EXPRESSWALA ACADEMY

Maths 1A: 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 $A = \{2, 3, 5\}$ and $B = \{p, t\}$, how many functions are there from B to A?

A. 8 **B.** 64 **C.** 6 **D.** 9

2. If $f : A \to \mathbb{Z}$ is defined by $f(x) = x^2 - 4$ where $A = \{-2, 0, 2, 4\}$, find the range of f.

A. $\{-2, 0, 2, 4\}$ **B.** $\{-4, 0, 12\}$ **C.** $\{4, 8, 20\}$ **D.** $\{-4, 0, 12, 13\}$

3. Find the degree of the polynomial function $f(x) = -2x^7 - 5x^4 - 4x$.

A. 8 **B.** 3 **C.** 7 **D.** 6

4. Find the maximum value of $f(x) = -3x^2 + 18x - 29$.

A. 2 **B.** -29 **C.** 3 **D.** -2

5. Find the discriminant of $x^2 - x + 6 = 0$ and state the nature of its roots.

A. -23 **B.** 23 **C.** 25 **D.** -25

6. Solve $-3x^2 - 8x - 4 < 0$.

A. $[-2, -\frac{2}{3}]$ **B.** $(-\infty, -2] \cup [-\frac{2}{3}, \infty)$
C. $(-2, -\frac{2}{3})$ **D.** $(-\infty, -2) \cup (-\frac{2}{3}, \infty)$

7. Solve $3x^2 - 6x \leq 0$.

A. $(-\infty, 0) \cup (2, \infty)$ **B.** $(0, 2)$
C. $(-\infty, 0] \cup [2, \infty)$ **D.** $[0, 2]$

8. Solve $|2x - 5| \geq 1$.

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

9. The set of all real x with $|x| > x$ is

A. $(-\infty, 0)$ **B.** $(0, \infty)$ **C.** $[0, \infty)$ **D.** $(-\infty, 0]$

10. Find the fractional part $\{-4.2\}$.

A. -0.8 **B.** 0.3 **C.** 0.2 **D.** $\frac{4}{5}$

11. The solution set of $[x] > -5$ is

A. $[-4, \infty)$ **B.** $[-5, \infty)$ **C.** $(-\infty, -4)$ **D.** $(-\infty, -5)$

12. Find $\log_{343} 2401$.

A. $\frac{3}{4}$ **B.** $\frac{4}{3}$ **C.** 1 **D.** 7

13. The domain of $f(x) = \log_{10} x$ is

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

14. If $f(x) = -2x - 3$ and $g(x) = -x^2 - 4$, find $(g \circ f)(x)$.

A. $-4x^2 - 12x - 13$ **B.** $2x^2 + 5$

C. $2x^3 + 3x^2 + 8x + 12$ **D.** $2x^2 - 7$

15. The function $f(x) = 3|x| - 2x^2$ is

A. neither even nor odd **B.** both even and odd

C. even **D.** odd

16. If $f(x) = x^2 + 7$ and $g(x) = |x| + 3$, then $f \circ g$ is

A. neither even nor odd **B.** even

C. odd **D.** a constant function

17. If $f(x) = \sqrt{x + 1}$ and $g(x) = \sqrt{1 - x}$, find the domain of $f + g$.

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

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

18. f satisfies $f(x + y) = f(x) + f(y)$ for all real x, y, and $f(4) = 24$. Find $f(7)$.

A. 279936 **B.** 42 **C.** 27 **D.** 168

19. How many onto functions are there from $A = \{5, 8, 10\}$ to $B = \{b, f\}$?

A. 9 **B.** 7 **C.** 8 **D.** 6

20. How many one-one functions are there from $A = \{7, 11\}$ to $B = \{b, d, f\}$?

A. 8 **B.** 3 **C.** 9 **D.** 6

21. If $f(x) = x - 5$ and $g(x) = 5x$ are functions from $\mathbb{R}$ to $\mathbb{R}$, find $(g \circ f)^{-1}(6)$.

A. 35 **B.** $\frac{11}{5}$ **C.** $\frac{31}{5}$ **D.** 5

22. Find the domain of $f(x) = \sin^{-1}(2x - 5)$.

A. $[2, 3]$ **B.** $(2, 3)$ **C.** $[-3, -2]$ **D.** $[4, 6]$

23. Find the range of $f(x) = 4 \sin x - 3 \cos x - 3$.

A. $[-4, -2]$ **B.** $[-8, 2]$ **C.** $[-10, 4]$ **D.** $[-5, 5]$

24. Find the range of $f(x) = |x + 2| + |x - 3|$.

A. $(5, \infty)$ **B.** $[1, \infty)$ **C.** $[0, \infty)$ **D.** $[5, \infty)$

25. The point $(7, 4)$ lies on $y = f(x)$. Which point must lie on $y = -f(-x)$?

A. $(4, 7)$ **B.** $(7, -4)$ **C.** $(-7, -4)$ **D.** $(-7, 4)$

Key sheet

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

Solutions

1. If $A = \{2, 3, 5\}$ and $B = \{p, t\}$, how many functions are there from B to A?

$n(B) = 2,\ n(A) = 3$

Number of functions from B to $A = \{n(A)\}^{n(B)} = 3^2 = 9$

Ans: (D) 9

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2. If $f : A \to \mathbb{Z}$ is defined by $f(x) = x^2 - 4$ where $A = \{-2, 0, 2, 4\}$, find the range of f.

$f(-2) = 0,\ f(0) = -4,\ f(2) = 0,\ f(4) = 12$

Range $= \{-4, 0, 12\}$

Ans: (B) $\{-4, 0, 12\}$

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3. Find the degree of the polynomial function $f(x) = -2x^7 - 5x^4 - 4x$.

The degree is the highest power of x with a non-zero coefficient.

The highest power is x^7, so the degree is 7.

Ans: (C) 7

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4. Find the maximum value of $f(x) = -3x^2 + 18x - 29$.

$\frac{4ac - b^2}{4a} = \frac{4(-3)(-29) - (18)^2}{4(-3)} = -2$

It occurs at $x = -\frac{b}{2a} = 3$.

Ans: (D) -2

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5. Find the discriminant of $x^2 - x + 6 = 0$ and state the nature of its roots.

$\Delta = b^2 - 4ac = (-1)^2 - 4(1)(6) = -23$

$\Delta < 0$, so the roots are complex (imaginary).

Ans: (A) -23

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6. Solve $-3x^2 - 8x - 4 < 0$.

$-3x^2 - 8x - 4 = -(x + 2)(3x + 2)$

The roots are -2 and $-\frac{2}{3}$, and $a = -3 < 0$.

The expression has the sign of a outside the roots.

Solution set: $(-\infty, -2) \cup (-\frac{2}{3}, \infty)$

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

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7. Solve $3x^2 - 6x \leq 0$.

$3x^2 - 6x = 3x(x - 2)$

The roots are 0 and 2, and $a = 3 > 0$.

The expression has the sign opposite to a between the roots.

Solution set: $[0, 2]$

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

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8. Solve $|2x - 5| \geq 1$.

$2x - 5 \geq 1$ or $2x - 5 \leq -1$

Solution set: $(-\infty, 2] \cup [3, \infty)$

Ans: (C) $(-\infty, 2] \cup [3, \infty)$

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9. The set of all real x with $|x| > x$ is

$|x| > x \iff x < 0$.

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

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10. Find the fractional part $\{-4.2\}$.

$-4.2 = -5 + 0.8$

$\{-4.2\} = -4.2 - (-5) = 0.8$

Ans: (D) $\frac{4}{5}$

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11. The solution set of $[x] > -5$ is

$[x] > k \Rightarrow x \in [k + 1, \infty)$ with $k = -5$.

So $x \in [-4, \infty)$.

Ans: (A) $[-4, \infty)$

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12. Find $\log_{343} 2401$.

$\log_{343} 2401 = \log_{7^3} 7^4$

$= \frac{4}{3} \log_7 7 = \frac{4}{3}$

Ans: (B) $\frac{4}{3}$

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13. The domain of $f(x) = \log_{10} x$ is

Only positive numbers have logarithms.

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

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14. If $f(x) = -2x - 3$ and $g(x) = -x^2 - 4$, find $(g \circ f)(x)$.

$(g \circ f)(x) = g(f(x)) = g(-2x - 3)$

$= -(-2x - 3)^2 - 4$

$= -4x^2 - 12x - 13$

Ans: (A) $-4x^2 - 12x - 13$

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15. The function $f(x) = 3|x| - 2x^2$ is

$f(-x) = -2x^2 + 3\,|x|$

$f(-x) = f(x)$, so f is even.

Ans: (C) even

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16. If $f(x) = x^2 + 7$ and $g(x) = |x| + 3$, then $f \circ g$ is

f is even and g is even.

From the table, $f \circ g$ is even.

Ans: (B) even

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17. If $f(x) = \sqrt{x+1}$ and $g(x) = \sqrt{1-x}$, find the domain of $f+g$.

$D_f = [-1, \infty),\ D_g = (-\infty, 1]$

$D_{f+g} = D_f \cap D_g = [-1, 1]$

Ans: (A) $[-1, 1]$

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18. f satisfies $f(x+y) = f(x) + f(y)$ for all real x, y, and $f(4) = 24$. Find $f(7)$.

$f(x+y) = f(x) + f(y) \Rightarrow f(x) = kx$.

$f(4) = 24 \Rightarrow 4k = 24 \Rightarrow k = 6$

$f(7) = 6 \times 7 = 42$

Ans: (B) 42

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19. How many onto functions are there from $A = \{5, 8, 10\}$ to $B = \{b, f\}$?

$n(A) = 3,\ n(B) = 2$

$\text{Number of onto functions} = 2^n - 2 = 2^3 - 2 = 6$

Ans: (D) 6

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20. How many one-one functions are there from $A = \{7, 11\}$ to $B = \{b, d, f\}$?

$n(A) = 2 \le n(B) = 3$

$\text{Number} = {}^3P_2 = 6$

Ans: (D) 6

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21. If $f(x) = x - 5$ and $g(x) = 5x$ are functions from $\mathbb{R}$ to $\mathbb{R}$, find $(g \circ f)^{-1}(6)$.

$(g \circ f)^{-1} = f^{-1} \circ g^{-1}$

$g^{-1}(x) = \frac{x}{5},\ f^{-1}(x) = x + 5$

$(g \circ f)^{-1}(6) = f^{-1}\left(\frac{6}{5}\right) = \frac{31}{5}$

Ans: (C) $\frac{31}{5}$

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22. Find the domain of $f(x) = \sin^{-1}(2x - 5)$.

$-1 \le 2x - 5 \le 1$

$4 \le 2x \le 6$

Domain $= [2, 3]$

Ans: (A) $[2, 3]$

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23. Find the range of $f(x) = 4\sin x - 3\cos x - 3$.

$\sqrt{a^2 + b^2} = \sqrt{9 + 16} = 5$

$\text{Range} = [c - \sqrt{a^2+b^2},\ c + \sqrt{a^2+b^2}] = [-8, 2]$

Ans: (B) $[-8, 2]$

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24. Find the range of $f(x) = |x + 2| + |x - 3|$.

For $b > a$, the range of $|x - a| + |x - b|$ is $[b - a, \infty)$.

Here $b - a = 3 - (-2) = 5$, so the range is $[5, \infty)$.

Ans: (D) $[5, \infty)$

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25. The point $(7, 4)$ lies on $y = f(x)$. Which point must lie on $y = -f(-x)$?

The graph of $y = -f(-x)$ is obtained by half turn about the origin: $(x, y) \to (-x, -y)$.

So $(7, 4) \to (-7, -4)$.

Ans: (C) $(-7, -4)$
