MATHS

BOOKS - ARIHANT MATHS

ESSENTIAL MATHEMATICAL TOOLS

Examples

1. Solve $2x + 1 > 3$.

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2. solve $-2 < 2x - 1 < 2$.

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3. Solve the inequalities given below for real x

:- $\frac{3(x-2)}{5} \leq \frac{5(2-x)}{3}$

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4. solve for X. $\frac{4}{x+1} \leq 3 \leq \frac{6}{x+1}, (x > 0)$

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5. Explain the following : (i) $|x| = 5$ (ii) $|x| = -5$ (iii) $|x| < 5$ (iv) $|x| < -5$ (v) $|x| > -5$ (vi) $|x| < 5$

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6. solve for ,x where $f(x) = |x| \geq 0$

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7. solve $|x-3|<5$.

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8. solve $|x-1| \leq 2$.

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9. Solve the following systems of linear inequations:

$1 \leq |x-2| \leq 3$

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10. solve $1 \leq |x-1| \leq 3$,

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11. solve $\left|\frac{2}{x-4}\right| > 1, x \neq 4.$

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12. Solve $|x-1| + |x-2| \geq 4$

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13. Find the interval in which f(x) is positive or negative : f(x) = (x-1)(x-2)(x-3)

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14. solve $f(x) = \frac{(x-1)(2-x)}{(x-3)} \geq 0.$

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15. find the value of x for which

$$f(x) = \frac{(2x-1)(x-1)^2(x-2)^2}{(x-4)^2} \geq 0.$$

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16. Find the value of x for which

$$f(x) = \frac{(x-2)^2(1-x)(x-3)^2(x-4)^2}{(x-1)} \leq 0.$$

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17. Solve : $\frac{|x|-1}{|x|-2} \geq 0, x \neq \pm 2$

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18. Solve:

$\frac{-1}{|x|-2} \geq 1, where x \in R, x \neq \pm 2.$

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19. solve $\frac{|x+3|+x}{x+2} > 1$

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20. If

$$f(x) = \frac{(x-1)^3(x+2)^4(x-3)^5(x+6)}{x^2(x-7)^3},$$

Solve the following inequality f $\geq$ 0

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21. For what values of x, the numbers $\frac{3}{8}, x, \frac{8}{3}$ are in G.P?

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22. Find the sum of the series – 1 + 5 + 11 +....to n terms.

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23. find a for which $3x^2 + ax + 3 > 0, \forall x \in R.$

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24. find a for which $ax^2 + x - 1 < 0, \forall x \in R?$

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25. Solve $(x+1)^2 + \left(x^2 + 3x + 2\right)^2 = 0.$

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26. Solve $|x+1| + \sqrt{x} - 1 = 0.$

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Example

1. Solve

$$\left|x^2-1\right|+(x-1)^2+\left(\sqrt{x}\right)^2-3x+2=0.$$

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2. Let f(x) =x and g(x)=|x| be two real-valued functions, check whether the functions are one -one.

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Exercise For Session 1

1. All the rational numbers are irrational also.

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2. All the integers are irrational also.

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3. Irrational numbers are real numbers also.

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4. Zero is a natural number.

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5. Sum of two natural numbers is a rational number.

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6. A positive intezer is a natural number also.

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7. sum of two rational numbers is

A. rational

B. irrational

C. Both (a) and (b)

D. None of these

Answer: A

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8. Which one of the following statement is true?

(i) The sum of two irrational numbers is always an irrational number.

(ii) The sum of two irrational numbers is always a rational number.

(iii) The sum of two irrational numbers may be a rational number or irrational number.

(iv) The sum of two irrational numbers is always an integer.

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9. Product of two rational numbers is

A. always rational

B. rational or irrational

C. always irrational

D. None of these

Answer: A

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10. If a is an irrational number which is divisible by b, then the number b

A. must be rational

B. must be irrational

C. may be rational or irrational

D. None of these

Answer: C

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Exercise For Session 2

1. solve for x, $|x-1|<2$

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2. solve for x, $|x-3|>2$

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3. Solve: $0 < |x - 1| < 3$

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4. solve for x, $(x - 1) + (2x - 3) = (3x - 4)$

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5. $\left| \frac{x - 3}{x^2 - 4} \right| \leq 1.$

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Exercise For Session 3

1. Solve $\frac{x-2}{x+2} > \frac{2x-3}{4x-1}$

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2. $\frac{2x-1}{2x^3+3x^2+x} > 0.$

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3. $\frac{4x}{x^2+3} \geq 1.$

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4. $\frac{(x-1)(x+1)(x+4)(x+6)}{7x^2+8x+4} > 0$

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5. $\frac{x}{x^2-5x+9} \leq 1.$

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6. Solution of inequality $|x-1|<0$ is

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7. Solution of inequailty $x^2+x+|x|+1\leq 0$ is

A. (1,2)

B. (0,1)

C. No solution

D. None of these

Answer: C

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8. Solution of inequality $x^2 + x + |x| + 1 \leq 0$ is

A. $\left(-\frac{2}{3}, 4\right)$

B. $(4, \infty)$

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

D. None of these

Answer: D

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9. Solve $\frac{x+2}{6} - \left(\frac{11-x}{3} - \frac{1}{4}\right) = \frac{3x-4}{12}$

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10. For what value of x , the numbers $-\frac{5}{9}, x, \frac{9}{5}$ are in G.P?

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11. The solution of $||x| - 1| < |1 - x|, x \in R$ is

A. $(-1, 1)$

B. (o, ∞)

C. $(-1, \infty)$

D. None of these

Answer: D

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12. The solution of $2^x + 2^{|x|} \geq 2\sqrt{2}$ is

A. $(-\infty, \log_2(\sqrt{2}+1)$

B. $(0, \infty)$

C. $\left(\frac{1}{2}, \log_2(\sqrt{2}-1)\right)$

D. $(-\infty \log_2(\sqrt{2}-1)] \cup \left[\frac{1}{2}, \infty\right)$

Answer: D

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Exercise For Session 4

1. Find all values of 'm' which $(2m-3)x^2+2mx+4<0$ for all real x.

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2. If $ax^2-bx+5=0$ does not have two distinct real roots, then find the minimun value of 5a+b.

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3. $a, b, c \in R, a \neq 0$ and the quadratic equation$ax^2 + bx + c = 0$ has no real roots, then

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4. If $x, y \in [0, 10]$, then find the number of solutions (x, y) of the inequation

$$3\left(\sec^2 x - 1\right)\sqrt{9y^2 - 6y + 2} \leq 1$$

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Exercise Single Option Correct Type Questions

1. For a $a \leq 0,$ determine all real roots of the equation $x^2 - 2a|x - a| - 3a^2 = 0.$

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2. Solve $\left|x^2 + 4x + 3\right| + 2x + 5 = 0.$

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3. Solve $\left|x^2-3x-4\right|=9-\left|x^2-1\right|$

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4. Solve the equation

$2^{|x+1|}-2^x=|2^x-1|+1$

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5. Solve $-\frac{3x-2}{4}+\frac{2x+3}{3}=x-\frac{2}{3}$

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6. Solve $(x+3)^2-(x-1)^2 \geq 244$.

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7. Solve $|x-2-1| \geq 3$.

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8. Solve $1 \leq \frac{3x^2-7x+8}{x^2+1} \leq 2$.

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9. Let $f(x) = \frac{2x}{2x^2 + 5x + 2}$, find the interval for which f(x)>0.

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10. Draw the graph of |x| and check its injectivity.

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11. Solve the inequality

$$|x-1|+|2-x|>3+x.$$

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12. Solve the equation

$$\sqrt{x^2+12y}+\sqrt{y^2+12x}=33, x+y=23.$$

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13. Solve the equation

$$\sqrt{2x-1}+\sqrt{3x-2}=\sqrt{4x-3}+\sqrt{5x-4}.$$

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14. If x,y and z are real such that $x+y+z=4, x^2+y^2+z^2=6,$ x belongs to

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15. If f(x) = 3x + 2 & g(x) = -3x – 1. Find f(g(-3))

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16. Given f(x) = 3x – 1. Find: (i) f(-2) (ii) f(5)

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17. Let

$$f(x) = \frac{x^2 - 2x + 1}{x + 3}, find x : (i) f(x) > 0$$

$(ii) f(x) < 0$

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18. Solve the inequation:

$$\left|1 - \left(\frac{|x|}{1+|x|}\right)\right| \geq \frac{1}{2}$$

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Exercise More Than One Correct Option Type Questions

1. If $\cos x - y^2 - \sqrt{y - x^2 - 1} \geq 0$, then

A. $y \geq 1$

B. $x \in R$

C. y=1

D. x=0

Answer: C::D

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2. If $(\sin\alpha)x^2 - 2x + b \geq 2,$ for all real values of $x \leq 1 and d\alpha \in \left(0, \frac{\pi}{2}\right) \cup (\pi/2, \pi),$ then possible real value of b is /are $a2$ b. 3 c. 4 d. 5

A. 2

B. 3

C. 4

D. 5

Answer: A::C

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3. If $\left|ax^2 + bx + c\right| \leq 1$ for all x in $[0, 1]$ then

A. $|a| \leq 8$

B. $|b| \leq 8$

C. $|c| \leq 1$

D. $|a| + |b|_{|c|} \leq 17$

Answer: A::B::D

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Exercise Passage Based Questions

1. If $f(x) = 5x + 3$, $x \in R$. If $f(x) = 13$, find the value of x.

A. 1

B. 0

C. 2

D. 3

Answer: A

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2. Let $f(x) = ax^2 + bx + C, a, b, c \in R$.It is given $|f(x)| \leq 1, |x| \leq 1$ The possible value of $|a + c|$,if $\frac{8}{3}a^2 + 2b^2$ is maximum, is given by

A. 1

B. 0

C. 2

D. 3

Answer: A

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3. Let $f(x) = ax^2 + bx + c, ab, c \in R.$ It is given $|f(x)| \leq 1, |x| \leq 1$

The possible value of $|a + c|,$ if $\frac{8}{3}a^2 + 2ab^2$ is maximum is given by

A. 32

B. $\frac{32}{3}$

C. $\frac{2}{3}$

D. $\frac{16}{3}$

Answer: B

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4. Consider the equation $|2x| - |x - 4| = x + 4$ The least integer satisfying the equation is

A. -4

B. 4

C. 5

D. -5

Answer: A

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5. solve $\frac{3x+5}{2} = 7$

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6. Solve $\frac{2x-3}{3x+2} = -\frac{2}{3}$

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7. Consider a number N=21 P 5 3 Q 4.

The number of ordered pairs (P,Q) so that the number' N' is divisible by 9, is

A. 11

B. 12

C. 10

D. 8

Answer: A

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8. Consider a number n=21 P 5 3 Q 4.

The number of values of Q so that the number 'N' is divisible by 8, is

A. 4

B. 3

C. 2

D. 6

Answer: B

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9. Consider a number N = 2 1 P 5 3 Q 4. The number of ordered pairs (P,Q) so that the number 'N' is divisible by 44, is

A. 2

B. 3

C. 4

D. 5

Answer: C

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10. Consider the nine digit number n = 7 3 α 4 9 6 1 β 0. If p is th number of all possible distinct values of $(\alpha - \beta)$, then P is equal to

A. 17

B. 18

C. 19

D. 20

Answer: C

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11. Consider the nine digit number n = 7 3 α 4 9 6 1 β 0. If q is the number of all possible values of β for which the given number is divisible by 8, then q is equal to

A. 2

B. 3

C. 4

D. 5

Answer: A

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12. Consider the nine digit number n = 7 3 α 4 9 6 1 β 0. The number of ordered pairs (α, β) for which the given number is divisible by 88, is

A. 1

B. 2

C. 3

D. 4

Answer: B

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13. Consider the nine digit number n = 7 3 α 4 9 6 1 β 0. The number of possible values of $(\alpha + \beta)$ for which the given number is divisible by 6, is

A. 3

B. 4

C. 6

D. 7

Answer: D

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14. Consider the nine digit number n = 7 3 α 4 9 6 1 β 0. The number of possible values of β for wich $i^N = 1(\text{where } \ i = \sqrt{-1}),$

A. 2

B. 3

C. 4

D. 5

Answer: D

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15. Solve $3x - \frac{2}{3}(x - 2) = 3 - x - \frac{1}{3}$

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16. Solve $\frac{2x-3}{3x-2} = \frac{x+4}{3x-8}$

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

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Exercise Single Integer Answer Type Questions

1. The number of solutions of the equation

$|x-1|-|2x-5|=2x$

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2. The number of integral solution of the equation $\left|x^2-7\right| \leq 9$ are

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3. Find the number of solution of the system of equation $x+2y=6$ and $|x-3|=y$

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