EXPRESSWALA ACADEMY

Functions

MCQ Test, Set 10

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 $f(x) = 6x - 1$, then the image of 3 under f is

A. -19 **B.** 19 **C.** 17 **D.** $\frac{2}{3}$

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

A. $\{-3, 0, 1, 2\}$ **B.** $\{-1, 0, 1, 2\}$ **C.** $\{1, 2, 5\}$ **D.** $\{-3, 0, 1\}$

3. If $f(x) = 3x^3 + 2x - 4$, then $f(-1) =$

A. -9 **B.** -7 **C.** 1 **D.** -5

4. The graph of $y = x$ is a straight line

A. parallel to the y-axis

B. through the origin at 45° to the x-axis

C. through $(0, 1)$ at 45° to the x-axis

D. parallel to the x-axis

5. The line $y = 10x - 4$ cuts the x-axis at

A. $(-\frac{2}{5}, 0)$ **B.** $(\frac{2}{5}, 0)$ **C.** $(0, -4)$ **D.** $(4, 0)$

6. The discriminant of $5x^2 - 2x + 1 = 0$ is

A. -24 **B.** -22 **C.** 24 **D.** -16

7. If α, β are the roots of $3x^2 - x - 2 = 0$, then $(\alpha - \beta)^2 =$

A. $-\frac{23}{9}$ **B.** $\frac{25}{3}$ **C.** $\frac{5}{3}$ **D.** $\frac{25}{9}$

8. The range of $f(x) = -2x^2 + 8x - 5$, $x \in \mathbb{R}$, is

A. $(-\infty, 2]$ **B.** $[3, \infty)$ **C.** $(-\infty, 3]$ **D.** $(-\infty, -5]$

9. The graph of $y = x^2 - 3x - 10$ cuts the x-axis at

A. $(-2, 0)$ and $(-5, 0)$ **B.** $(2, 0)$ and $(-5, 0)$

C. $(2, 0)$ and $(5, 0)$ **D.** $(-2, 0)$ and $(5, 0)$

10. If $2x^2 + 3x - 2 > 0$, then $x \in$

A. $(-\infty, -2) \cup (\frac{1}{2}, \infty)$ **B.** $(-2, \frac{1}{2})$

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

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11. If $x(x - 7) < 0$, then $x \in$

A. $(-\infty, 0) \cup (7, \infty)$ **B.** $[0, 7]$

C. $(-\infty, 0] \cup [7, \infty)$ **D.** $(0, 7)$

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12. If $\log_3(2x - 1) = 2$, then $x =$

A. 4 **B.** 5 **C.** $\frac{7}{2}$ **D.** 9

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13. $9^{\log_3 2} =$

A. 18 **B.** 4 **C.** 8 **D.** 2

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14. For $a > 1$, $\log_a x < 0$ when

A. $0 < x < 1$ **B.** $x > 1$ **C.** $x < 0$ **D.** $x \geq 1$

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15. $(0.5)^{\log_{0.5} 6 - 1} =$

A. 6 **B.** 12 **C.** 3 **D.** 5

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16. Which of these is true for every real x?

A. $|-x| = |x|$ **B.** $|x| = x$ **C.** $|x| > 0$ **D.** $|-x| = -x$

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17. If $|4 - 3x| \leq 2$, then $x \in$

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

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

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18. If $|x - 4| = |x + 2|$, then $x \in$

A. $\{-1, 1\}$ **B.** ϕ **C.** $\{1\}$ **D.** $\{-1\}$

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19. The solution set of $|x - 2| + |x + 2| = 2$ is

A. $\{2\}$ **B.** $\{-2, 2\}$ **C.** ϕ **D.** $\{0\}$

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20. If $|x^2 - 5x| < 6$, then $x \in$

A. $(-1, 2) \cup (3, 6)$ **B.** $(2, 3)$

C. $(-\infty, 2) \cup (3, \infty)$ **D.** $(-1, 6)$

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21. The domain of $f(x) = \sqrt{x^2 - 6x + 9}$ is

A. $\{3\}$ **B.** $\mathbb{R} - \{3\}$ **C.** $\mathbb{R}$ **D.** $[3, \infty)$

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22. The domain of $f(x) = [x]$ is

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

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23. For every real x,

A. $x - 1 \leq [x] < x$ **B.** $[x] > x$ **C.** $x - 1 < [x] \leq x$ **D.** $x < [x] \leq x + 1$

24. $\{-7.9\} + \{-0.1\} =$

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

25. If $x \in [1, 5]$, then $\frac{1}{x} \in$

A. $(0, 1]$ **B.** $[1, 5]$ **C.** $[-5, -1]$ **D.** $[\frac{1}{5}, 1]$

Key sheet

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

Solutions

1. If $f(x) = 6x - 1$, then the image of 3 under f is

$f(3) = 6(3) - 1 = 17$

Ans: (C) 17

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

$f(-1) = 1 - (-1)^2 = 0$, $f(0) = 1 - (0)^2 = 1$, $f(1) = 1 - (1)^2 = 0$, $f(2) = 1 - (2)^2 = -3$

Range $= f(A) = \{-3, 0, 1\}$ (not the codomain B)

Ans: (D) $\{-3, 0, 1\}$

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3. If $f(x) = 3x^3 + 2x - 4$, then $f(-1) =$

$f(-1) = 3(-1)^3 + 2(-1) - 4 = -9$

Ans: (A) -9

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4. The graph of $y = x$ is a straight line

$x = 0 \Rightarrow y = 0$, so it passes through the origin

It is the identity function: inclined at 45°

Ans: (B) through the origin at 45° to the x-axis

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5. The line $y = 10x - 4$ cuts the x-axis at

put $y = 0$: $10x - 4 = 0 \Rightarrow x = \frac{2}{5}$

Ans: (B) $(\frac{2}{5}, 0)$

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6. The discriminant of $5x^2 - 2x + 1 = 0$ is

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

Ans: (D) -16

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7. If α, β are the roots of $3x^2 - x - 2 = 0$, then $(\alpha - \beta)^2 =$

$(\alpha - \beta)^2 = (\alpha + \beta)^2 - 4\alpha\beta = \frac{b^2 - 4ac}{a^2} = \frac{25}{9} = \frac{25}{9}$

Ans: (D) $\frac{25}{9}$

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8. The range of $f(x) = -2x^2 + 8x - 5$, $x \in \mathbb{R}$, is

$\text{Vertex} = \left(-\frac{b}{2a}, \frac{4ac - b^2}{4a}\right) = \left(2, \frac{40 - 64}{-8}\right) = (2, 3)$

Range $= (-\infty, 3]$

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

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9. The graph of $y = x^2 - 3x - 10$ cuts the x-axis at

put $y = 0$: $x^2 - 3x - 10 = 0 \Rightarrow x = -2, 5$

Ans: (D) $(-2, 0)$ **and** $(5, 0)$

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10. If $2x^2 + 3x - 2 > 0$, then $x \in$

$a = 2 > 0$ (upward parabola)

$\Delta = b^2 - 4ac = 3^2 - 4(2)(-2) = 25$

$y = 0 \Rightarrow x = \frac{-3 \pm 5}{4} = -2, \frac{1}{2}$

Sign: $+$ outside -2 and $\frac{1}{2}$, $-$ between them

$\therefore x \in (-\infty, -2) \cup (\frac{1}{2}, \infty)$

Ans: (A) $(-\infty, -2) \cup (\frac{1}{2}, \infty)$

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11. If $x(x - 7) < 0$, then $x \in$

$y = x(x - 7) = x^2 - 7x$

$a = 1 > 0$ (upward parabola)

$\Delta = b^2 - 4ac = (-7)^2 - 4(1)(0) = 49$

$y = 0 \Rightarrow x = \frac{7 \pm 7}{2} = 0, 7$

Sign: $+$ outside 0 and 7, $-$ between them

$\therefore x \in (0, 7)$

Ans: (D) $(0, 7)$

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12. If $\log_3(2x - 1) = 2$, then $x =$

$2x - 1 = 3^2 = 9 \Rightarrow 2x = 10 \Rightarrow x = 5$

Ans: (B) 5

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13. $9^{\log_3 2} =$

$a^{\log_c b} = b^{\log_c a}$

$9^{\log_3 2} = 2^{\log_3 9} = 2^2 = 4$

Ans: (B) 4

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14. For $a > 1$, $\log_a x < 0$ when

The graph of $\log_a x$ ($a > 1$) is below the x-axis for $0 < x < 1$

Ans: (A) $0 < x < 1$

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15. $(0.5)^{\log_{0.5} 6 - 1} =$

$(0.5)^{\log_{0.5} 6} \cdot (0.5)^{-1} = 6 \times 2 = 12$

Ans: (B) 12

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16. Which of these is true for every real x?

$|-x| = |x|$ always

$|-x| = -x$ fails for $x = 2$: $|-2| = 2 \neq -2$; $|x| = x$ fails for $x < 0$; $|0| = 0$

Ans: (A) $|-x| = |x|$

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17. If $|4-3x| \leq 2$, then $x \in$

$-2 \leq 4-3x \leq 2$

$\Rightarrow -2-4 \leq -3x \leq 2-4$

$\Rightarrow \frac{2}{3} \leq x \leq 2$ (dividing by a negative number turns the signs)

$\Rightarrow x \in [\frac{2}{3}, 2]$

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

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18. If $|x-4| = |x+2|$, then $x \in$

$x-4 = \pm(x+2)$

$x-4 = x+2$: not possible

$x-4 = -x-2 \Rightarrow 2x-2=0 \Rightarrow x=1$

Ans: (C) $\{1\}$

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19. The solution set of $|x-2|+|x+2|=2$ is

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

Case (ii) Suppose $-2 \leq x \leq 2$ $(x-2 \leq 0, x+2 \geq 0)$: $(2-x)+(x+2)=2 \Rightarrow 4=2$: not possible, no solution

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

So $x \in \phi$

Ans: (C) ϕ

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20. If $|x^2-5x| < 6$, then $x \in$

$-6 < x^2-5x < 6$

$\Rightarrow x^2-5x+6>0$ and $x^2-5x-6<0$

$x^2-5x+6>0$: $x \in (-\infty, 2) \cup (3, \infty)$

$x^2-5x-6<0$: $\Delta = 49,\ x = \frac{5 \pm 7}{2} = -1, 6 \Rightarrow x \in (-1, 6)$

Common values: $x \in (-1, 2) \cup (3, 6)$

Ans: (A) $(-1, 2) \cup (3, 6)$

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21. The domain of $f(x) = \sqrt{x^2-6x+9}$ is

$\sqrt{x^2-6x+9}$ is defined when $x^2-6x+9 \geq 0$

$\Rightarrow (x-3)^2 \geq 0$: a perfect square

Domain $= \mathbb{R}$

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

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22. The domain of $f(x) = [x]$ is

$[x]$ is defined for every real x

Domain $= \mathbb{R}$

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

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23. For every real x,

$[x] \le x$ always, and $[x] > x - 1$

So $x - 1 < [x] \le x$

Ans: (C) $x - 1 < [x] \le x$

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24. $\{-7.9\} + \{-0.1\} =$

$\{-7.9\} = -7.9 - (-8) = 0.1,\ \{-0.1\} = -0.1 - (-1) = 0.9$

$0.1 + 0.9 = 1$

Ans: (B) 1

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25. If $x \in [1, 5]$, then $\frac{1}{x} \in$

$\frac{1}{x}$ decreases: $x = 1 \to 1$, $x = 5 \to \frac{1}{5}$

So $\frac{1}{x} \in \left[\frac{1}{5}, 1\right]$

Ans: (D) $\left[\frac{1}{5}, 1\right]$