doubtnut
India's Number 1 Education App

MATHS

BOOKS - ARIHANT MATHS (HINGLISH)

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 following inequations. $\frac{3(x-2)}{5} \geq \frac{5(2-x)}{3}$

(ii) $\frac{2x-2}{4} + 9 \geq 3 + \frac{4x}{3}$

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

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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. Let $F(x) = \frac{\left(\sin x - \frac{1}{2}\right)(\ln x - 1)^4(x-2)^3\left(\tan x - \sqrt{3}\right)^5}{(e^x - e^2)(x-3)^6\left(\sin^2 x - 1\right)}$ solve the following inequalities for $x \in (0, 2\pi)$

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22. Let $f(x)=\frac{(\cos x+|\cos x|)\left(\sin x-\frac{3}{2}\right)^3(\tan x-1)^5}{(\cos x-2)^2\left(\tan x-\sqrt{3}\right)^3}$ Find the interval of $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ for which (i) f(x) > 0(ii) f(x) < 0

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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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Exercise For Session 1

1. All the rational numbers are irrational also.

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2. Irrational numbers are real numbers also.

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

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4. A positive interber is a natural number also.

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5. 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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6. Which one of the following statement is true? The sum of two irrational numbers is always an irrational number The sum of two irrational numbers is always a rational number The sum of two irrational

numbers may be a rational number or irrational number The sum of two irrational numbers is always an integer

A. rational

B. irrational

C. real

D. None of these

Answer: C

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7. 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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8. 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. $|x-1|<2$

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2. $|x-3|>2$

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

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4. $|x-1|+|2x-3|=|3x-4|$

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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

A. x=0

B. x=1

C. $x \neq 1$

D. No solution

Answer: D

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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 inequailty $x^2 + x + |x| + 1 \leq 0$ 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. Solution of inequality $\left|x+\frac{1}{x}\right|<4$ is

A. $(2-\sqrt{3},2+\sqrt{3})\cup(-2-\sqrt{3},-2+\sqrt{3})$

B. $R-(2-\sqrt{3},2+\sqrt{3})$

C. $R-(-\sqrt{2}-\sqrt{3},2+\sqrt{3})$

D. None of these

Answer: A

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10. The solution of $\left|x^2+3x\right|+x^2-2\geq 0$ is `

A. $(-\infty,1)$

B. (0,1)

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

D. None of these

Answer: C

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

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

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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. Find the set of all real 'a' such that $5a^2-3a-2, a^2+a-2$ and $2a^2+a-1$ are the lenghts of the sides of a triangle?

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6. Solve $(x+3)^5 - (x-1)^5 \geq 244$.

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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 $f(x) = \frac{2x}{2x^2 + 5x + 2}$ and $g(x) = \frac{1}{x+1}$.

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10. For $x \in R$, $||x||$ is defined as follows,

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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 three real numbers such that $x+y+z=4$ and $x^2+y^2+z^2=6$,then show that each of x,y and z lie in the closed interval $\left[\frac{2}{3}, 2\right]$

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15. If $\{(\alpha+1)(\beta-1)+(\beta+1)(\alpha-1)\}a+(\alpha-1)(\beta-1)=0$ and $a(\alpha+1)$

Also, let $A=\left\{\frac{\alpha+1}{\alpha-1}, \frac{\beta+1}{\beta-1}\right\}$ and $B=\left\{\frac{2\alpha}{\alpha+1}, \frac{2\beta}{\beta+1}\right\}. If A \cap B \neq \phi$then find all the permissible values of the parameter 'a'.

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16. Solve $\left|\frac{x-1}{3+x2x-8x^2}\right|+|1-x|=\frac{(x-1)^2}{|3+2x=8x^2|}+1$

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17. Let $f(x) = \left(x^2 - 2|x|\right)(2|x| - 2) - 9\dfrac{2|x| - 2}{x^2 - 2|x|}$.

$(i)\, f(x) > 0$

$(ii)\, f(x) \geq 0$

$(iii)\, f(x) < 0$

$(iv)\, f(x) \leq 0$

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18. Solve $\left|1 - \dfrac{|x|}{1 + |x|}\right| \geq \dfrac{1}{2}$

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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 $\alpha \in \left(0, \frac{\pi}{2}\right) \cup \left(\frac{\pi}{2}, \pi\right)$, then the possible real values of b is/are

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 is $[0,1]$,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. 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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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 $f(x) = ax^2 + bx + C, a, b, c \in R$.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. 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. Consider the equation $|2x| - |x - 4| = x + 4$ Total number of prime numbers less than 20 satisfying the equation is

A. 3

B. 4

C. 5

D. 6

Answer: D

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6. Cnsider the equation $|2x|x-4|=x+4$ If P= greast composite number less than 34 satisfying the given equation then p^{2007} has the digit on its units place as

A. 8

B. 1

C. 7

D. 0

Answer: C

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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. The set of intergers can be classified into k classes, according to the remainder obtained when they are divided by K (where is a fixed natural number). The classification enables is solving even some more difficult problems of number theory e.g.

(i) even, odd classification is based on whether ramainder is 0 or 1 when divided by 2.

(ii) when divided by 3, the ramainder may be 0,1,2. Thus, there are three classes.

The number obtained, when the square of an integer is divided by 3, is

A. 0,1

B. 1,2

C. 0,2

D. 0,1,2

Answer: A

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The number obtained, when the square of an integer is divided by 3, is

A. 2

B. 3

C. 111

D. None of these

Answer: C

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(i) even, odd classification is based on whether ramainder is 0 or 1 when divided by 2.

(ii) when divided by 3, the ramainder may be 0,1,2. Thus, there are three classes.

The number obtained, when the square of an integer is divided by 3, is

A. 16

B. 15

C. 240

D. 720

Answer: D

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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. The number of solutions of the system of equation $x+2y=6$ and $|x-3|=y$ is/are

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