EXPRESSWALA ACADEMY

# Maths 1A: Functions

## MCQ Test, Set 06

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 $A = \{1, 3, 4, 5, 6\}$ and $B = \{p, s, t\}$, find the number of relations from $A$ to $B$.

**A.** $32768$ **B.** $15$ **C.** $243$ **D.** $256$

**2.** If $f : A \to \mathbb{Z}$ is defined by $f(x) = x^2 - 4$ where $A = \{0, 1, 2, 4\}$, find the range of $f$.

**A.** $\{-4, -3, 0, 12\}$ **B.** $\{-4, -3, 0, 12, 13\}$ **C.** $\{4, 5, 8, 20\}$ **D.** $\{0, 1, 2, 4\}$

**3.** Find the point where the line $y = 3 - 5x$ meets the $x$-axis.

**A.** $(0, \frac{3}{5})$ **B.** $(\frac{3}{5}, 0)$ **C.** $(-\frac{3}{5}, 0)$ **D.** $(0, 3)$

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

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

**5.** The roots of $2x^2 - 3x + 2 = 0$ are

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

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

**6.** Solve $x^2 - 2x - 24 \leq 0$.

**A.** $[-4, 6]$ **B.** $(-\infty, -4] \cup [6, \infty)$

**C.** $(-\infty, -4) \cup (6, \infty)$ **D.** $(-4, 6)$

**7.** Solve $3x^2 - 4x - 15 \leq 0$.

**A.** $(-\frac{5}{3}, 3)$ **B.** $(-\infty, -\frac{5}{3}] \cup [3, \infty)$

**C.** $(-\infty, -\frac{5}{3}) \cup (3, \infty)$ **D.** $[-\frac{5}{3}, 3]$

**8.** Solve $|2x + 3| \geq 6$.

**A.** $[-\frac{9}{2}, \frac{3}{2}]$ **B.** $(-\frac{9}{2}, \frac{3}{2})$

**C.** $(-\infty, -\frac{9}{2}) \cup (\frac{3}{2}, \infty)$ **D.** $(-\infty, -\frac{9}{2}] \cup [\frac{3}{2}, \infty)$

**9.** Find the domain of $f(x) = \dfrac{x + 2}{x^2 - 4x}$.

**A.** $\mathbb{R} - \{0, 4\}$ **B.** $\mathbb{R}$ **C.** $\mathbb{R} - \{-2\}$ **D.** $\mathbb{R} - \{-4, 0\}$

**10.** Find $\lceil -5.2 \rceil - [8.4]$.

**A.** $-14$ **B.** $-13$ **C.** $-12$ **D.** $-15$

**11.** The solution set of $[x] > 4$ is

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

**12.** Find $\log_{27} 81$.

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

**13.** The range of $f(x) = \left(\frac{1}{2}\right)^x$ is

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

**14.** Are $f(x) = \dfrac{3x}{x}$ and $g(x) = 3$ equal functions?

**A.** equal: both are constant **B.** not equal: $R_f \neq R_g$

**C.** equal: $\frac{3x}{x} = 3$ **D.** not equal: $D_f = \mathbb{R} - \{0\}$, $D_g = \mathbb{R}$

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

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

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

**16.** The fundamental period of $\tan\left(\frac{5x}{2}\right)$ is

**A.** $\frac{\pi}{5}$ **B.** $\frac{5\pi}{2}$ **C.** $\frac{4\pi}{5}$ **D.** $\frac{2\pi}{5}$

**17.** If $f(x) = x + 3$ and $g(x) = x^2 - 9$, find $(fg)(-4)$ and $\left(\dfrac{f}{g}\right)(-4)$.

**A.** $-7,\ -7$ **B.** $6,\ -\frac{1}{7}$ **C.** $7,\ -\frac{1}{7}$ **D.** $-7,\ -\frac{1}{7}$

**18.** A polynomial $f$ satisfies $f(x)f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$ and $f(4) = 257$. Find $f(-2)$.

**A.** $16$ **B.** $-31$ **C.** $17$ **D.** $-15$

**19.** How many one-one functions are there from $A = \{3, 8, 10\}$ to $B = \{a, c, d, e, f, g\}$?

**A.** $20$ **B.** $216$ **C.** $120$ **D.** $729$

**20.** How many one-one functions are there from $A = \{1, 8\}$ to $B = \{c, d, e, f\}$?

**A.** $6$ **B.** $12$ **C.** $16$ **D.** $4$

**21.** The function $f : \mathbb{R} \to \mathbb{R}$, $f(x) = x^2 + 2$ is

**A.** one-one and onto **B.** one-one but not onto

**C.** onto but not one-one **D.** neither one-one nor onto

**22.** Find the domain of $f(x) = \sin^{-1}(4x - 7)$.

**A.** $(\frac{3}{2}, 2)$ **B.** $[\frac{3}{2}, 2]$ **C.** $[-2, -\frac{3}{2}]$ **D.** $[6, 8]$

**23.** Find the range of $f(x) = \sin x + \cos x + 2$.

**A.** $[0, 4]$ **B.** $[-\sqrt{2}, \sqrt{2}]$

**C.** $[2 - \sqrt{2}, \sqrt{2} + 2]$ **D.** $[1, 3]$

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

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

**25.** The point $(3, 5)$ lies on $y = f(x)$. Which point must lie on $y = f(x - 4)$?

**A.** $(5, 3)$ **B.** $(3, -5)$ **C.** $(7, 5)$ **D.** $(-3, 5)$

## Key sheet

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

## Solutions

**1.** If $A = \{1, 3, 4, 5, 6\}$ and $B = \{p, s, t\}$, find the number of relations from $A$ to $B$.

$n(A \times B) = 5 \times 3 = 15$

Every subset of $A \times B$ is a relation.

$\text{Number of relations} = 2^{15} = 32768$

**Ans: (A)** $32768$

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**2.** If $f : A \to \mathbb{Z}$ is defined by $f(x) = x^2 - 4$ where $A = \{0, 1, 2, 4\}$, find the range of $f$.

$f(0) = -4$, $f(1) = -3$, $f(2) = 0$, $f(4) = 12$

Range $= \{-4, -3, 0, 12\}$

**Ans: (A)** $\{-4, -3, 0, 12\}$

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**3.** Find the point where the line $y = 3 - 5x$ meets the $x$-axis.

$y = 0 \Rightarrow 3 - 5x = 0$

$\Rightarrow x = \frac{3}{5}$

The point is $(\frac{3}{5}, 0)$.

**Ans: (B)** $(\frac{3}{5}, 0)$

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

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

$f(x) = -(x + 1)^2 + 1$

The maximum value is $1$ at $x = -1$.

Range $= (-\infty, 1]$

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

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**5.** The roots of $2x^2 - 3x + 2 = 0$ are

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

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

**Ans: (A) complex (imaginary)**

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**6.** Solve $x^2 - 2x - 24 \leq 0$.

$x^2 - 2x - 24 = (x - 6)(x + 4)$

The roots are $-4$ and $6$, and $a = 1 > 0$.

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

Solution set: $[-4, 6]$

**Ans: (A)** $[-4, 6]$

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**7.** Solve $3x^2 - 4x - 15 \leq 0$.

$3x^2 - 4x - 15 = (x - 3)(3x + 5)$

The roots are $-\frac{5}{3}$ and $3$, and $a = 3 > 0$.

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

Solution set: $[-\frac{5}{3}, 3]$

**Ans: (D)** $[-\frac{5}{3}, 3]$

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**8.** Solve $|2x + 3| \geq 6$.

$2x + 3 \geq 6$ or $2x + 3 \leq -6$

Solution set: $(-\infty, -\frac{9}{2}] \cup [\frac{3}{2}, \infty)$

**Ans: (D)** $(-\infty, -\frac{9}{2}] \cup [\frac{3}{2}, \infty)$

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**9.** Find the domain of $f(x) = \dfrac{x + 2}{x^2 - 4x}$.

The denominator must not be zero.

$x^2 - 4x = x(x - 4) = 0 \Rightarrow x = 0, 4$

Domain $= \mathbb{R} - \{0, 4\}$

**Ans: (A)** $\mathbb{R} - \{0, 4\}$

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**10.** Find $\lceil -5.2 \rceil - [8.4]$.

$\lceil -5.2 \rceil = -5,\ [8.4] = 8$

$\lceil -5.2 \rceil - [8.4] = -13$

**Ans: (B)** $-13$

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**11.** The solution set of $[x] > 4$ is

$[x] > k \Rightarrow x \in [k + 1, \infty)$ with $k = 4$.

So $x \in [5, \infty)$.

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

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**12.** Find $\log_{27} 81$.

$\log_{27} 81 = \log_{3^3} 3^4$

$= \frac{4}{3} \log_3 3 = \frac{4}{3}$

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

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**13.** The range of $f(x) = \left(\frac{1}{2}\right)^x$ is

$a^x > 0$ for all $x$ and takes every positive value.

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

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**14.** Are $f(x) = \dfrac{3x}{x}$ and $g(x) = 3$ equal functions?

Equal functions need the same domain and the same value at every point of it.

So they are not equal: $D_f = \mathbb{R} - \{0\}$, $D_g = \mathbb{R}$.

**Ans: (D) not equal:** $D_f = \mathbb{R} - \{0\}$, $D_g = \mathbb{R}$

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

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

$f(-x)$ is neither $f(x)$ nor $-f(x)$, so $f$ is neither even nor odd.

**Ans: (A) neither even nor odd**

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**16.** The fundamental period of $\tan\left(\frac{5x}{2}\right)$ is

$\tan x$ has period $\pi$.

$\tan(kx)$ has period $\frac{\pi}{k} = \frac{2\pi}{5}$

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

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**17.** If $f(x) = x + 3$ and $g(x) = x^2 - 9$, find $(fg)(-4)$ and $\left(\frac{f}{g}\right)(-4)$.

$(fg)(-4) = f(-4)\, g(-4) = (-1)(7) = -7$

$\left(\frac{f}{g}\right)(-4) = \frac{f(-4)}{g(-4)} = \frac{-1}{7} = -\frac{1}{7}$

**Ans: (D)** $-7,\ -\frac{1}{7}$

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**18.** A polynomial $f$ satisfies $f(x)f\left(\frac{1}{x}\right) = f(x) + f\left(\frac{1}{x}\right)$ and $f(4) = 257$. Find $f(-2)$.

So $f(x) = 1 \pm x^n$.

$1 + 4^n = 257 \Rightarrow 4^n = 256 \Rightarrow n = 4$

$f(x) = 1 + x^4$

$f(-2) = 1 + (-2)^4 = 17$

**Ans: (C)** $17$

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**19.** How many one-one functions are there from $A = \{3, 8, 10\}$ to $B = \{a, c, d, e, f, g\}$?

$n(A) = 3 \le n(B) = 6$

$\text{Number} = {}^6P_3 = 120$

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

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**20.** How many one-one functions are there from $A = \{1, 8\}$ to $B = \{c, d, e, f\}$?

$n(A) = 2 \le n(B) = 4$

$\text{Number} = {}^4P_2 = 12$

**Ans: (B)** $12$

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**21.** The function $f : \mathbb{R} \to \mathbb{R}$, $f(x) = x^2 + 2$ is

Neither one-one nor onto: $f(1) = f(-1)$, and the range $[2, \infty)$ is not $\mathbb{R}$.

**Ans: (D) neither one-one nor onto**

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**22.** Find the domain of $f(x) = \sin^{-1}(4x - 7)$.

$-1 \le 4x - 7 \le 1$

$6 \le 4x \le 8$

Domain $= [\frac{3}{2}, 2]$

**Ans: (B)** $[\frac{3}{2}, 2]$

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**23.** Find the range of $f(x) = \sin x + \cos x + 2$.

$\sqrt{a^2+b^2} = \sqrt{1+1} = \sqrt{2}$

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

**Ans: (C)** $[2-\sqrt{2}, \sqrt{2}+2]$

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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 $b - a = 3 - (2) = 1$, so the range is $[1, \infty)$.

**Ans: (A)** $[1, \infty)$

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**25.** The point $(3, 5)$ lies on $y = f(x)$. Which point must lie on $y = f(x-4)$?

The graph of $y = f(x-4)$ is obtained by shift right by $4$: $(x, y) \to (x+4, y)$.

So $(3, 5) \to (7, 5)$.

**Ans: (C)** $(7, 5)$

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