



# MATHS

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## INEQUALITIES AND MODULUS

Subjective

1. Solve  $\frac{2x + 3}{x^2 + x - 12} < \frac{1}{2}$ .



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2. Solve  $\frac{1}{x-2} + \frac{1}{x-1} > \frac{1}{x}$ .



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3.  $\left( \sqrt{8 + 2x - x^2} > 6 - 3x \right)$



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4. Solve,  $\frac{\sqrt{2x-1}}{x-2} < 1$ .



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5. Solve,  $\sqrt{x - 6} - \sqrt{10 - x} \geq 1$ .



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6. Solve,  $\frac{1 - \sqrt{21 - 4x - x^2}}{x + 1} \geq 0$ .



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7. Solve  $|x|^2 - |x| + 4 = 2x^2 - 3|x| + 1$ .



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8. Solve the simultaneous equations

$$|x + 2| + y = 5 \text{ and } x - |y| = 1$$



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9. Solve  $x - \sqrt{1 - |x|} < 0$ .



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10. Solve  $||x - 1| - 2| = x - 3$



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11. Solve :  $(|x - 1| - 3)(|x + 2| - 5) < 0$ .



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12. For  $a, b \in \mathbb{R}$  prove that

$$\frac{|a + b|}{1 + |a + b|} \leq \frac{|a|}{1 + |a|} + \frac{|b|}{1 + |b|}$$



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Single Correct Answer

1. If  $f(x) = ax^2 + bx + c$  and  $f(-1) \geq -4$ ,  
 $f(1) \leq 0$  and  $f(3) \geq 5$ , then the least value of  
 $a$  is

A. A.  $1/4$

B. B.  $1/8$

C. C.  $1/3$

D. D.  $-1/3$

**Answer: B**



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2. The complete set of values of  $x$  for which

$$\frac{x^3(x-1)^2(x+4)}{(x+1)(x-3)} \geq 0 \text{ is}$$

A. A.

$$(-\infty, -4] \cup (-1, 0] \cup (3, \infty) \cup \{1\}$$

B. B.

$$(-\infty, -4] \cup (-1, 0] \cup (3, \infty) \cup \{-1\}$$

C. C.  $[-4, -1) \cup [0, 1) \cup (3, \infty)$

D. D.  $[-4, -1) \cup [0, 1] \cup (3, \infty)$

**Answer: A**



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3. The set of all values of  $x$  for which

$$\frac{(x + 1)(x - 3)^2(x - 5)(x - 4)^3(x - 2)}{x} < 0$$

A.  $(-\infty, -1) \cup (0, 2) \cup (4, 5)$

B.  $(-1, 0) \cup (2, 4) \cup (5, \infty)$

C.  $(-1, 0) \cup (2, 3) \cup (4, 5)$

D.  $(-\infty, -1) \cup (0, 2) \cup [3, 5)$

**Answer: A**



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4. The solution set of inequality

$$\frac{(e^x - 1)(2x - 3)(x^2 + x + 2)}{(\sin x - 2)(x + 1)x} \leq 0$$

A. A.  $\left[\frac{3}{2}, \infty\right)$

B. B.  $(-\infty, -1) \cup \left[\frac{3}{2}, \infty\right)$

C. C.  $(-1, 0) \cup \left[\frac{3}{2}, \infty\right)$

D. D.  $\mathbb{R} - \{0, -1\}$

**Answer: B**



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5. The solution set of inequality

$$\frac{1}{2^x - 1} > \frac{1}{1 - 2^{x-1}} \text{ is}$$

A. A.  $(1, \infty)$

B. B.  $(0, \log_2(4/3))$

C. C.  $(-1, \infty)$

D. D.  $(0, \log_2(4/3)) \cup (1, \infty)$

**Answer: D**



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6. Let  $A = \{x : x^2 - 4x + 3 < 0, x \in R\}$

$B = \{x : 2^{1-x} + p \leq 0, x^2 - 2(p+7)x + 5 \leq 0\}$

If  $B \subseteq A$ , then  $p \in$

A.  $[-4, -1]$

B.  $[-4, \infty)$

C.  $(-\infty, 1)$

D.  $[0, 1]$

**Answer: A**



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7. Let  $a, b > 0$  satisfies  $a^3 + b^3 = a - b$ . Then

A.  $a^2 + b^2 = 1$

B.  $a^2 + ab + b^2 < 1$

C.  $a^2 + b^2 > 1$

D. none of these

**Answer: B**



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8. The number of integers satisfying

$$|2x - 3| + |x + 5| \leq |x - 8| \text{ is}$$

A. 5

B. 6

C. 7

D. 8

**Answer: C**



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9. Which of the following is not the solution of

$$|2x + 5| - |x - 3| \geq |x + 8| ?$$

A.  $(-\infty, -8]$

B.  $[3, \infty)$

C.  $(-8, 3)$

D. none of these

**Answer: C**



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10. The number of integral values of  $x$  satisfying the equation  $|x - |x - 4|| = 4$  is  
(a) 5 , (b) 7 , (c) 9 , (d) infinite

A. 5

B. 7

C. 9

D. infinite

**Answer: D**



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11. The solution of  $|2x - 3| < |x + 2|$  is

A.  $(-\infty, 1/3)$

B.  $(1/3, 5)$

C.  $(5, \infty)$

D.  $(-\infty, 1/3) \cup (5, \infty)$

**Answer: B**



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12. The solution set of the inequation

$$\left| \frac{1}{x} - 2 \right| < 4, \text{ is}$$

A.  $(-\infty, -1/2)$

B.  $(1/6, \infty)$

C.  $(-1/2, 1/6)$

D.  $(-\infty, -1/2) \cup (1/6, \infty)$

**Answer: D**



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13. The solution of  $\left|x + \frac{1}{x}\right| > 2$  is

A.  $R - \{0\}$

B.  $R - \{-1, 0, 1\}$

C.  $R - \{1\}$

D.  $R - \{-1, 1\}$

**Answer: B**



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14. The solution of the inequality

$$\frac{|x + 2| - |x|}{\sqrt{8 - x^3}} \geq 0 \text{ is}$$

A. A.  $[-1, 2)$

B. B.  $[1, 2]$

C. C.  $[-1, 1]$

D. D.  $[0, 3\sqrt{4})$

**Answer: A**



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15. If  $\left| \frac{12x}{4x^2 + 9} \right| \leq 1$ , then (a)  $x \in R$  (b)

$x \in [-3, 3]$  (c)  $x \in [-1, \infty)$  (d)

$x \in (-\infty, 2]$

A.  $x \in R$

B.  $x \in [-3, 3]$

C.  $x \in [-1, \infty)$

D.  $x \in (-\infty, 2]$

**Answer: A**



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16. Let  $a, b, c, d$  be real numbers such that  $|a-b|=2$ ,  $|b-c|=3$ ,  $|c-d|=4$ . Then the sum of all possible values of  $|a-d|$  =

- A. 9
- B. 18
- C. 24
- D. 30

**Answer: B**



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17. The number of solutions of the equation

$$\sqrt{x^2} - \sqrt{(x-1)^2} + \sqrt{(x-2)^2} = \sqrt{5}$$
 is

A. 0

B. 1

C. 2

D. More than 2

**Answer: C**



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18. If  $|x^2 - 2x - 8| + |x^2 + x - 2| = 3|x + 2|$ ,

then the set of all real values of  $x$  is

A.  $[1, 4] \cup \{-2\}$

B.  $[1, 4]$

C.  $[-2, 1] \cup [4, \infty)$

D.  $(-\infty, -2] \cup [1, 4]$

**Answer: A**



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19. Solve  $|x| + \left| \frac{4 - x^2}{x} \right| = \left| \frac{4}{x} \right|$

A. 5

B. 4

C. 6

D. 7

**Answer: B**



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20. The equation

$$|2ax - 3| + |ax + 1| + |5 - ax| = \frac{1}{2}$$

possesses

A. Infinite number of real solutions for some

$$a \in \mathcal{R}$$

B. finitely many real solutions for some

$$a \in \mathcal{R}'$$

C. no real solutions for some  $a \in \mathcal{R}$

D. no real solutions  $a \in \mathcal{R}$

**Answer: D**



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21. Solve :  $\left| \frac{x^2 - 5x + 4}{x^2 - 4} \right| \leq 1$

A.  $\left[ 0, \frac{8}{5} \right]$

B.  $\left[ \frac{8}{5}, \infty \right]$

C.  $[ -\infty, -2 ]$

D.  $R$

**Answer: A**



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