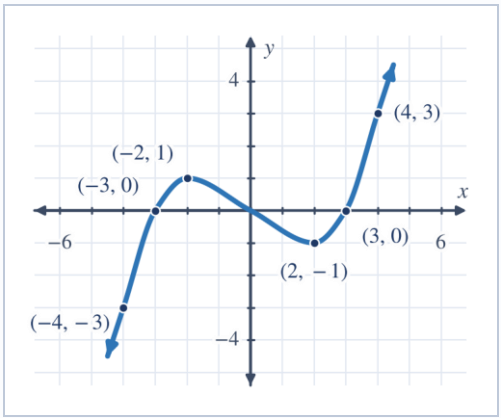
A) $[-2, 2]$

B) $[-4, -2]$

C) $[2, 4]$

D) $[-3, 3]$

E) $[-4, 4]$



Topic 5 | Range of a Function

Finding the range of piecewise, absolute value and greatest integer functions • Questions 29–34

Q **29**

The range of the function $f(x) = \begin{cases} x^2 - 1 & \text{if } x \geq 0 \\ \frac{|x|}{x} & \text{if } x < 0 \end{cases}$ is

A) $[-1, \infty)$

B) $(-\infty, 1]$

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

D) $(0, \infty)$

E) $(-1, \infty)$

Q **30**

The range of $f(x) = \begin{cases} |x| + 1 & \text{if } x < 1 \\ -x^2 - 1 & \text{if } 1 \leq x < 2 \\ 3 & \text{if } x \geq 2 \end{cases}$ is

A) $(-5, -2] \cup [1, \infty)$

B) $(-\infty, -2] \cup [1, \infty)$

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

D) $(-5, -1] \cup (3, \infty)$

E) $(-5, -2] \cup [1, 2) \cup (2, \infty)$

Q
31

If D is the domain of $f(x) = \sqrt{16 - x^2}$ and R is the range of $g(x) = [[x + 1]]$, where $[[x]]$ denotes the greatest integer function of x, then $D \cap R =$

A) $\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$

B) $(-4, 4)$

C) $[-4, 4]$

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

E) $(-\infty, -4] \cup [4, \infty)$

Q
32

The range of the function $f(x) = 3 - |x - 1|$ is given by

A) $(-\infty, 3]$

B) $[3, \infty)$

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

D) $[0, 3]$

E) $(-\infty, 1]$

Q
33

The range of the function $f(x) = \begin{cases} x^2 + 1 & \text{if } x \geq 0 \\ x - 1 & \text{if } x < 0 \end{cases}$ is

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

B) $(-\infty, 1]$

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

D) $(1, \infty)$

E) $(-1, \infty)$

Q
34

Let $f(x) = [[x]]$ be the greatest integer function. Then only one of the following statements is TRUE:

A) $y = [[x]]$ is not a function by the vertical line test

B) $[[\pi - 1]] = 3$

C) $[[x]] = -3$ if $-4 \leq x < -3$

D) the range of $y = [[x - 1]]$ is the set of all integers

E) the domain of $y = [[x - 1]]$ is the set of all integers

Topic 6 | Greatest Integer Function: Equations and Graphs

Solving equations that involve the greatest integer function • Questions 35–38

Q **35**

The graph of the function $f(x) = \left[\left[\frac{x}{2} - 3\right]\right]$ lies above the x-axis over the interval

A) $[8, \infty)$

B) $(-6, 6)$

C) $(-3, \infty)$

D) $(0, \infty)$

E) $(6, \infty)$

Q **36**

If $f(x) = \left[\left[1 - 2x\right]\right]$, where $\left[\left[\cdot\right]\right]$ is the greatest integer function, then $f(x) = 1$ when

A) $0 \leq x < \frac{1}{2}$

B) $-\frac{1}{2} < x \leq 0$

C) $-\frac{1}{2} \leq x < 0$

D) $-1 < x \leq 1$

E) $\frac{1}{2} < x \leq 1$

Q
37

If $f(x) = [[3x - 1]]$, where $[[\cdot]]$ is the greatest integer function, then $f(x) = 0$ when

A) $\frac{1}{3} \leq x < \frac{2}{3}$

B) $\frac{1}{3} < x \leq 1$

C) $-3 < x \leq \frac{1}{3}$

D) $\frac{2}{3} \leq x < 1$

E) $-3 \leq x < 1$

Q
38

The set of all values of x for which $\left[\left[\frac{1}{2}x + 1\right]\right] = -3$, where $[[\cdot]]$ denotes the greatest integer function, is in the interval

A) $[-8, -6)$

B) $[-4, -3)$

C) $[-7, -5)$

D) $[-3, 0)$

E) $[6, 8)$

Answer Key

"Original" shows the question number in the source worksheet.

Q	Original	Ans.	Value
1	1	**C**	symmetric with respect to the origin only.
2	8	**A**	$f(x) - 2$
3	9	**A**	one x-intercept and one y-intercept
4	12	**A**	two x-intercepts and one y-intercept.
5	3	**A**	$2\|x\| + y = 0$
6	22	**A**	$5y + x = 2y + \sqrt{x^2 - 5}$
7	24	**A**	$y = \sqrt{2x + 1}$
8	25	**A**	$y^3 + 3x = 1$
9	26	**B**	$xy - y = 7$
10	27	**A**	$\|x\| + y = 5$
11	23	**A**	$y^2 = 3x + 6$
12	28	**E**	$x + 2\|y\| = 0$
13	29	**A**	$x^2 - \|y\| = 4$
14	30	**A**	$4x = \sqrt{y^2}$
15	17	**D**	3
16	31	**A**	-2
17	32	**A**	11
18	33	**A**	-3
19	34	**A**	0
20	35	**A**	4
21	36	**A**	-2
22	38	**A**	-4
23	4	**A**	1
24	16	**A**	$(1, \infty)$
25	18	**B**	$(1, 2)$
26	20	**A**	$(0, 1)$
27	14	**A**	$[-2, 0] \cup [2, 4]$
28	15	**A**	$[-2, 2]$
29	2	**A**	$[-1, \infty)$
30	6	**A**	$(-5, -2] \cup [1, \infty)$
31	7	**A**	$\{-4, -3, -2, -1, 0, 1, 2, 3, 4\}$
32	19	**A**	$(-\infty, 3]$
33	21	**A**	$(-\infty, -1) \cup [1, \infty)$
34	10	**D**	the range of $y = [[x - 1]]$ is the set of all integers
35	5	**A**	$[8, \infty)$
36	11	**B**	$-\frac{1}{2} < x \leq 0$
37	13	**A**	$\frac{1}{3} \leq x < \frac{2}{3}$

Q	Original	Ans.	Value
38	39	**A**	$[-8, -6)$