

Functions

MCQ Test, Set 02

Time: 30 minutes

Maximum marks: 25

Name: _____ Class: _____ Date: _____

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

1. Let $A = \{-3, -2, -1, 0, 1, 2, 3\}$ and $f(x) = x^2$ for $x \in A$. The pre-images of 9 under f are
A. $\{-3\}$ **B.** $\{3\}$ **C.** $\{81\}$ **D.** $\{-3, 3\}$
2. If $A = \{-1, 0, 2\}$, $B = \{-2, 0, 2, 4\}$ and $f : A \rightarrow B$ is defined by $f(x) = 2x$, then the range of f is
A. $\{1, 2, 4\}$ **B.** $\{-2, 0, 4\}$ **C.** $\{-1, 0, 2\}$ **D.** $\{-2, 0, 2, 4\}$
3. If $f(x) = 2x^2 - 3x + 1$, then $f(-1) =$
A. 0 **B.** 4 **C.** 6 **D.** 8
4. If $f : A \rightarrow B$ is a constant function, $A = \{1, 2, 3, 4\}$ and $f(1) = 9$, then the range of f is
A. $\{1\}$ **B.** $\{9, 18, 27, 36\}$ **C.** $\{9\}$ **D.** $\{1, 2, 3, 4\}$
5. The line $y = 9 - 7x$ cuts the y-axis at
A. $(9, 0)$ **B.** $(\frac{9}{7}, 0)$ **C.** $(0, -9)$ **D.** $(0, 9)$
6. The roots of $x^2 - 7x + 10 = 0$ are
A. $\{-5, 2\}$ **B.** $\{-2, 5\}$ **C.** $\{-5, -2\}$ **D.** $\{2, 5\}$
7. If α, β are the roots of $3x^2 - 2x - 8 = 0$, then $\alpha\beta =$
A. $\frac{2}{3}$ **B.** $-\frac{8}{3}$ **C.** $\frac{8}{3}$ **D.** $-\frac{3}{8}$
8. The minimum value of $2x^2 - 4x + 7$ is
A. 7 **B.** 9 **C.** 1 **D.** 5
9. The graph of $y = (x + 5)(x - 2)$ cuts the y-axis at
A. $(0, -10)$ **B.** $(-10, 0)$ **C.** $(0, -9)$ **D.** $(0, 10)$
10. If $(4 - x)(x + 1) > 0$, then $x \in$
A. $[-1, 4]$ **B.** $(-1, 4)$
C. $(-\infty, -1) \cup (4, \infty)$ **D.** $(-\infty, -1] \cup [4, \infty)$
11. If $(4x - 3)^2 \leq 0$, then $x \in$
A. $\{\frac{3}{4}\}$ **B.** ϕ
C. $\mathbb{R} - \{\frac{3}{4}\}$ **D.** $\mathbb{R}$

12. $\log_9 3 =$
A. 2 **B.** 3 **C.** $\frac{1}{2}$ **D.** $-\frac{1}{2}$
-
13. $\log_{25} 125 =$
A. $\frac{3}{2}$ **B.** 5 **C.** 3 **D.** $\frac{2}{3}$
-
14. If $\log_3(x - 5) < 0$, then $x \in$
A. $(-\infty, 6)$ **B.** $(5, \infty)$ **C.** $(5, 6)$ **D.** $(6, \infty)$
-
15. $2^{\log_8 27} =$
A. $\frac{1}{3}$ **B.** 27 **C.** 9 **D.** 3
-
16. The range of $f(x) = |x|$ is
A. $[0, \infty)$ **B.** $(0, \infty)$ **C.** $(-\infty, 0]$ **D.** $\mathbb{R}$
-
17. If $|x - 5| < 2$, then $x \in$
A. $(-\infty, 3] \cup [7, \infty)$ **B.** $(-\infty, 3) \cup (7, \infty)$
C. $[3, 7]$ **D.** $(3, 7)$
-
18. If $|2x + 3| = 5$, then $x \in$
A. $\{-4, -1\}$ **B.** $\{-4, 1\}$ **C.** $\{1\}$ **D.** $\{-1, 4\}$
-
19. The solution set of $|x - 1| + |x + 2| = 5$ is
A. $\{-2, 3\}$ **B.** $\{2\}$ **C.** $\{-3\}$ **D.** $\{-3, 2\}$
-
20. If $|x - 3| + |x - 5| = 0$, then $x \in$
A. $\{3\}$ **B.** ϕ **C.** $\{5\}$ **D.** $\{3, 5\}$
-
21. The domain of $f(x) = \sqrt{3x + 7}$ is
A. $[-\frac{7}{3}, \infty)$ **B.** $(-\frac{7}{3}, \infty)$ **C.** $(-\infty, -\frac{7}{3}]$ **D.** $[\frac{7}{3}, \infty)$
-
22. $[-0.7] + [0.7] =$
A. -1 **B.** 0 **C.** -2 **D.** 1
-
23. If $[x - 2] \leq -2$, then $x \in$
A. $(-\infty, 0]$ **B.** $(-\infty, 0)$ **C.** $(-\infty, 1)$ **D.** $(-\infty, -3)$
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24. The range of $f(x) = x - [x]$ is
A. $(0, 1)$ **B.** $[0, 1)$ **C.** $[0, 1]$ **D.** $(-1, 0]$
-
25. The graph of $y = (\frac{1}{3})^x$
A. rises from left to right and passes through $(0, 1)$
B. rises from left to right and passes through $(1, 0)$
C. falls from left to right and passes through $(0, 1)$
D. falls from left to right and passes through $(1, 0)$
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Key sheet

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

Solutions

1. Let $A = \{-3, -2, -1, 0, 1, 2, 3\}$ and $f(x) = x^2$ for $x \in A$. The pre-images of 9 under f are

Pre-images of 9 are the elements of A whose image is 9

$$f(-3) = 9, f(3) = 9$$

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

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

$$f(-1) = 2(-1) = -2, f(0) = 2(0) = 0, f(2) = 2(2) = 4$$

Range = $f(A) = \{-2, 0, 4\}$ (not the codomain B)

Ans: (B) $\{-2, 0, 4\}$

3. If $f(x) = 2x^2 - 3x + 1$, then $f(-1) =$

$$f(-1) = 2(-1)^2 - 3(-1) + 1 = 6$$

Ans: (C) 6

4. If $f : A \rightarrow B$ is a constant function, $A = \{1, 2, 3, 4\}$ and $f(1) = 9$, then the range of f is

Constant function: every element has the same image 9

$$\text{Range} = \{9\}$$

Ans: (C) $\{9\}$

5. The line $y = 9 - 7x$ cuts the y-axis at

$$\text{put } x = 0: y = 9$$

Ans: (D) $(0, 9)$

6. The roots of $x^2 - 7x + 10 = 0$ are

$$\Delta = b^2 - 4ac = (-7)^2 - 4(1)(10) = 9$$

$$x = \frac{7 \pm 3}{2} = 2, 5$$

Ans: (D) $\{2, 5\}$

7. If α, β are the roots of $3x^2 - 2x - 8 = 0$, then $\alpha\beta =$

$$a = 3, c = -8$$

$$\alpha\beta = \frac{c}{a} = -\frac{8}{3}$$

Ans: (B) $-\frac{8}{3}$

8. The minimum value of $2x^2 - 4x + 7$ is

$$\text{Vertex} = \left(-\frac{b}{2a}, \frac{4ac-b^2}{4a}\right) = \left(1, \frac{56-16}{8}\right) = (1, 5)$$

$a > 0$: minimum value = 5

Ans: (D) 5

9. The graph of $y = (x + 5)(x - 2)$ cuts the y-axis at

$$\text{put } x = 0: y = -10$$

Ans: (A) $(0, -10)$

10. If $(4 - x)(x + 1) > 0$, then $x \in$

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

$a = -1 < 0$ (downward parabola)

$$\Delta = b^2 - 4ac = 3^2 - 4(-1)(4) = 25$$

$$y = 0 \Rightarrow x = \frac{-3 \pm 5}{-2} = -1, 4$$

Sign: $-$ outside -1 and 4 , $+$ between them

$$\therefore x \in (-1, 4)$$

Ans: (B) $(-1, 4)$

11. If $(4x - 3)^2 \leq 0$, then $x \in$

$$y = (4x - 3)^2 = 16x^2 - 24x + 9$$

$a = 16 > 0$ (upward parabola)

$$\Delta = b^2 - 4ac = (-24)^2 - 4(16)(9) = 0$$

$$\Delta = 0 \Rightarrow y = 16\left(x - \frac{3}{4}\right)^2$$

$y > 0$ for all $x \neq \frac{3}{4}$, and $y = 0$ at $x = \frac{3}{4}$

$$\therefore x \in \left\{\frac{3}{4}\right\}$$

Ans: (A) $\left\{\frac{3}{4}\right\}$

12. $\log_9 3 =$

$$9^{1/2} = \sqrt{9} = 3$$

$$\text{So } \log_9 3 = \frac{1}{2}$$

Ans: (C) $\frac{1}{2}$

13. $\log_{25} 125 =$

$$\log_{5^2} 5^3 = \frac{3}{2} \log_5 5 = \frac{3}{2}$$

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

14. If $\log_3(x - 5) < 0$, then $x \in$

Base $3 > 1$: $0 < x - 5 < 1$

$$5 < x < 6$$

Ans: (C) $(5, 6)$

15. $2^{\log_8 27} =$

$$2^{\log_{2^3} 3^3} = 2^{\log_2 3} = 3$$

Ans: (D) 3

16. The range of $f(x) = |x|$ is

$|x| \geq 0$ for all x and every value ≥ 0 is taken

$$\text{Range} = [0, \infty)$$

Ans: (A) $[0, \infty)$

17. If $|x - 5| < 2$, then $x \in$

$$-2 < x - 5 < 2$$

$$\Rightarrow -2 + 5 < x < 2 + 5$$

$$\Rightarrow 3 < x < 7$$

$$\Rightarrow x \in (3, 7)$$

Ans: (D) $(3, 7)$

18. If $|2x + 3| = 5$, then $x \in$

$$2x + 3 = \pm 5$$

$$2x + 3 = 5 \Rightarrow 2x - 2 = 0 \Rightarrow x = 1$$

$$2x + 3 = -5 \Rightarrow 2x + 8 = 0 \Rightarrow x = -4$$

Ans: (B) $\{-4, 1\}$

19. The solution set of $|x - 1| + |x + 2| = 5$ is

Case (i) Suppose $x < -2$ ($x - 1 < 0, x + 2 < 0$): $(1 - x) + (-x - 2) = 5 \Rightarrow -2x - 1 = 5 \Rightarrow x = -3$, which is in this case

Case (ii) Suppose $-2 \leq x \leq 1$ ($x - 1 \leq 0, x + 2 \geq 0$): $(1 - x) + (x + 2) = 5 \Rightarrow 3 = 5$: not possible, no solution

Case (iii) Suppose $x > 1$ ($x - 1 > 0, x + 2 > 0$): $(x - 1) + (x + 2) = 5 \Rightarrow 2x + 1 = 5 \Rightarrow x = 2$, which is in this case

$$\text{So } x \in \{-3, 2\}$$

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

20. If $|x - 3| + |x - 5| = 0$, then $x \in$

The sum is 0 only if $|x - 3| = 0$ and $|x - 5| = 0$ together

No x makes both zero: $x \in \phi$

Ans: (B) ϕ

21. The domain of $f(x) = \sqrt{3x + 7}$ is

$\sqrt{3x + 7}$ is defined when $3x + 7 \geq 0$

$$\Rightarrow 3x \geq -7$$

$$\Rightarrow x \geq -\frac{7}{3}$$

$$\text{Domain} = \left[-\frac{7}{3}, \infty\right)$$

Ans: (A) $\left[-\frac{7}{3}, \infty\right)$

22. $[-0.7] + [0.7] =$

$$[-0.7] = -1, [0.7] = 0$$

$$-1 + 0 = -1$$

Ans: (A) -1

23. If $[x - 2] \leq -2$, then $x \in$

$$[x - 2] = [x] - 2$$

$$[x] - 2 \leq -2 \Rightarrow [x] \leq 0$$

$$[x] = 0 \text{ for } 0 \leq x < 1: x \in (-\infty, 1)$$

Ans: (C) $(-\infty, 1)$

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

$$0 \leq x - [x] < 1 \text{ for every } x \text{ (it is 0 at integers and never reaches 1)}$$

Ans: (B) $[0, 1)$

25. The graph of $y = \left(\frac{1}{3}\right)^x$

$$a = \frac{1}{3} \text{ lies between 0 and 1, so } a^x \text{ decreases}$$

$$x = 0 \Rightarrow y = 1: \text{ it passes through } (0, 1)$$

Ans: (C) falls from left to right and passes through $(0, 1)$
