

Functions

MCQ Test, Set 03

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. The pre-image of 9 under $f(x) = 2x - 5$ is
A. -7 **B.** 13 **C.** 7 **D.** 2
2. If $A = \{-1, 1, 2\}$, $B = \{1, 2, 4\}$ and $f : A \rightarrow B$ is defined by $f(x) = x^2$, then the range of f is
A. $\{-1, 1, 2\}$ **B.** $\{1, 2, 4\}$ **C.** $\{1, 4\}$ **D.** $\{-4, -1\}$
3. The domain of the polynomial function $f(x) = x^3 - 4x + 1$ is
A. $[0, \infty)$ **B.** $\mathbb{R} = (-\infty, \infty)$
C. $(0, \infty)$ **D.** $\mathbb{R} - \{0\}$
4. The graph of the identity function $y = x$ makes an angle of ____ with the x-axis.
A. 135° **B.** 0° **C.** 90° **D.** 45°
5. The inclination of the line $y = 14 - 9x$ with the x-axis is
A. greater than 90° **B.** less than 90°
C. equal to 90° **D.** equal to 0°
6. For $9x^2 - 30x + 25 = 0$:
A. $\Delta = -930$, roots are not real (imaginary)
B. $\Delta = 0$, roots are real and equal
C. $\Delta = 0$, roots are real and distinct
D. $\Delta = 1800$, roots are real and distinct
7. If α, β are the roots of $3x^2 - 4x - 7 = 0$, then $|\alpha - \beta| =$
A. $\frac{4}{3}$ **B.** 10 **C.** $\frac{10}{3}$ **D.** $\frac{2\sqrt{17}}{3}$
8. The vertex of $y = 3(x - 2)^2 - 5$ is
A. $(2, -5)$ **B.** $(-2, -5)$ **C.** $(-2, 5)$ **D.** $(2, 5)$
9. The graph of $y = 4x^2 - 12x + 9$ touches the x-axis at
A. $(3, 0)$ **B.** $(0, 9)$ **C.** $(-\frac{3}{2}, 0)$ **D.** $(\frac{3}{2}, 0)$

10.	If $x^2 + x + 3 < 0$, then $x \in$			
	A. $\mathbb{R}$	B. $\{-\frac{1}{2}\}$		
	C. $\mathbb{R} - \{-\frac{1}{2}\}$	D. ϕ		
11.	If $-x^2 + 6x - 9 < 0$, then $x \in$			
	A. $\mathbb{R}$	B. $\mathbb{R} - \{3\}$	C. ϕ	D. $\{3\}$
12.	If $\log_4 x = -2$, then $x =$			
	A. 16	B. -16	C. -8	D. $\frac{1}{16}$
13.	$\log_3 7 \cdot \log_7 9 =$			
	A. 9	B. 1	C. 2	D. $\log_{21} 63$
14.	If $\log_{1/2} x > 0$, then $x \in$			
	A. $(-\infty, 1)$	B. $(0, 1)$	C. $(1, \infty)$	D. $(0, \infty)$
15.	$(1.5)^{\log_{1.5} 4+2} =$			
	A. 6	B. 9	C. 16	D. 8
16.	If $ x > x$, then			
	A. no real x	B. $x > 0$	C. $x \geq 0$	D. $x < 0$
17.	If $ 3x - 2 > 4$, then $x \in$			
	A. $(-\infty, -\frac{2}{3}) \cup (2, \infty)$	B. $(-\frac{2}{3}, 2)$		
	C. $(-\infty, -\frac{2}{3}] \cup [2, \infty)$	D. $[-\frac{2}{3}, 2]$		
18.	$ 3x - 4 = 3x - 4$ for $x \in$			
	A. $\mathbb{R}$	B. $(\frac{4}{3}, \infty)$	C. $(-\infty, \frac{4}{3})$	D. $[\frac{4}{3}, \infty)$
19.	For $1 \leq x \leq 4$, $ x - 1 + x - 4 =$			
	A. 3	B. $2x - 5$	C. $5 - 2x$	D. -3
20.	If $x^2 - 3 x \leq 0$, then $x \in$			
	A. $[-3, 0]$	B. $[0, 3]$	C. $[-3, 3]$	D. $(-3, 3)$
21.	The domain of $f(x) = \frac{1}{\sqrt{2x+5}}$ is			
	A. $(\frac{5}{2}, \infty)$	B. $[-\frac{5}{2}, \infty)$	C. $(-\infty, -\frac{5}{2}]$	D. $(-\frac{5}{2}, \infty)$
22.	$2[3.999] - [-3.999] =$			
	A. 10	B. 2	C. 9	D. 12
23.	If $[x + 3] > 6$, then $x \in$			
	A. $[4, \infty)$	B. $(4, \infty)$	C. $(3, \infty)$	D. $[3, \infty)$
24.	$\{6.4\} - \{-6.4\} =$			
	A. 0	B. 0.2	C. -0.2	D. 1

25. The range of $f(x) = x^3$ is

A. $(0, \infty)$

B. $\mathbb{R}$

C. $\mathbb{R} - \{0\}$

D. $[0, \infty)$

Key sheet

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

Solutions

1. The pre-image of 9 under $f(x) = 2x - 5$ is

$$f(x) = 9 \Rightarrow 2x - 5 = 9 \Rightarrow x = 7$$

Ans: (C) 7

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

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

Range = $f(A) = \{1, 4\}$ (not the codomain B)

Ans: (C) $\{1, 4\}$

3. The domain of the polynomial function $f(x) = x^3 - 4x + 1$ is

$f(x)$ is defined for every real x

Domain of a polynomial function is $\mathbb{R}$

Ans: (B) $\mathbb{R} = (-\infty, \infty)$

4. The graph of the identity function $y = x$ makes an angle of ____ with the x-axis.

$y = x$ passes through $(0, 0)$, $(1, 1)$, $(2, 2)$

It rises 1 for every 1 across: angle 45°

Ans: (D) 45°

5. The inclination of the line $y = 14 - 9x$ with the x-axis is

Here $a = -9 < 0$

So the inclination is greater than 90°

Ans: (A) greater than 90°

6. For $9x^2 - 30x + 25 = 0$:

$$\Delta = b^2 - 4ac = (-30)^2 - 4(9)(25) = 0$$

So the roots are real and equal

Ans: (B) $\Delta = 0$, roots are real and equal

7. If α, β are the roots of $3x^2 - 4x - 7 = 0$, then $|\alpha - \beta| =$

$$\Delta = b^2 - 4ac = (-4)^2 - 4(3)(-7) = 100$$

$$|\alpha - \beta| = \frac{\sqrt{\Delta}}{|a|} = \frac{10}{3}$$

Ans: (C) $\frac{10}{3}$

8. The vertex of $y = 3(x - 2)^2 - 5$ is

$y = a(x - h)^2 + k$ has vertex (h, k)

Vertex = $(2, -5)$

Ans: (A) $(2, -5)$

9. The graph of $y = 4x^2 - 12x + 9$ touches the x-axis at

$$\Delta = 0, \text{ perfect square: } y = (2x - 3)^2$$

$$y = 0 \Rightarrow x = \frac{3}{2}$$

$$\text{Ans: (D) } \left(\frac{3}{2}, 0\right)$$

10. If $x^2 + x + 3 < 0$, then $x \in$

$$a = 1 > 0 \text{ (upward parabola)}$$

$$\Delta = b^2 - 4ac = 1^2 - 4(1)(3) = -11$$

$$a > 0, \Delta < 0: y > 0 \text{ for all } x \in \mathbb{R}$$

$$\therefore x \in \phi$$

$$\text{Ans: (D) } \phi$$

11. If $-x^2 + 6x - 9 < 0$, then $x \in$

$$a = -1 < 0 \text{ (downward parabola)}$$

$$\Delta = b^2 - 4ac = 6^2 - 4(-1)(-9) = 0$$

$$\Delta = 0 \Rightarrow y = -(x - 3)^2$$

$$y < 0 \text{ for all } x \neq 3, \text{ and } y = 0 \text{ at } x = 3$$

$$\therefore x \in \mathbb{R} - \{3\}$$

$$\text{Ans: (B) } \mathbb{R} - \{3\}$$

12. If $\log_4 x = -2$, then $x =$

$$x = 4^{-2} = \frac{1}{16}$$

$$\text{Ans: (D) } \frac{1}{16}$$

13. $\log_3 7 \cdot \log_7 9 =$

$$\log_7 9 \cdot \log_3 7 = \log_3 9 = 2$$

$$\text{Ans: (C) } 2$$

14. If $\log_{1/2} x > 0$, then $x \in$

$$\text{Base } 0 < \frac{1}{2} < 1: \log_a x > 0 \Leftrightarrow 0 < x < 1$$

$$\text{Ans: (B) } (0, 1)$$

15. $(1.5)^{\log_{1.5} 4 + 2} =$

$$(1.5)^{\log_{1.5} 4} \cdot (1.5)^2 = 4 \times 2.25 = 9$$

$$\text{Ans: (B) } 9$$

16. If $|x| > x$, then

$$\text{For } x \geq 0, |x| = x; \text{ for } x < 0, |x| = -x > x$$

$$\text{So } |x| > x \Rightarrow x < 0$$

$$\text{Ans: (D) } x < 0$$

17. If $|3x - 2| > 4$, then $x \in$

$$3x - 2 < -4 \text{ (or) } 3x - 2 > 4$$

$$\Rightarrow x < -\frac{2}{3} \text{ (or) } x > 2$$

$$\Rightarrow x \in (-\infty, -\frac{2}{3}) \cup (2, \infty)$$

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

18. $|3x - 4| = 3x - 4$ for $x \in$

$$|T| = T \Rightarrow T \geq 0$$

$$3x - 4 \geq 0 \Rightarrow x \geq \frac{4}{3}$$

$$\text{Ans: (D) } [\frac{4}{3}, \infty)$$

19. For $1 \leq x \leq 4$, $|x - 1| + |x - 4| =$

$$\text{Here } x - 1 \geq 0 \text{ and } x - 4 \leq 0$$

$$|x - 1| + |x - 4| = (x - 1) + (4 - x) = 3$$

$$\text{Ans: (A) } 3$$

20. If $x^2 - 3|x| \leq 0$, then $x \in$

$$x = 0 \text{ is the critical point}$$

$$\text{Case (i) Suppose } x < 0: |x| = -x, x^2 + 3x \leq 0 \Rightarrow x(x + 3) \leq 0 \Rightarrow x \in [-3, 0]; \text{ common values } [-3, 0)$$

$$\text{Case (ii) Suppose } x \geq 0: |x| = x, x^2 - 3x \leq 0 \Rightarrow x(x - 3) \leq 0 \Rightarrow x \in [0, 3]; \text{ common values } [0, 3]$$

$$\text{From (i), (ii): } x \in [-3, 3]$$

$$\text{Ans: (C) } [-3, 3]$$

21. The domain of $f(x) = \frac{1}{\sqrt{2x+5}}$ is

$$\frac{1}{\sqrt{2x+5}} \text{ is defined when } 2x + 5 > 0$$

$$\Rightarrow 2x > -5$$

$$\Rightarrow x > -\frac{5}{2}$$

$$\text{Domain} = (-\frac{5}{2}, \infty)$$

$$\text{Ans: (D) } (-\frac{5}{2}, \infty)$$

22. $2[3.999] - [-3.999] =$

$$3 \leq 3.999 < 4, \text{ so } [3.999] = 3; -4 \leq -3.999 < -3, \text{ so } [-3.999] = -4$$

$$2(3) - (-4) = 6 + 4 = 10$$

$$\text{Ans: (A) } 10$$

23. If $[x + 3] > 6$, then $x \in$

$$[x + 3] = [x] + 3$$

$$[x] + 3 > 6 \Rightarrow [x] > 3 \Rightarrow [x] \geq 4$$

$$x \in [4, \infty)$$

$$\text{Ans: (A) } [4, \infty)$$

24. $\{6.4\} - \{-6.4\} =$

$$\{6.4\} = 6.4 - 6 = 0.4, \{-6.4\} = -6.4 - (-7) = 0.6$$

$$0.4 - 0.6 = -0.2$$

Ans: (C) -0.2

25. The range of $f(x) = x^3$ is

x^3 is negative for $x < 0$ and positive for $x > 0$

Range = $\mathbb{R}$

Ans: (B) $\mathbb{R}$
