

Functions

MCQ Test, Set 05

Time: 30 minutes

Maximum marks: 25

Name: _____ Class: _____ Date: _____

- There are 25 questions. Each has exactly one correct answer: choose A, B, C or D.
- Each correct answer carries 1 mark. There is no negative marking.
- The key sheet and worked solutions are at the end of this test.

- Let $A = \{-1, 0, 1, 2, 3\}$ and $f(x) = x^2 - 2x$ for $x \in A$. The pre-images of 3 under f are
A. $\{-3, 1\}$ **B.** $\{-1\}$ **C.** $\{-1, 3\}$ **D.** $\{3\}$
- If $A = \{-2, 0, 2\}$, $B = \{-1, 0, 3, 4\}$ and $f : A \rightarrow B$ is defined by $f(x) = x^2 - 1$, then the range of f is
A. $\{1, 5\}$ **B.** $\{-1, 0, 3, 4\}$ **C.** $\{-2, 0, 2\}$ **D.** $\{-1, 3\}$
- If $f(x) = x^3 - 2x^2 + 5$, then $f(-2) =$
A. -9 **B.** -11 **C.** -21 **D.** 5
- If $f(x) = x$ for all $x \in \mathbb{R}$, then $f(-6) + f(4) =$
A. -2 **B.** 2 **C.** 10 **D.** -10
- The line $y = 9x - 2$ cuts the y-axis at
A. $(-2, 0)$ **B.** $(0, -2)$ **C.** $(\frac{2}{9}, 0)$ **D.** $(0, 2)$
- The roots of $2x^2 + 3x - 9 = 0$ are
A. $\{-3, \frac{3}{2}\}$ **B.** $\{-3, -\frac{3}{2}\}$ **C.** $\{-\frac{3}{2}, 3\}$ **D.** $\{\frac{3}{2}, 3\}$
- If α, β are the roots of $6x^2 - 5x + 1 = 0$, then $\alpha\beta =$
A. $\frac{5}{6}$ **B.** 6 **C.** $\frac{1}{6}$ **D.** $-\frac{1}{6}$
- The vertex of $y = 2x^2 - 12x + 13$ is
A. $(3, 5)$ **B.** $(-3, -5)$ **C.** $(3, -5)$ **D.** $(-3, 13)$
- The graph of $y = x^2 - 2x + 5$
A. touches the x-axis at one point **B.** lies entirely below the x-axis
C. cuts the x-axis at two points **D.** lies entirely above the x-axis
- If $3x^2 - 5x - 2 \leq 0$, then $x \in$
A. $(-\infty, -\frac{1}{3}] \cup [2, \infty)$ **B.** $(-\frac{1}{3}, 2)$
C. $[-\frac{1}{3}, 2]$ **D.** $(-\infty, -\frac{1}{3}) \cup (2, \infty)$

11. If $(x + 3)(x - 6) \geq 0$, then $x \in$
- A. $(-\infty, -3] \cup [6, \infty)$ B. $(-\infty, -3) \cup (6, \infty)$
 C. $[-3, 6]$ D. $(-3, 6)$
-
12. $\log_{10} 1000 =$
- A. 30 B. 4 C. 100 D. 3
-
13. $11^{\log_{11} 5} =$
- A. 5 B. 1 C. 55 D. 11
-
14. If $\log_{0.5}(x - 2) \leq 0$, then $x \in$
- A. $(3, \infty)$ B. $[3, \infty)$ C. $(2, 3]$ D. $[2, 3]$
-
15. If $\log_5 x + \log_{25} x^2 + \log_{125} x^3 = 6$, then $x =$
- A. 5 B. 2 C. 25 D. 125
-
16. If $|x| = -x$, then $x \in$
- A. $[0, \infty)$ B. $(-\infty, 0]$ C. $\mathbb{R}$ D. $(-\infty, 0)$
-
17. If $|3x + 6| < 9$, then $x \in$
- A. $(-\infty, -5] \cup [1, \infty)$ B. $(-5, 1)$
 C. $(-\infty, -5) \cup (1, \infty)$ D. $[-5, 1]$
-
18. For $x < 5$, $|x - 5| =$
- A. $x + 5$ B. $-x - 5$ C. $5 - x$ D. $x - 5$
-
19. The critical points for solving $|3x + 2| + |x - 4| = 9$ are
- A. $\{-\frac{2}{3}, 4, 9\}$ B. $\{-4, \frac{2}{3}\}$ C. $\{-\frac{2}{3}, 4\}$ D. $\{\frac{2}{3}, 4\}$
-
20. The number of integers satisfying $\frac{|x-3|}{x+1} > 1$ is
- A. 1 B. 3 C. 2 D. 0
-
21. The domain of $f(x) = \sqrt{25 - 4x^2}$ is
- A. $[-\frac{5}{2}, \frac{5}{2}]$ B. $\mathbb{R}$
 C. $(-\infty, -\frac{5}{2}] \cup [\frac{5}{2}, \infty)$ D. $(-\frac{5}{2}, \frac{5}{2})$
-
22. $[-1] + [-1.5] =$
- A. -2.5 B. -2 C. -1 D. -3
-
23. If $x = 2.5$, then $[x] + [-x] =$
- A. 1 B. -1 C. 0 D. -5
-
24. The period of $f(x) = x - [x]$ is
- A. 0 B. $\frac{1}{2}$ C. 2 D. 1
-

25. If $x \in [-2, 4] - \{0\}$, then $\frac{1}{x} \in$

A. $(-\infty, -2] \cup [4, \infty)$

C. $(-\infty, -\frac{1}{2}) \cup (\frac{1}{4}, \infty)$

B. $[-\frac{1}{2}, \frac{1}{4}]$

D. $(-\infty, -\frac{1}{2}] \cup [\frac{1}{4}, \infty)$

Key sheet

1. C	2. D	3. B	4. A	5. B
6. A	7. C	8. C	9. D	10. C
11. A	12. D	13. A	14. B	15. C
16. B	17. B	18. C	19. C	20. A
21. A	22. D	23. B	24. D	25. D

Solutions

1. Let $A = \{-1, 0, 1, 2, 3\}$ and $f(x) = x^2 - 2x$ for $x \in A$. The pre-images of 3 under f are

Pre-images of 3 are the elements of A whose image is 3

$$f(-1) = 3, f(3) = 3$$

Ans: (C) $\{-1, 3\}$

2. If $A = \{-2, 0, 2\}$, $B = \{-1, 0, 3, 4\}$ and $f : A \rightarrow B$ is defined by $f(x) = x^2 - 1$, then the range of f is

$$f(-2) = (-2)^2 - 1 = 3, f(0) = (0)^2 - 1 = -1, f(2) = (2)^2 - 1 = 3$$

Range = $f(A) = \{-1, 3\}$ (not the codomain B)

Ans: (D) $\{-1, 3\}$

3. If $f(x) = x^3 - 2x^2 + 5$, then $f(-2) =$

$$f(-2) = (-2)^3 - 2(-2)^2 + 5 = -11$$

Ans: (B) -11

4. If $f(x) = x$ for all $x \in \mathbb{R}$, then $f(-6) + f(4) =$

f is the identity function

$$f(-6) + f(4) = -6 + 4 = -2$$

Ans: (A) -2

5. The line $y = 9x - 2$ cuts the y-axis at

put $x = 0$: $y = -2$

Ans: (B) $(0, -2)$

6. The roots of $2x^2 + 3x - 9 = 0$ are

$$\Delta = b^2 - 4ac = 3^2 - 4(2)(-9) = 81$$

$$x = \frac{-3 \pm 9}{4} = -3, \frac{3}{2}$$

Ans: (A) $\{-3, \frac{3}{2}\}$

7. If α, β are the roots of $6x^2 - 5x + 1 = 0$, then $\alpha\beta =$

$$a = 6, c = 1$$

$$\alpha\beta = \frac{c}{a} = \frac{1}{6}$$

Ans: (C) $\frac{1}{6}$

8. The vertex of $y = 2x^2 - 12x + 13$ is

$$\text{Vertex} = \left(-\frac{b}{2a}, \frac{4ac-b^2}{4a}\right) = \left(3, \frac{104-144}{8}\right) = (3, -5)$$

Ans: (C) $(3, -5)$

9. The graph of $y = x^2 - 2x + 5$

$$a = 1 > 0, \Delta = 4 - 20 = -16 < 0$$

Upward parabola that never meets the x-axis: it lies above it

Ans: (D) lies entirely above the x-axis

10. If $3x^2 - 5x - 2 \leq 0$, then $x \in$

$a = 3 > 0$ (upward parabola)

$$\Delta = b^2 - 4ac = (-5)^2 - 4(3)(-2) = 49$$

$$y = 0 \Rightarrow x = \frac{5 \pm 7}{6} = -\frac{1}{3}, 2$$

Sign: + outside $-\frac{1}{3}$ and 2, - between them

$$\therefore x \in [-\frac{1}{3}, 2]$$

Ans: (C) $[-\frac{1}{3}, 2]$

11. If $(x + 3)(x - 6) \geq 0$, then $x \in$

$$y = (x + 3)(x - 6) = x^2 - 3x - 18$$

$a = 1 > 0$ (upward parabola)

$$\Delta = b^2 - 4ac = (-3)^2 - 4(1)(-18) = 81$$

$$y = 0 \Rightarrow x = \frac{3 \pm 9}{2} = -3, 6$$

Sign: + outside -3 and 6, - between them

$$\therefore x \in (-\infty, -3] \cup [6, \infty)$$

Ans: (A) $(-\infty, -3] \cup [6, \infty)$

12. $\log_{10} 1000 =$

$$10^3 = 1000$$

$$\text{So } \log_{10} 1000 = 3$$

Ans: (D) 3

13. $11^{\log_{11} 5} =$

$$a^{\log_a N} = N, \text{ so the value is } 5$$

Ans: (A) 5

14. If $\log_{0.5}(x - 2) \leq 0$, then $x \in$

$$\text{Base } 0 < 0.5 < 1: \log_a T \leq 0 \Leftrightarrow T \geq 1$$

$$x - 2 \geq 1 \Rightarrow x \geq 3$$

Ans: (B) $[3, \infty)$

15. If $\log_5 x + \log_{25} x^2 + \log_{125} x^3 = 6$, then $x =$

$$\log_5 x + \log_5 x + \log_5 x = 6 \Rightarrow \log_5 x = 2 \Rightarrow x = 25$$

Ans: (C) 25

16. If $|x| = -x$, then $x \in$

$$|x| = -x \text{ when } x < 0, \text{ and also at } x = 0$$

$$\text{So } x \leq 0: x \in (-\infty, 0]$$

Ans: (B) $(-\infty, 0]$

17. If $|3x + 6| < 9$, then $x \in$

$$-9 < 3x + 6 < 9$$

$$\Rightarrow -9 - 6 < 3x < 9 - 6$$

$$\Rightarrow -5 < x < 1$$

$$\Rightarrow x \in (-5, 1)$$

Ans: (B) $(-5, 1)$

18. For $x < 5$, $|x - 5| =$

$$\text{For } x < 5, x - 5 < 0$$

$$|x - 5| = -(x - 5) = 5 - x$$

Ans: (C) $5 - x$

19. The critical points for solving $|3x + 2| + |x - 4| = 9$ are

Critical points: where each expression inside $| |$ is 0

$$3x + 2 = 0 \Rightarrow x = -\frac{2}{3}; x - 4 = 0 \Rightarrow x = 4$$

Ans: (C) $\{-\frac{2}{3}, 4\}$

20. The number of integers satisfying $\frac{|x-3|}{x+1} > 1$ is

$$\text{Case (i) } x < 3: |x - 3| = 3 - x, \frac{3-x}{x+1} - 1 > 0 \Rightarrow \frac{2-2x}{x+1} > 0 \Rightarrow x \in (-1, 1)$$

$$\text{Case (ii) } x \geq 3: |x - 3| = x - 3, \frac{x-3}{x+1} - 1 > 0 \Rightarrow \frac{-4}{x+1} > 0: \text{no common value}$$

So $x \in (-1, 1)$; integers: 0

Number of integers = 1

Ans: (A) 1

21. The domain of $f(x) = \sqrt{25 - 4x^2}$ is

$$\sqrt{25 - 4x^2} \text{ is defined when } 25 - 4x^2 \geq 0$$

$$\Rightarrow 4x^2 - 25 \leq 0$$

$$\Rightarrow (2x - 5)(2x + 5) \leq 0$$

$$\text{Domain} = [-\frac{5}{2}, \frac{5}{2}]$$

Ans: (A) $[-\frac{5}{2}, \frac{5}{2}]$

22. $[-1] + [-1.5] =$

$$[-1] = -1, [-1.5] = -2$$

$$-1 - 2 = -3$$

Ans: (D) -3

23. If $x = 2.5$, then $[x] + [-x] =$

$$x \notin \mathbb{Z}, \text{ so } [x] + [-x] = -1$$

$$[2.5] + [-2.5] = 2 - 3 = -1$$

Ans: (B) -1

24. The period of $f(x) = x - [x]$ is

The graph repeats after every 1 unit: $\{x + 1\} = \{x\}$

Ans: (D) 1

25. If $x \in [-2, 4] - \{0\}$, then $\frac{1}{x} \in$

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

$$0 < x \leq 4 \Rightarrow \frac{1}{x} \geq \frac{1}{4}$$

Ans: (D) $(-\infty, -\frac{1}{2}] \cup [\frac{1}{4}, \infty)$
