EXPRESSWALA ACADEMY

Functions

MCQ Test, Set 04

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. If $f(x) = 5 - 3x$, then the image of 2 under f is

A. 1 **B.** -1 **C.** -11 **D.** 11

2. If $A = \{1, 2, 3\}$, $B = \{1, 2, 3, 4\}$ and $f : A \to B$ is defined by $f(x) = 5 - x$, then the range of f is

A. $\{1, 2, 3, 4\}$ **B.** $\{2, 3, 4\}$ **C.** $\{1, 2, 3\}$ **D.** $\{-4, -3, -2\}$

3. The degree of the polynomial function $f(x) = 8x^2 + 5x^4 - x + 6$ is

A. 4 **B.** 2 **C.** 8 **D.** 3

4. Which point lies on the graph of the identity function?

A. $(0, 4)$ **B.** $(4, 0)$ **C.** $(-4, -4)$ **D.** $(-4, 4)$

5. The line $y = 7x - 14$ cuts the x-axis at

A. $(0, -14)$ **B.** $(-2, 0)$ **C.** $(14, 0)$ **D.** $(2, 0)$

6. The discriminant of $2x^2 + 5x - 3 = 0$ is

A. 1 **B.** 29 **C.** 49 **D.** -1

7. If α, β are the roots of $2x^2 - 9x + 5 = 0$, then $\alpha + \beta =$

A. $\frac{9}{2}$ **B.** $-\frac{5}{2}$ **C.** $\frac{5}{2}$ **D.** $-\frac{9}{2}$

8. The range of $f(x) = x^2 - 4x + 1$, $x \in \mathbb{R}$, is

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

9. The lowest point of the graph of $y = (x - 3)(x - 11)$ is

A. $(-7, -16)$ **B.** $(7, 33)$ **C.** $(7, 16)$ **D.** $(7, -16)$

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

A. $\mathbb{R} - \{\frac{3}{4}\}$ **B.** ϕ

C. $\{\frac{3}{4}\}$ **D.** $\mathbb{R}$

11. If $25x^2 - 10x + 1 > 0$, then $x \in$

A. ϕ **B.** $\mathbb{R}$

C. $\mathbb{R} - \{\frac{1}{5}\}$ **D.** $\{\frac{1}{5}\}$

12. If $\log_5(x+2) = 2$, then $x =$

A. 10 **B.** 27 **C.** 23 **D.** 8

13. $\frac{1}{\log_4 2} =$

A. $\frac{1}{2}$ **B.** 2 **C.** 4 **D.** -2

14. Which of the following is negative?

A. $\log_5 1.2$ **B.** $\log_{1/4} 9$ **C.** $\log_{0.2} 0.5$ **D.** $\log_3 7$

15. $\log_7 2 \cdot \log_{13} 7 \cdot \log_8 13 =$

A. $\frac{2}{3}$ **B.** 3 **C.** $\frac{1}{3}$ **D.** $\frac{1}{2}$

16. If $|x| < x$, then $x \in$

A. ϕ **B.** $(-\infty, 0)$ **C.** $\mathbb{R}$ **D.** $(0, \infty)$

17. If $|x| \geq 6$, then $x \in$

A. $(-6, 6)$ **B.** $(-\infty, -6) \cup (6, \infty)$

C. $(-\infty, -6] \cup [6, \infty)$ **D.** $[-6, 6]$

18. If $|x-2| = |2x+1|$, then $x \in$

A. $\{-\frac{1}{3}, 3\}$ **B.** $\{-3, \frac{1}{3}\}$ **C.** $\{\frac{1}{3}\}$ **D.** $\{-3\}$

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

A. $\{-4, 2\}$ **B.** $\{2\}$ **C.** $\{-2, 4\}$ **D.** $\{-4\}$

20. If $|x^2 + 2x| < 8$, then $x \in$

A. $(-2, 4)$ **B.** $[-4, 2]$ **C.** $\mathbb{R}$ **D.** $(-4, 2)$

21. The domain of $f(x) = \sqrt{x^2 - 1}$ is

A. $[-1, 1]$ **B.** $(-\infty, -1] \cup [1, \infty)$

C. $[1, \infty)$ **D.** $(-\infty, -1) \cup (1, \infty)$

22. The range of the step function $f(x) = [x]$ is

A. $\mathbb{N}$ **B.** $\mathbb{R}$ **C.** $[0, \infty)$ **D.** $\mathbb{Z}$

23. If $[x - 1] < -3$, then $x \in$

A. $(-\infty, -1)$ **B.** $(-\infty, -2]$ **C.** $(-\infty, -3)$ **D.** $(-\infty, -2)$

24. $[-1.2] + \{-1.2\} =$

A. -0.8 **B.** 1.2 **C.** -1.2 **D.** -2.8

25. The domain of $f(x) = \log_2 x$ is

A. $(0, \infty)$ **B.** $(1, \infty)$ **C.** $\mathbb{R}$ **D.** $[0, \infty)$

Key sheet

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

Solutions

1. If $f(x) = 5 - 3x$, then the image of 2 under f is

$f(2) = 5 - 3(2) = -1$

Ans: (B) -1

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2. If $A = \{1, 2, 3\}$, $B = \{1, 2, 3, 4\}$ and $f : A \to B$ is defined by $f(x) = 5 - x$, then the range of f is

$f(1) = 5 - (1) = 4$, $f(2) = 5 - (2) = 3$, $f(3) = 5 - (3) = 2$

Range $= f(A) = \{2, 3, 4\}$ (not the codomain B)

Ans: (B) $\{2, 3, 4\}$

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3. The degree of the polynomial function $f(x) = 8x^2 + 5x^4 - x + 6$ is

Degree = highest power of x with non-zero coefficient $= 4$

Ans: (A) 4

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4. Which point lies on the graph of the identity function?

On $y = x$ both coordinates are equal: $(-4, -4)$

Ans: (C) $(-4, -4)$

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5. The line $y = 7x - 14$ cuts the x-axis at

put $y = 0$: $7x - 14 = 0 \Rightarrow x = 2$

Ans: (D) $(2, 0)$

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6. The discriminant of $2x^2 + 5x - 3 = 0$ is

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

Ans: (C) 49

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7. If α, β are the roots of $2x^2 - 9x + 5 = 0$, then $\alpha + \beta =$

$a = 2, b = -9$

$\alpha + \beta = -\frac{b}{a} = \frac{9}{2}$

Ans: (A) $\frac{9}{2}$

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8. The range of $f(x) = x^2 - 4x + 1$, $x \in \mathbb{R}$, is

$\text{Vertex} = \left(-\frac{b}{2a}, \frac{4ac - b^2}{4a}\right) = \left(2, \frac{4 - 16}{4}\right) = (2, -3)$

Range $= [-3, \infty)$

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

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9. The lowest point of the graph of $y = (x - 3)(x - 11)$ is

It cuts the x-axis at $x = 3, 11$; lowest point at $x = \frac{\alpha + \beta}{2} = 7$

$y = (7 - 3)(7 - 11) = -16$

Ans: (D) $(7, -16)$

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

$a = -2 < 0$ (downward parabola)

$\Delta = b^2 - 4ac = 3^2 - 4(-2)(-5) = -31$

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

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

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

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11. If $25x^2 - 10x + 1 > 0$, then $x \in$

$a = 25 > 0$ (upward parabola)

$\Delta = b^2 - 4ac = (-10)^2 - 4(25)(1) = 0$

$\Delta = 0 \Rightarrow y = 25(x - \frac{1}{5})^2$

$y > 0$ for all $x \neq \frac{1}{5}$, and $y = 0$ at $x = \frac{1}{5}$

$\therefore x \in \mathbb{R} - \{\frac{1}{5}\}$

Ans: (C) $\mathbb{R} - \{\frac{1}{5}\}$

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12. If $\log_5(x + 2) = 2$, then $x =$

$x + 2 = 5^2 = 25 \Rightarrow x = 23$

Ans: (C) 23

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13. $\frac{1}{\log_4 2} =$

$\frac{1}{\log_4 2} = \log_2 4 = 2$

Ans: (B) 2

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14. Which of the following is negative?

$\log_a x < 0$ when $a > 1, 0 < x < 1$ or $0 < a < 1, x > 1$

$\log_{1/4} 9$: base < 1, $9 > 1$: negative

Ans: (B) $\log_{1/4} 9$

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15. $\log_7 2 \cdot \log_{13} 7 \cdot \log_8 13 =$

$= \log_8 2 = \log_{2^3} 2 = \frac{1}{3}$

Ans: (C) $\frac{1}{3}$

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16. If $|x| < x$, then $x \in$

$|x| \geq x$ for every real x

So $|x| < x$ has no solution: $x \in \phi$

Ans: (A) ϕ

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17. If $|x| \geq 6$, then $x \in$

$x \leq -6$ (or) $x \geq 6$

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

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

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18. If $|x-2| = |2x+1|$, then $x \in$

$x - 2 = \pm(2x+1)$

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

$x - 2 = -2x - 1 \Rightarrow 3x - 1 = 0 \Rightarrow x = \frac{1}{3}$

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

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

Case (i) Suppose $x < \frac{1}{2}$ $(2x - 1 < 0)$: $(1 - 2x) + x = 5 \Rightarrow 1 - x = 5 \Rightarrow x = -4$, which is in this case

Case (ii) Suppose $x \geq \frac{1}{2}$ $(2x - 1 \geq 0)$: $(2x - 1) + x = 5 \Rightarrow 3x - 1 = 5 \Rightarrow x = 2$, which is in this case

So $x \in \{-4, 2\}$

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

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20. If $|x^2 + 2x| < 8$, then $x \in$

$-8 < x^2 + 2x < 8$

$\Rightarrow x^2 + 2x + 8 > 0$ and $x^2 + 2x - 8 < 0$

$x^2 + 2x + 8 > 0$: $a > 0, \Delta = -28 < 0 \Rightarrow x \in \mathbb{R}$

$x^2 + 2x - 8 < 0$: $\Delta = 36,\ x = \frac{-2 \pm 6}{2} = -4, 2 \Rightarrow x \in (-4, 2)$

Common values: $x \in (-4, 2)$

Ans: (D) $(-4, 2)$

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21. The domain of $f(x) = \sqrt{x^2 - 1}$ is

$\sqrt{x^2 - 1}$ is defined when $x^2 - 1 \geq 0$

$\Rightarrow (x-1)(x+1) \geq 0$

Domain $= (-\infty, -1] \cup [1, \infty)$

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

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22. The range of the step function $f(x) = [x]$ is

$[x]$ is always an integer and every integer n is $[n]$

Range $= \mathbb{Z}$

Ans: (D) $\mathbb{Z}$

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23. If $[x-1] < -3$, then $x \in$

$[x - 1] = [x] - 1$

$[x] - 1 < -3 \Rightarrow [x] < -2 \Rightarrow [x] \leq -3$

$[x] = -3$ for $-3 \leq x < -2$: $x \in (-\infty, -2)$

Ans: (D) $(-\infty, -2)$

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24. $[-1.2] + \{-1.2\} =$

$[-1.2] = -2,\ \{-1.2\} = -1.2 - (-2) = 0.8$

$-2 + 0.8 = -1.2$

(always $[x] + \{x\} = x$)

Ans: (C) -1.2

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25. The domain of $f(x) = \log_2 x$ is

$\log_a N$ needs $N > 0$

Domain $= (0, \infty)$

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