EXPRESSWALA ACADEMY

Maths 1A: 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. If $A = \{1, 3, 4, 8\}$ and $B = \{q, r, s, u, w\}$, how many elements does $A \times B$ have?

A. 9 **B.** 20 **C.** 1048576 **D.** 625

2. If $f : A \to \mathbb{Z}$ is defined by $f(x) = x^2 + 1$ where $A = \{-2, 0, 2, 3, 4\}$, find the range of f.

A. $\{-1, 3, 8, 15\}$ **B.** $\{1, 5, 10, 17, 18\}$ **C.** $\{-2, 0, 2, 3, 4\}$ **D.** $\{1, 5, 10, 17\}$

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

A. 4 **B.** 5 **C.** 3 **D.** 0

4. Find the vertex of the parabola $y = -2x^2 - 8x - 2$.

A. $(2, 6)$ **B.** $(6, -2)$ **C.** $(-2, 6)$ **D.** $(-2, -6)$

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

A. real and equal **B.** complex (imaginary)
C. real and distinct **D.** rational and equal in sign

6. Solve $x^2 - 36 < 0$.

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

7. Solve $2x^2 - 6x - 36 \leq 0$.

A. $(-\infty, -3) \cup (6, \infty)$ **B.** $(-\infty, -3] \cup [6, \infty)$
C. $(-3, 6)$ **D.** $[-3, 6]$

8. Solve $|x + 2| \leq 2$.

A. $(-\infty, -4) \cup (0, \infty)$ **B.** $(-4, 0)$
C. $[-4, 0]$ **D.** $(-\infty, -4] \cup [0, \infty)$

9. Find all real x with $|x - 6| = x - 6$.

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

10. Find $\lceil -3.5 \rceil - \lfloor 5.6 \rfloor$.

A. -8 **B.** -7 **C.** -9 **D.** -10

11. The solution set of $[x] \leq 3$ is

A. $[3, \infty)$ **B.** $[4, \infty)$ **C.** $(-\infty, 3)$ **D.** $(-\infty, 4)$

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12. Find the value of $2^{2\log_2 38}$.

A. 76 **B.** 4 **C.** 1444 **D.** 38

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13. The graph of $y = \log_7 x$ passes through

A. $(0, 0)$ **B.** $(1, 1)$ **C.** $(0, 1)$ **D.** $(1, 0)$

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14. If $f(x) = -x - 3$, find $(f \circ f)(x)$.

A. $x - 3$ **B.** x **C.** $x^2 + 6x + 9$ **D.** $-2x - 6$

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15. The function $f(x) = 4x^2 + x \sin x$ is

A. even **B.** both even and odd

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

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16. If $f(x) = \cos x$ and $g(x) = x^3$, then $f \circ g$ is

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

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

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17. If $f(x) = x + 4$ and $g(x) = x^2 + 3x + 2$, find the domain of $\dfrac{f}{g}$.

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

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18. f satisfies $f(xy) = f(x) + f(y)$ for all positive x, y, and $f(5) = a$. Find $f(625)$.

A. $a + 4$ **B.** $625a$ **C.** a^4 **D.** $4a$

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19. How many bijections are there from $A = \{1, 3, 4, 9, 10, 11\}$ to $B = \{a, b, c, d, e, h\}$?

A. 46656 **B.** 36 **C.** 64 **D.** 720

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20. How many onto functions are there from $A = \{6, 9, 12\}$ to $B = \{c, d\}$?

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

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21. If $f : \mathbb{R} \to \mathbb{R}$ is $f(x) = \frac{2x-2}{2}$, find $f^{-1}(-1)$.

A. $-\frac{1}{2}$ **B.** 0 **C.** -2 **D.** 1

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22. Find the domain of $f(x) = \dfrac{1}{\sqrt{4 - x^2}}$.

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

C. $(-4, 4)$ **D.** $(-\infty, -2) \cup (2, \infty)$

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23. The range of $f(x) = \sin^3 x + \cos^3 x$ is

A. $[-2, 2]$ **B.** $[-1, 1]$ **C.** $[0, 1]$ **D.** $[-\sqrt{2}, \sqrt{2}]$

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24. Find the range of $f(x) = |x + 6| + |x|$.

A. $[7, \infty)$ **B.** $[0, \infty)$ **C.** $[6, \infty)$ **D.** $(6, \infty)$

25. The graph of $y = -f(x)$ is obtained by

A. reflecting it in $y = x$

B. reflecting $y = f(x)$ in the x-axis

C. a half turn about the origin

D. reflecting it in the y-axis

Key sheet

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

Solutions

1. If $A = \{1, 3, 4, 8\}$ and $B = \{q, r, s, u, w\}$, how many elements does $A \times B$ have?

$n(A) = 4,\ n(B) = 5$

$n(A \times B) = n(A) \cdot n(B) = 20$

Ans: (B) 20

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2. If $f : A \to \mathbb{Z}$ is defined by $f(x) = x^2 + 1$ where $A = \{-2, 0, 2, 3, 4\}$, find the range of f.

$f(-2) = 5,\ f(0) = 1,\ f(2) = 5,\ f(3) = 10,\ f(4) = 17$

Range $= \{1, 5, 10, 17\}$

Ans: (D) $\{1, 5, 10, 17\}$

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

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

The highest power is x^4, so the degree is 4.

Ans: (A) 4

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4. Find the vertex of the parabola $y = -2x^2 - 8x - 2$.

$x = -\frac{b}{2a} = -\frac{-8}{2(-2)} = -2$

$y = \frac{4ac - b^2}{4a} = 6$

Vertex $= (-2, 6)$

Ans: (C) $(-2, 6)$

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

$\Delta = (-3)^2 - 4(3)(-3) = 45$

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

Ans: (C) real and distinct

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6. Solve $x^2 - 36 < 0$.

$x^2 - 36 = (x - 6)(x + 6)$

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

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

Solution set: $(-6, 6)$

Ans: (A) $(-6, 6)$

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7. Solve $2x^2 - 6x - 36 \leq 0$.

$2x^2 - 6x - 36 = 2(x - 6)(x + 3)$

The roots are -3 and 6, and $a = 2 > 0$.

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

Solution set: $[-3, 6]$

Ans: (D) $[-3, 6]$

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8. Solve $|x+2| \leq 2$.

$-2 \leq x+2 \leq 2$

Solution set: $[-4, 0]$

Ans: (C) $[-4, 0]$

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9. Find all real x with $|x-6| = x-6$.

$|u| = u \iff u \geq 0$.

$x - 6 \geq 0 \Rightarrow x \geq 6$

So $x \in [6, \infty)$.

Ans: (A) $[6, \infty)$

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10. Find $\lceil -3.5 \rceil - [5.6]$.

$\lceil -3.5 \rceil = -3,\ [5.6] = 5$

$\lceil -3.5 \rceil - [5.6] = -8$

Ans: (A) -8

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11. The solution set of $[x] \leq 3$ is

$[x] \leq k \Rightarrow x \in (-\infty, k+1)$ with $k = 3$.

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

Ans: (D) $(-\infty, 4)$

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12. Find the value of $2^{2\log_2 38}$.

$2^{2\log_2 38} = 2^{\log_2 38^2}$

$= 38^2 = 1444$ (using $a^{\log_a N} = N$)

Ans: (C) 1444

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13. The graph of $y = \log_7 x$ passes through

$\log_a 1 = 0$, so $(1, 0)$ lies on every log graph.

Ans: (D) $(1, 0)$

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14. If $f(x) = -x - 3$, find $(f \circ f)(x)$.

$(f \circ f)(x) = f(-x-3) = -1(-x-3) - 3$

$= x$

Ans: (B) x

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15. The function $f(x) = 4x^2 + x \sin x$ is

$f(-x) = 4x^2 + x \sin x$

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

Ans: (A) even

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16. If $f(x) = \cos x$ and $g(x) = x^3$, then $f \circ g$ is

f is even and g is odd.

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

Ans: (C) even

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17. If $f(x) = x + 4$ and $g(x) = x^2 + 3x + 2$, find the domain of $\frac{f}{g}$.

$D_f = D_g = \mathbb{R}$, and $\frac{f}{g}$ needs $g(x) \neq 0$.

$(x + 1)(x + 2) = 0 \Rightarrow x = -2, -1$

Domain $= \mathbb{R} - \{-2, -1\}$

Ans: (A) $\mathbb{R} - \{-2, -1\}$

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18. f satisfies $f(xy) = f(x) + f(y)$ for all positive x, y, and $f(5) = a$. Find $f(625)$.

$f(xy) = f(x) + f(y) \Rightarrow f(x) = k \log_e x$.

$f(625) = f(5^4) = 4\,f(5) = 4a$

Ans: (D) $4a$

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19. How many bijections are there from $A = \{1, 3, 4, 9, 10, 11\}$ to $B = \{a, b, c, d, e, h\}$?

$n(A) = n(B) = 6$

$\text{Number of bijections} = 6! = 720$

Ans: (D) 720

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20. How many onto functions are there from $A = \{6, 9, 12\}$ to $B = \{c, d\}$?

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

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

Ans: (B) 6

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21. If $f : \mathbb{R} \to \mathbb{R}$ is $f(x) = \frac{2x-2}{2}$, find $f^{-1}(-1)$.

$f^{-1}(-1) = x \iff f(x) = -1$

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

Ans: (B) 0

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22. Find the domain of $f(x) = \dfrac{1}{\sqrt{4 - x^2}}$.

$4 - x^2 > 0$ (under the root and in the denominator)

$x^2 < 4 \Rightarrow -2 < x < 2$

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

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23. The range of $f(x) = \sin^3 x + \cos^3 x$ is

From the standard results: $[-1, 1]$.

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

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24. Find the range of $f(x) = |x + 6| + |x|$.

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

Here $b - a = 0 - (-6) = 6$, so the range is $[6, \infty)$.

Ans: (C) $[6, \infty)$

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25. The graph of $y = -f(x)$ is obtained by

This is the standard rule for $y = -f(x)$.

Ans: (B) reflecting $y = f(x)$ in the x-axis
