EXPRESSWALA ACADEMY

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. The pre-image of -8 under $f(x) = 3x + 4$ is

A. -4 **B.** -20 **C.** $-\frac{4}{3}$ **D.** 4

2. If $A = \{0, 1, 2\}$, $B = \{2, 5, 8, 11\}$ and $f : A \to B$ is defined by $f(x) = 3x + 2$, then the range of f is

A. $\{2, 5, 8\}$ **B.** $\{2, 5, 8, 11\}$ **C.** $\{0, 1, 2\}$ **D.** $\{-2, 1, 4\}$

3. The degree of the polynomial function $f(x) = x - 4x^3 + 9$ is

A. 1 **B.** 2 **C.** 3 **D.** 9

4. The identity function on $A = \{a, b, c\}$ is

A. $\{(a, a), (b, b), (c, c)\}$ **B.** $\{(a, b), (b, c), (c, a)\}$

C. $\{(a, c), (b, b), (c, a)\}$ **D.** $\{(a, a)\}$

5. The inclination of the line $y = 11x - 3$ with the x-axis is

A. greater than 90° **B.** less than 90°

C. equal to 90° **D.** equal to 0°

6. For $x^2 + 5x + 7 = 0$:

A. $\Delta = -23$, roots are not real (imaginary)

B. $\Delta = -3$, roots are real and distinct

C. $\Delta = -3$, roots are not real (imaginary)

D. $\Delta = 53$, roots are real and distinct

7. $x^2 - x - 12 =$

A. $(x - 3)(x - 4)$ **B.** $(x + 3)(x + 4)$ **C.** $(x - 3)(x + 4)$ **D.** $(x + 3)(x - 4)$

8. The maximum value of $-x^2 + 2x + 4$ is

A. 3 **B.** 4 **C.** 1 **D.** 5

9. The graph of $y = (x + 4)(x - 3)$ cuts the x-axis at

A. $(-4, 0)$ and $(-3, 0)$ **B.** $(-4, 0)$ and $(3, 0)$

C. $(4, 0)$ and $(-3, 0)$ **D.** $(4, 0)$ and $(3, 0)$

10. If $(5-x)(x-1) \leq 0$, then $x \in$

A. $(-\infty, 1] \cup [5, \infty)$ **B.** $(1, 5)$

C. $(-\infty, 1) \cup (5, \infty)$ **D.** $[1, 5]$

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11. If $x^2 - 9 < 0$, then $x \in$

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

C. $(-3, 3)$ **D.** $(-\infty, -3) \cup (3, \infty)$

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12. $2^7 = 128$ in logarithmic form is

A. $\log_7 128 = 2$ **B.** $\log_2 7 = 128$ **C.** $\log_2 128 = 7$ **D.** $\log_{128} 2 = 7$

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13. $\log_3 54 - \log_3 2 =$

A. 3 **B.** 1 **C.** 27 **D.** $\log_3 52$

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14. If $\log_3(x+1) \geq 0$, then $x \in$

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

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15. If $\log_2(x^2 + 3x) - \log_2(x+3) = 4$, then $x =$

A. 13 **B.** 4 **C.** 8 **D.** 16

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16. If $x = 5$ and $y = -8$, then $|x + y| =$

A. 13 **B.** -3 **C.** 40 **D.** 3

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17. If $|1 - x| > 4$, then $x \in$

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

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

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18. If $|x^2 - 1| = 3$, then $x \in$

A. $\{-2, -\sqrt{2}, \sqrt{2}, 2\}$ **B.** $\{-2, 2\}$

C. $\{4\}$ **D.** $\{2\}$

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19. The solution set of $|x+1| + |x-3| = 4$ is

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

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20. If $x^2 - 4|x| + 3 > 0$, then $x \in$

A. $(-1, 1)$ **B.** $(-\infty, -3) \cup (-1, 1) \cup (3, \infty)$

C. $(-\infty, 1) \cup (3, \infty)$ **D.** $(-\infty, -3) \cup (3, \infty)$

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21. The domain of $f(x) = \frac{1}{\sqrt{x^2 - 5x + 4}}$ is

A. $(-\infty, 1] \cup [4, \infty)$ **B.** $(-\infty, 1) \cup (4, \infty)$

C. $(-\infty, -4) \cup (-1, \infty)$ **D.** $(1, 4)$

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22. $[7.1] - [-7.1] =$

A. 0 **B.** -1 **C.** 14 **D.** 15

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23. The domain of $f(x) = \sqrt{x - [x]}$ is

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

24. $\{3\} + \{-3\} =$

A. -6 **B.** 1 **C.** 0 **D.** 6

25. The range of $f(x) = x + \frac{1}{x}$ is

A. $\mathbb{R} - \{0\}$ **B.** $(-2, 2)$

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

Key sheet

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

Solutions

1. The pre-image of -8 under $f(x) = 3x + 4$ is

$f(x) = -8 \Rightarrow 3x + 4 = -8 \Rightarrow x = -4$

Ans: (A) -4

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2. If $A = \{0, 1, 2\}$, $B = \{2, 5, 8, 11\}$ and $f : A \to B$ is defined by $f(x) = 3x + 2$, then the range of f is

$f(0) = 3(0) + 2 = 2$, $f(1) = 3(1) + 2 = 5$, $f(2) = 3(2) + 2 = 8$

Range $= f(A) = \{2, 5, 8\}$ (not the codomain B)

Ans: (A) $\{2, 5, 8\}$

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3. The degree of the polynomial function $f(x) = x - 4x^3 + 9$ is

Degree = highest power of x with non-zero coefficient $= 3$

Ans: (C) 3

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4. The identity function on $A = \{a, b, c\}$ is

$I_A(x) = x$ for every $x \in A$

So $I_A = \{(a, a), (b, b), (c, c)\}$

Ans: (A) $\{(a, a), (b, b), (c, c)\}$

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5. The inclination of the line $y = 11x - 3$ with the x-axis is

Here $a = 11 > 0$

So the inclination is less than 90°

Ans: (B) less than 90°

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6. For $x^2 + 5x + 7 = 0$:

$\Delta = b^2 - 4ac = 5^2 - 4(1)(7) = -3$

So the roots are not real (imaginary)

Ans: (C) $\Delta = -3$**, roots are not real (imaginary)**

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7. $x^2 - x - 12 =$

$x = \frac{1 \pm 7}{2} = -3, 4$

$x^2 - x - 12 = (x - \alpha)(x - \beta) = (x + 3)(x - 4)$

Ans: (D) $(x + 3)(x - 4)$

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8. The maximum value of $-x^2 + 2x + 4$ is

$\text{Vertex} = \left(-\frac{b}{2a}, \frac{4ac - b^2}{4a}\right) = \left(1, \frac{-16 - 4}{-4}\right) = (1, 5)$

$a < 0$: maximum value $= 5$

Ans: (D) 5

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9. The graph of $y = (x + 4)(x - 3)$ cuts the x-axis at

put $y = 0$: $(x + 4)(x - 3) = 0 \Rightarrow x = -4, 3$

Ans: (B) $(-4, 0)$ **and** $(3, 0)$

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10. If $(5-x)(x-1) \leq 0$, then $x \in$

$y = (5-x)(x-1) = -x^2 + 6x - 5$

$a = -1 < 0$ (downward parabola)

$\Delta = b^2 - 4ac = 6^2 - 4(-1)(-5) = 16$

$y = 0 \Rightarrow x = \frac{-6 \pm 4}{-2} = 1, 5$

Sign: $-$ outside 1 and 5, $+$ between them

$\therefore x \in (-\infty, 1] \cup [5, \infty)$

Ans: (A) $(-\infty, 1] \cup [5, \infty)$

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11. If $x^2 - 9 < 0$, then $x \in$

$a = 1 > 0$ (upward parabola)

$\Delta = b^2 - 4ac = 0^2 - 4(1)(-9) = 36$

$y = 0 \Rightarrow x = \pm\sqrt{9} = -3, 3$

Sign: $+$ outside -3 and 3, $-$ between them

$\therefore x \in (-3, 3)$

Ans: (C) $(-3, 3)$

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12. $2^7 = 128$ in logarithmic form is

$a^x = N \Leftrightarrow x = \log_a N$

Base 2, power 7: $\log_2 128 = 7$

Ans: (C) $\log_2 128 = 7$

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13. $\log_3 54 - \log_3 2 =$

$\log_3 \frac{54}{2} = \log_3 27 = 3$

Ans: (A) 3

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14. If $\log_3(x+1) \geq 0$, then $x \in$

Base $3 > 1$: $\log_a T \geq 0 \Leftrightarrow T \geq 1$

$x + 1 \geq 1 \Rightarrow x \geq 0$

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

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15. If $\log_2(x^2 + 3x) - \log_2(x+3) = 4$, then $x =$

$\log_2 \frac{x(x+3)}{x+3} = 4 \Rightarrow \log_2 x = 4 \Rightarrow x = 2^4 = 16$

Ans: (D) 16

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16. If $x = 5$ and $y = -8$, then $|x + y| =$

$|5 + (-8)| = |-3| = 3$

Ans: (D) 3

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17. If $|1-x|>4$, then $x \in$

$1-x<-4$ (or) $1-x>4$

$\Rightarrow x<-3$ (or) $x>5$ (dividing by a negative number turns the signs)

$\Rightarrow x \in (-\infty,-3) \cup (5,\infty)$

Ans: (C) $(-\infty,-3) \cup (5,\infty)$

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18. If $|x^2-1|=3$, then $x \in$

$x^2-1=\pm 3$

$x^2-1=3 \Rightarrow x^2-4=0 \Rightarrow x=\pm\sqrt{4}=-2,2$

$x^2-1=-3 \Rightarrow x^2+2=0$, $\Delta=-8<0$: no real x

Ans: (B) $\{-2,2\}$

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19. The solution set of $|x+1|+|x-3|=4$ is

Case (i) Suppose $x<-1$ $(x+1<0, x-3<0)$: $(-x-1)+(3-x)=4 \Rightarrow 2-2x=4 \Rightarrow x=-1$, not in this case: no solution

Case (ii) Suppose $-1 \le x \le 3$ $(x+1 \ge 0, x-3 \le 0)$: $(x+1)+(3-x)=4 \Rightarrow 4=4$: true for every x in this case

Case (iii) Suppose $x>3$ $(x+1>0, x-3>0)$: $(x+1)+(x-3)=4 \Rightarrow 2x-2=4 \Rightarrow x=3$, not in this case: no solution

So $x \in [-1,3]$

Ans: (C) $[-1,3]$

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20. If $x^2-4|x|+3>0$, then $x \in$

$x=0$ is the critical point

Case (i) Suppose $x<0$: $|x|=-x$, $x^2+4x+3>0 \Rightarrow (x+1)(x+3)>0 \Rightarrow x \in (-\infty,-3) \cup (-1,\infty)$; common values $(-\infty,-3) \cup (-1,0)$

Case (ii) Suppose $x \ge 0$: $|x|=x$, $x^2-4x+3>0 \Rightarrow (x-3)(x-1)>0 \Rightarrow x \in (-\infty,1) \cup (3,\infty)$; common values $[0,1) \cup (3,\infty)$

From (i), (ii): $x \in (-\infty,-3) \cup (-1,1) \cup (3,\infty)$

Ans: (B) $(-\infty,-3) \cup (-1,1) \cup (3,\infty)$

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21. The domain of $f(x)=\frac{1}{\sqrt{x^2-5x+4}}$ is

$\frac{1}{\sqrt{x^2-5x+4}}$ is defined when $x^2-5x+4>0$

$\Rightarrow (x-4)(x-1)>0$

Domain $=(-\infty,1) \cup (4,\infty)$

Ans: (B) $(-\infty,1) \cup (4,\infty)$

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22. $[7.1]-[-7.1]=$

$[7.1]=7$, $[-7.1]=-8$

$7-(-8)=15$

Ans: (D) 15

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23. The domain of $f(x) = \sqrt{x - [x]}$ is

Need $x - [x] \geq 0$, i.e. $[x] \leq x$

This is true for every real x: domain $= \mathbb{R}$

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

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24. $\{3\} + \{-3\} =$

$\{3\} = 3 - 3 = 0,\ \{-3\} = -3 - (-3) = 0$

Ans: (C) 0

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25. The range of $f(x) = x + \frac{1}{x}$ is

Minimum 2 at $x = 1$ (for $x > 0$), maximum -2 at $x = -1$ (for $x < 0$)

Range $= (-\infty, -2] \cup [2, \infty)$

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