EXPRESSWALA ACADEMY

# Maths 1A: 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.** If $A = \{1, 2, 3, 4, 5\}$ and $B = \{r, t, u, v, w\}$, how many elements does $A \times B$ have?

**A.** $33554432$ **B.** $25$ **C.** $10$ **D.** $3125$

**2.** For $f(x) = 2x - 3$ on the domain $A = \{-1, 1, 2, 4\}$, find the pre-image of $5$.

**A.** $4$ **B.** $7$ **C.** $1$ **D.** $-4$

**3.** Find the degree of the polynomial function $f(x) = 5x^7 + 2x^6 - 2$.

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

**4.** Find the range of $f(x) = 6 - x^2$, $x \in \mathbb{R}$.

**A.** $(-\infty, -6]$ **B.** $(-\infty, 6]$ **C.** $(-\infty, 0]$ **D.** $[6, \infty)$

**5.** The roots of $-x^2 + 7x + 1 = 0$ are

**A.** real and equal **B.** complex (imaginary)

**C.** rational and equal in sign **D.** real and distinct

**6.** Solve $2x^2 - 2x - 4 \leq 0$.

**A.** $[-1, 2]$ **B.** $(-1, 2)$

**C.** $(-\infty, -1) \cup (2, \infty)$ **D.** $(-\infty, -1] \cup [2, \infty)$

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

**A.** $(-6, 0)$ **B.** $[-6, 0]$

**C.** $(-\infty, -6] \cup [0, \infty)$ **D.** $(-\infty, -6) \cup (0, \infty)$

**8.** Solve $|4x - 1| > 9$.

**A.** $[-2, \frac{5}{2}]$ **B.** $(-\infty, -2] \cup [\frac{5}{2}, \infty)$

**C.** $(-\infty, -2) \cup (\frac{5}{2}, \infty)$ **D.** $(-2, \frac{5}{2})$

**9.** Find the domain of $f(x) = \dfrac{x - 1}{x^2 - 3x - 18}$.

**A.** $\mathbb{R} - \{-3, 6\}$ **B.** $\mathbb{R} - \{-6, 3\}$ **C.** $\mathbb{R} - \{1\}$ **D.** $\mathbb{R}$

**10.** Find $[4.6] + [-4.6]$.

**A.** $1$ **B.** $-1$ **C.** $8$ **D.** $0$

**11.** The solution set of $[x] = 0$ is

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

**12.** Find $\log_9 243$.

**A.** $\frac{5}{2}$ **B.** $27$ **C.** $\frac{2}{5}$ **D.** $3$

**13.** The domain of $f(x) = \log_9 x$ is

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

**14.** If $f(x) = 6 - x$ and $g(x) = -x^2 - 2$, find $(g \circ f)(x)$.

**A.** $x^2 + 8$ **B.** $x^2 + 4$

**C.** $x^3 - 6x^2 + 2x - 12$ **D.** $-x^2 + 12x - 38$

**15.** The function $f(x) = 5\cos x + 2e^x + e^{-x}$ is

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

**C.** both even and odd **D.** odd

**16.** If $f(x) = x^4$ and $g(x) = x^5$, then $f \circ g$ is

**A.** a constant function **B.** odd

**C.** neither even nor odd **D.** even

**17.** If $f(x) = x - 1$ and $g(x) = x^2 - 1$, find $(fg)(-2)$ and $\left(\frac{f}{g}\right)(0)$.

**A.** $9,\ 1$ **B.** $0,\ 1$ **C.** $-9,\ 1$ **D.** $-8,\ -1$

**18.** $f$ satisfies $f(x + y) = f(x)\, f(y)$ for all real $x, y$, and $f(1) = \frac{2}{3}$. Find $f(3)$.

**A.** $\frac{8}{27}$ **B.** $2$ **C.** $\frac{4}{9}$ **D.** $\frac{11}{3}$

**19.** How many one-one functions are there from $A = \{1, 2, 8, 12\}$ to $B = \{a, b, d, e, f, g, h\}$?

**A.** $840$ **B.** $2401$ **C.** $35$ **D.** $16384$

**20.** How many bijections are there from $A = \{2, 3, 7, 11, 12\}$ to $B = \{b, d, e, g, h\}$?

**A.** $3125$ **B.** $32$ **C.** $120$ **D.** $25$

**21.** The function $f : \mathbb{R} \to \mathbb{R}$, $f(x) = 9^x$ is

**A.** neither one-one nor onto **B.** one-one and onto

**C.** onto but not one-one **D.** one-one but not onto

**22.** Find the domain of $f(x) = \sqrt{-x^2 + x + 20}$.

**A.** $(-\infty, -4] \cup [5, \infty)$ **B.** $(-4, 5)$

**C.** $[-5, 4]$ **D.** $[-4, 5]$

**23.** Find the range of $f(x) = -3x^2 + 12x - 17$ on $[3, 5]$.

**A.** $[3, 5]$ **B.** $[-32, -8]$ **C.** $[-33, -8]$ **D.** $(-\infty, -5]$

**24.** Find the range of $f(x) = -2x^2 + 12x - 21$ on $[0, 7]$.

**A.** $[-35, -21]$ **B.** $(-\infty, -3]$ **C.** $[-35, -3]$ **D.** $[0, 7]$

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**25.** The graph of $y = f^{-1}(x)$ is obtained by

**A.** reflecting it in the $y$-axis

**B.** a half turn about the origin

**C.** reflecting it in the $x$-axis

**D.** reflecting $y = f(x)$ in the line $y = x$

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## Key sheet

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

## Solutions

**1.** If $A = \{1, 2, 3, 4, 5\}$ and $B = \{r, t, u, v, w\}$, how many elements does $A \times B$ have?

$n(A) = 5,\ n(B) = 5$

$n(A \times B) = n(A) \cdot n(B) = 25$

**Ans: (B)** $25$

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**2.** For $f(x) = 2x - 3$ on the domain $A = \{-1, 1, 2, 4\}$, find the pre-image of $5$.

$f(x) = 5 \Rightarrow 2x - 3 = 5$

$\Rightarrow x = 4$

$4 \in A$, so the pre-image is $4$.

**Ans: (A)** $4$

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**3.** Find the degree of the polynomial function $f(x) = 5x^7 + 2x^6 - 2$.

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: (B)** $7$

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**4.** Find the range of $f(x) = 6 - x^2$, $x \in \mathbb{R}$.

$a = -1 < 0$, so the parabola opens downward.

$f(x) = -x^2 + 6$

The maximum value is $6$ at $x = 0$.

Range $= (-\infty, 6]$

**Ans: (B)** $(-\infty, 6]$

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**5.** The roots of $-x^2 + 7x + 1 = 0$ are

$\Delta = (7)^2 - 4(-1)(1) = 53$

$\Delta > 0$, so the roots are real and distinct.

**Ans: (D) real and distinct**

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**6.** Solve $2x^2 - 2x - 4 \leq 0$.

$2x^2 - 2x - 4 = 2\,(x - 2)\,(x + 1)$

The roots are $-1$ and $2$, and $a = 2 > 0$.

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

Solution set: $[-1, 2]$

**Ans: (A)** $[-1, 2]$

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

$-x^2 - 6x = -x\,(x + 6)$

The roots are $-6$ and $0$, and $a = -1 < 0$.

The expression has the sign of $a$ outside the roots.

Solution set: $(-\infty, -6] \cup [0, \infty)$

**Ans: (C)** $(-\infty, -6] \cup [0, \infty)$

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**8.** Solve $|4x - 1| > 9$.

$4x - 1 > 9$ or $4x - 1 < -9$

Solution set: $(-\infty, -2) \cup (\frac{5}{2}, \infty)$

**Ans: (C)** $(-\infty, -2) \cup (\frac{5}{2}, \infty)$

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**9.** Find the domain of $f(x) = \dfrac{x - 1}{x^2 - 3x - 18}$.

The denominator must not be zero.

$x^2 - 3x - 18 = (x - 6)(x + 3) = 0 \Rightarrow x = -3, 6$

Domain $= \mathbb{R} - \{-3, 6\}$

**Ans: (A)** $\mathbb{R} - \{-3, 6\}$

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**10.** Find $[4.6] + [-4.6]$.

$[4.6] = 4,\ [-4.6] = -5$

The sum is $-1$ (for a non-integer $x$, $[x] + [-x] = -1$).

**Ans: (B)** $-1$

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**11.** The solution set of $[x] = 0$ is

$[x] = k \iff k \le x < k + 1$ with $k = 0$.

So $x \in [0, 1)$.

**Ans: (A)** $[0, 1)$

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**12.** Find $\log_9 243$.

$\log_9 243 = \log_{3^2} 3^5$

$= \frac{5}{2} \log_3 3 = \frac{5}{2}$

**Ans: (A)** $\frac{5}{2}$

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**13.** The domain of $f(x) = \log_9 x$ is

Only positive numbers have logarithms.

**Ans: (D)** $(0, \infty)$

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**14.** If $f(x) = 6 - x$ and $g(x) = -x^2 - 2$, find $(g \circ f)(x)$.

$(g \circ f)(x) = g(f(x)) = g(6 - x)$

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

$= -x^2 + 12x - 38$

**Ans: (D)** $-x^2 + 12x - 38$

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**15.** The function $f(x) = 5 \cos x + 2e^x + e^{-x}$ is

$f(-x) = 2e^x + 5 \cos x + 2e^{-x}$

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

**Ans: (A) even**

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**16.** If $f(x) = x^4$ and $g(x) = x^5$, then $f \circ g$ is

$f$ is even and $g$ is odd.

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

**Ans: (D) even**

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**17.** If $f(x) = x - 1$ and $g(x) = x^2 - 1$, find $(fg)(-2)$ and $\left(\frac{f}{g}\right)(0)$.

$(fg)(-2) = f(-2)\, g(-2) = (-3)(3) = -9$

$\left(\frac{f}{g}\right)(0) = \frac{f(0)}{g(0)} = \frac{-1}{-1} = 1$

**Ans: (C)** $-9,\ 1$

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**18.** $f$ satisfies $f(x+y) = f(x)\, f(y)$ for all real $x, y$, and $f(1) = \frac{2}{3}$. Find $f(3)$.

$f(3) = f(1 + 1 + \cdots + 1) = f(1)^3$

$= \left(\frac{2}{3}\right)^3 = \frac{8}{27}$

**Ans: (A)** $\frac{8}{27}$

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**19.** How many one-one functions are there from $A = \{1, 2, 8, 12\}$ to $B = \{a, b, d, e, f, g, h\}$?

$n(A) = 4 \le n(B) = 7$

$\text{Number} = {}^7P_4 = 840$

**Ans: (A)** $840$

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**20.** How many bijections are there from $A = \{2, 3, 7, 11, 12\}$ to $B = \{b, d, e, g, h\}$?

$n(A) = n(B) = 5$

$\text{Number of bijections} = 5! = 120$

**Ans: (C)** $120$

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**21.** The function $f : \mathbb{R} \to \mathbb{R}$, $f(x) = 9^x$ is

One-one but not onto: it is strictly increasing, but its range is $(0, \infty)$.

**Ans: (D) one-one but not onto**

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**22.** Find the domain of $f(x) = \sqrt{-x^2 + x + 20}$.

We need $-x^2 + x + 20 \ge 0$.

$-x^2 + x + 20 = -(x - 5)(x + 4)$

Domain $= [-4, 5]$

**Ans: (D)** $[-4, 5]$

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**23.** Find the range of $f(x) = -3x^2 + 12x - 17$ on $[3, 5]$.

$f(3) = -8$, $f(5) = -32$; the vertex $x = 2$ is outside, so $f$ is monotonic here.

Least value $-32$, greatest value $-8$, so the range is $[-32, -8]$.

**Ans: (B)** $[-32, -8]$

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**24.** Find the range of $f(x) = -2x^2 + 12x - 21$ on $[0, 7]$.

$f(0) = -21$, $f(7) = -35$; the vertex $x = 3$ lies in the interval, $f(3) = -3$.

Least value $-35$, greatest value $-3$, so the range is $[-35, -3]$.

**Ans: (C)** $[-35, -3]$

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**25.** The graph of $y = f^{-1}(x)$ is obtained by

This is the standard rule for $y = f^{-1}(x)$.

**Ans: (D) reflecting $y = f(x)$ in the line $y = x$**

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