MATHS

BOOKS - CENGAGE PUBLICATION

SET THEORY AND REAL NUMBER SYSTEM

Illustration

1. State which of the following statement are true and which ones are false . Justify your answer .

(i) $21 \in \{x \mid x$ has exactly four positive factors $\}$

(ii) $64 \in \{y \mid$ the sun of the all the positve factors of y is 2y $\}$

(iii) $2 \in \left\{x \mid x^4 - 3x^3 + 4x^2 - 5x + 6 = 0\right\}$

(iv) 23562 $\in \{y \mid y$ is divisible by 9$\}$

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2. Are the following pairs of sets equal ? (i) A={x | x is prime factor of 6 } B= {x |x is a solution of $x^2 - 5x + 6 = 0\}Mlbtr$ (ii) A={x|y is a letter in the word REPLACED}, B= { y is a letter in the word PARCELED } (iii) A= { x| x is a natural number $x > 1\}$ B= {x|x is natural number $x \geq 1\}$

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3. If $A \not\subset B$ and $B \not\subset C$ .Is this statement true ? A is not subset of C

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4. If $x \in A$ and $A \not\subset B$, then $x \in B$. Is this statement true ?

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5. Consider the following sets:

A= set ofnaturai numbers which are multiples of 2

B= set ofnaturai numbers which are multiples of 3

C= set ofnaturai numbers which are multiples of 5

Then find the following set

$(i)A \cup B(ii)B \cup C(iii)A - B(iv)B - C(v)A \cap C(vi)A \cap B \cap C(vii)(A \cup$

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6. If A- B = A and B- A=B , then what can we conclude ?

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7. If the sets A,B are such that $A \cup B = B \cap A$ thrn show that A=B

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8. Show that $A \cap B = A \cap C$ need not imply B=C

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9. Consider the following sets:

A = set all rectangles in the same plane

B = set all squares in the same plane

C = set all parellegrams in the same plane

Find the following sets :

$(i) A - B (ii) C - A (iii) A \cap C (iv) B \cap C (v) B \cup C (Vi) A \cap B \cup C$

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10. Show that $A \subset B$ then C- $B \subset C - A$

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11. Assume that $P(A) = P(B)$. Show that $A = B$

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12. If sets A= (-3,2] and B= (-1, 5] then find the following sets :

A. $A \cap B$

B. $A \cup B$

C. A-B

D. B- A

Answer:

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13. In a group of 500 people, 350 speak Hindi and 300 speak English. It is given that each person speaks at least one language.

(i) How many people can speak both Hindi and English?

(ii) How many people can speak Hindi only?

(iii) How many people can speak English only?

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14. In a group of 50 students, the number of students studying French, English, Sanskrit were found to be as follows French = 17, English = 13, Sanskrit = 15 French and English = 09, English and Sanskrit = 4, French and Sanskrit = 5, English , French and Sanskrit = 3. Find the number of students who study

(i) only French, (ii) only English.

(iii) only Sanskrit. ,

(iv) atleast one of the three languages.

(v) none of the three languages.

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15. Solve the following inequlaities ,Write the solution in the from of intervals (i) $3x \geq 18$

(ii) $2x + 17 < 3$

$(iii) 7 - 4x > -17$

(iv) $\frac{x}{7} + 3 \leq -2$

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16. Solve the following inequlaities

$7x + 15 \geq 9 - 4x$

$-5 \leq \frac{2 - 3x}{4} \leq 9$

$5x - 6 \leq 4 \text{ and } 7 - 3x \geq 2x$

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17. Abhinav obtained 65 and 80 marks in first two unit test .Find the minimum marks he should get in the third test of have an average of at least 70 marks.

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18. Solve $\sqrt{(z-5)} - \sqrt{9-z} > 1, x \in Z.$

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19. Solve $\sqrt{x-2} \geq -1$.

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20. Solve $\sqrt{x-1} > \sqrt{3-x}$.

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21. Solve $x + \sqrt{x} \geq \sqrt{x} - 3$

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22. Find the values of x^2 for the given values of x. (i) $x < 2$

(ii) $x > -1$

(iii) $x \geq 2$

(iv) $x < -1$

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23. Find all the possible values of the expression $\sqrt{x^2-4}$.

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24. Solve $\left(x^2-4\right)\sqrt{x^2-1}<0$.

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25. Find all the possible values of $\frac{1}{x}$ for $x>3$.

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26. Find all the possible values of the expression: $\frac{1}{x^2+2}$

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27. Solve $x^2-x-2>0$.

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28. Solve $x^2 - x - 1 < 0$

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29. Solve $(x-1)(x-2)(1-2x) > 0$

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30. Solve $\frac{2}{x} > 3$

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

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32. Solve $x > \sqrt{(1-x)}$

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33. Solve $\frac{2}{x^2-x+1} - \frac{1}{x+1} - \frac{2}{x^3+1} \geq 0.$

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34. Solve $x(x+2)^2(x-1)^5(2x-3)(x-3)^4 \geq 0$

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35. Solve $x(2^x-1)(3^x-9)^5(x-3) < 0.$

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36. Solve $\left(x^2-x-1\right)\left(x^2-x-7\right) < -5$

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37. Solve the following : $|x| = 5$ (ii) $x^2 - |x| - 2 = 0$

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38. Find the value of x for which following expressions are defined: $\frac{1}{\sqrt{x - |x|}}$ (ii) $\frac{1}{\sqrt{x + |x|}}$

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39. Find all the possible values of expression :

$\frac{|x|}{x} + \frac{|y|}{y}$

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40. Solve $|x| = x^2 - 1$

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41. For $2 < x < 4$, find the values of |x|.

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42. Solve the following: $(i)|x-2| = 1$ (ii) $2|x+1|^2 - |x+1| = 3$

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43. Find the values of a for which eht equation $||x-2|+a| = 4$ can have four distinct real solutions.

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44. Solve the expression | x-2 | = (x-2) .

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45. Solve $1 - x = \sqrt{x^2 - 2x + 1}.$

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46. Solve $|3x - 2| = x.$

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47. Solve $\sqrt{x + 3 - 4\sqrt{x - 1}} + \sqrt{x + 8 - 6\sqrt{x - 1}} = 1$

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48. Prove that

$\sqrt{x^2 + 2x + 1} - \sqrt{x^2 - 2x + 1} = \{-2, x < -12x, -1 \leq x \leq 12, x >$

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49. For $x \in R$, find all possible values of $|x-3|-2$ (ii) $4-|2x+3|$

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50. Find all possible values of

$\sqrt{|x|-2}$

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51. Solve $|x-3|+|x-2|=1$.

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52. Solve $x^2-4|x|+3<0$.

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53. Solve $0 < |x| < 2$

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54. Solve $|3x - 2| < 4$.

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55. Solve $1 \leq |x - 2| \leq 3$

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56. Solve the following $0 < |x - 3| \leq 5$

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57. Solve $||x - 1| - 5| \leq 2$

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58. Solve $|x-3| \geq 2$

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59. Solve : $||x|-3| > 1.$

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60. Solve the following $\left|\frac{x-3}{x+1}\right| \leq 1$

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61. Solve $\left|1+\frac{3}{x}\right| > 2$

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62. Solve $|x| + |x - 2| = 2$.

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63. Solve $|2x - 3| + |x - 1| = |x - 2|$.

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64. Solve $|x^2 + x - 4| = |x^2 - 4| + |x|$.

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65. If $|\sin x + \cos x| = |\sin x| + |\cos x| (\sin x, \cos x \neq 0)$, then in which quadrant does x lie?

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66. Is $|tanx + \cot x| < |tanx| + |\cot x|$ true for any x? If it is true, then find the values of x.

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67. Solve $\left|\frac{x+1}{x}\right| + |x+1| = \frac{(x+1)^2}{|x|}$.

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68. Solve $|x^2 - 2x| + |x-4| > |x^2 - 3x + 4|$.

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69. Solve $|2^x - 1| + |4 - 2^x| < 3$

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Solved Exp

1. Find the total number of integer n such that $2 \leq n \leq 2000$ and H.C.F. of n and 36 is 1.

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2. For three sets A,B,C prove that $A - (B \cup C) = (A - B) \cap (A - C)$

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3. For sets A,B, and C using Venn diagram , check if A-(B-C) = (A-B-C)

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4. Suppose $A_1, A_2 \ldots . A_{30}$ are thirty sets each having 5 elements and $B_1 B_2 \ldots . B_n$ are n sets each having 3 elements ,Let

$\bigcup_{i=1}^{30} A_1 = \bigcup_{j=1}^{n} B_j = s$

and each element of S belongs to exactly 10 of the A_1 and exactly 9 of the

value of n.

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5. Let $a > 2$ be a constant. If there are just 18 positive integers satisfying the inequality $(x - a)(x - 2a)\left(x - a^2\right) < 0,$ then the value of a is

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6. The set of all possible real values of a such that the inequality $(x - (a - 1))\left(x - \left(a^2 - 1\right)\right) < 0$ holds for all $x \in (-1, 3)$ is a. $(0, 1)$ b. $(\infty, -1]$ c. $(-\infty, -1)$ d. $(1, \infty)$

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7. Find all possible values of $\frac{x^2+1}{x^2-2}$.

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8. $Solve\left(\frac{1}{3}\right)^{\frac{|x+2|}{2-|x|}} > 9$

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

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10. Solve |x+1|+|2x-3|=4.`

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11. Solve $\frac{x}{x+2} \leq \frac{1}{|x|}$

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Concept Application Exercise 1 1

1. Let $A = \{1, 2, \{3, 4\}, 5\}$. Which of the following statements are incorrect and why ?

(i) $\{3, 4\} \subset A$

(ii) $\{3, 4\} \in A$

(iii) $\{\{3, 4\}\} \subset A$

(iv) $1 \in A$

(v) $1 \subset A$

(vi) $\{1, 2, 5\} \subset A$

(vii) $\{1, 2, 5\} \in A$

(viii) $\{1, 2, 3\} \subset A$

(ix) $\phi \in A$

(x) $\phi \subset A$

(xi) $\{\phi\} \subset A$.

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2. If x = {1,2,3 ...., 10 } and a represents any elements of X then write the follwing sets containing all the elements satisfing the given conditions

$a \in Xbuta^2 \in X$

$a \in Xbuta/2 \in X$

a is factor of 24

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3. Write down all the subsets of the set : {a, b}

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4. If the number of elements in the power set of set A is 128 then find the number of elements in the set A .

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5. If $A \subset B \quad \text{and} \quad B \subset C, \quad \text{then} \quad A \in C$ is this statement true ?

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6. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}, B = \{2, 4, 6, 8\} \text{ and } C = \{3, 4, 5, 6\}$ Find $(B - C)'$.

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7. If $A - B = \phi \text{ and } B - A = \phi$ then what can we conclude ?

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8. Is it true that for any sets A and B, $P(A) \cup P(B) = P(A \cup B)$? Justify your answer.

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9. Let A ,B and X be three sets such that $A \cap X = B \cap X = \phi$ and $A \cup X = B \cup X$ .Then show that A=B .

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10. If A= [-4 , 1) and B =[0,3), then find $A \cap B$.

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11. In a survey conduced on 800 students of a school , 250 students were found to like tea and 300 like coffee , 150 like both tea and coffee .Find how many students like neither tea nor coffee ?

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12. Out of 100 students, 15 passed in English, 12 passed in Mathmatics, 8 in Science, 6 in English and Mathematics, 7 in Mathematics and Science , 4 in English and Science, 4 in all the three. Find how many passed

(i) in English and Mathematics but not in Science.

(ii) in Mathematics and Science but not in English.

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Concept Application Exercise 1 2

1. Find the values of x which satisfy the inequality $-3 < 2x - 1 < 19$.

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2. The longest side of a triangle is three times the shortest side and the third side is 2 cm shorter than the longest side. If the perimeter of the

triangle is at least 61 cm, find the minimum length of the shortest side.

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3. Find the values of 1/x for $2 \leq x \leq 5$.

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4. Find the values of $\frac{1}{x}$ for $-5 \leq x \leq -1$.

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5. Find all possible values (range) of the quadratic expression: $1 + 6x - x^2$, when $x \in [-3, 2]$.

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6. Find all possible values of expressions $\frac{2 + x^2}{4 - x^2}$

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7. Solve $\frac{\sqrt{x-1}}{x-2} < 0$

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8. Solve $\sqrt{x-2} \leq 3$

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Concept Application Exercise 1 3

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

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2. Solve $\frac{(2x+3)(4-3x)^3(x-4)}{(x-2)^2x^5} \leq 0$

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3. Solve $\frac{(x-3)(x+5)(x-7)}{|x-4|(x+6)} \leq 0$

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4. Solve $\frac{5x+1}{(x+1)^2} < 1$

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

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6. The solution of the inequation $4^{-x+0.5} - 7.2^{-x} < 4, x \in R$ is

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7. Solve $\frac{x^4}{(x-2)^4} > 0$

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8. Solve $\frac{6x^2 - 5x - 3}{x^2 - 2x + 6} \leq 4$

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9. Solve $\frac{(x+2)(x^2 - 2x + 1)}{-4 + 3x - x^2} \geq 0$

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10. solve $\sqrt{x+2} \geq x$

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11. Solve $\sqrt{2+x-x^2} > x-4$

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12. The number of integral values of x satisfying $\sqrt{(-x^2+10x-16)} < x-2$ is

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13. Find all the possible values of $f(x) = \dfrac{1-x^2}{x^2+3}$

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Concept Application Exercise 1 4

1. Which is the following is always true ?

(a) If $a < b, \quad \text{then} \quad a^2 < b^2$

(b) If $a < b \text{then} \quad \frac{1}{a} > \frac{1}{b}$

(c) If $a < b, \quad \text{then} \quad |a| < |b|$

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2. Which of the following equations has maximum number of real roots ?

A. $x^2 - |x| - 2 = 0$

B. $x^2 - 2|x| + 3 = 0$

C. $x^2 - 3|x| + 2 = 0$

D. $x^2 + 3|x| + 2 = 0$

Answer: c

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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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4. Find the values of x for which the following function is defined: $f(x) = \sqrt{\frac{1}{|x-2| - (x-2)}}$

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5. Find all values of f(x) for which f(x) $= x + \sqrt{x^2}$

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6. Solve $\left|\frac{x+2}{x-1}\right| = 2$

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7. Solve $|x|= 2x-1$

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8. Solve $|2^x - 1| + |2^x + 1| = 2$

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

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10. Solve $|4-|x-1||=3$

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11. Solve |x-1|-|2x-5|=2x

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Concept Application Exercise 1 5

1. If $\left|x^2-7\right| \leq 9$ then find the values of x

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2. Solve $||x-2|-3|<5$

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3. Which of the following is / are true ?

(a) If |x+y|=|x|+|y| then points (x,y) lie in 1st or 3rd quadrant or any of the x-axis or y axis

(b) If $|x+y| < |x| + |y|$ then points (x,y) lie in 2nd or 4th quadrant.

(c) If |x-y|=|x|+|y| then points (x,y) lie in 2nd or 4th quadrant.

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4. Find the values of x of for which $\sqrt{5 - |2x - 3|}$ is defined

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5. Solve $|x^2 - x - 2| + |x + 6| = |x^2 - 2x - 8|$

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6. Solve $|x^2 + x - 6| < 6$

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7. Solve $|x| + |\frac{4 - x^2}{x}| = |\frac{4}{x}|$

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8. Solve $\frac{1}{|x|-3} < \frac{1}{2}$

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9. Solve $|x-\pi| + \left|x^2 - \pi^2\right| \leq 0$

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10. Solve the inequation: $\left|1 - \left(\frac{|x|}{1+|x|}\right)\right| \geq \frac{1}{2}$

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

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12. Solve $\left|x^2-1\right|+\left|x^2-4\right|>3$

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Exercises

1. Let F_1 be the set of parallelograms, F_2 the set of rectangle , F_3 the set of rhombuses, F_4 the set of squares and F_5 the set of trapeziums in a plane. Then, F_1 may be equal to

A. $F_2 \cap F_3$

B. $F_3 \cap F_4$

C. $F_2 \cup F_5$

D. $F_2 \cup F_3 \cup F_4 \cup F_1$

Answer: D

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2. If n (A) =3 ,n(B)=6 and $A \subseteq B$ .Then the number of elements in $A \cup B$ is equal to

A. 3

B. 9

C. 6

D. Non of these

Answer: C

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3. If set A and B are defined as

$$A = \left\{(x, y) \mid y = \frac{1}{x}, 0 \neq x \in R\right\}, B = \{(x, y) \mid y = -x, x \in R, \}.$$

Then

A. $A \cap B = A$

B. $A \cup B = B$

C. $A \cap B = \phi$

D. $A \cup B = A$

Answer: C

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4. Two finite sets have m and $n(m > n)$ elements .The number of subes of the first set is 112 more than that of the second set. The value of mn is

A. 18

B. 28

C. 32

D. 36

Answer: B

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5. Let A and B be two non empty subsets of set X such that A is not a subset of B, then: (a) A is a subset of complement of B (b) B is a subset of A (c) A and B are disjoint sets (d) A and complement of B are non-disjoint sets

A. A is a subset of complement of B

B. B is a subset of A

C. A and B are disjoint sets

D. A and complement of B are non-disjoint sets

Answer: D

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6. If a N = $\{ax : x \in N\}$ then the set $4N \cap 6N$ is

A. 8N

B. 10 N

C. 12 N

D. Non of these

Answer: C

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7. The set $(A \cap B') \cup (B \cap C)$ equals a).$A' \cup B \cup C$ b).$A' \cup B$ c). $A' \cup C$ d).$A' \cap B$

A. $A' \cup B \cup C$

B. $A' \cup B$

C. $A' \cup C$

D. $A' \cap B$

Answer: B

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8. For sets $(A \cup B) \cup (A \cap B)$equals (a) A' (b) B' (c) A

(d) None of these

A. A'

B. B'

C. A

D. None of these

Answer: D

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9. Let U be the universal set and $A \cup B \cup C = U$, Then

$\{(A - B) \cup (B - C) \cup (C - A)\}'$ is equal to

A. a. $A \cup B \cup C$

B. b. $A \cap B \cap C$

C. c. $A \cup (B \cap C)$

D. d. $A \cap (B \cup C)$

Answer: B

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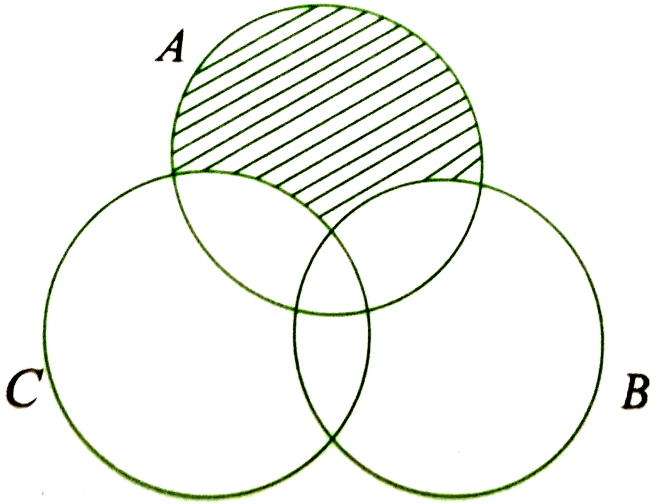
10. The shaded region in the given figure is



A. $A \cap (B \cup C)$

B. $A \cup (B \cap C)$

C. $A \cap (B - C)$

D. $A - (B \cup C)$

Answer: D

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11. Which is the simplified representation of $(A' \cap B' \cap C) \cup (B \cap C) \cup (A \cap C)$ where A,B and C are subsets of set X

A. a. A

B. b. B

C. c. C

D. d. $X \cap (A \cup B \cup C)$

Answer: C

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12. In a statistical investigation of 1,003 families of Calcutta, it was found that 63 families had neither a radio nor a T.V, 794 families had a radio and 187 had a T.V. The number of families in that group having both a radio and a T.V is (a) 36 (b)41 (c) 32 (d) None of these

A. 36

B. 41

C. 32

D. None of these

Answer: B

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13. A survey shows that 63 % of the pepole watch a news channel whereas , 76 % watch an entertiament channel at a particular time If X% of the pepole watch both types of channels , then

A. x= 35

B. $x \geq 63$

C. $39 \leq x \leq 63$

D. x=39

Answer: C

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14. In a town of 10000 families, it was found that 40% families buy newspaper A, 20% families buy newspaper B, 10 % families buy newspaper C, 5% families buy A and B, 3% buy B and C and 4 % buy A and C. If 2% families buy all the three newspaper. Find

(i) the number of families which buy newspaper A only.

A. a. 3100

B. b. 3300

C. c. 2900

D. d. 1400

Answer: B

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15. Complete solution set of inequlaity $\frac{(x+2)(x+3)}{(x-2)(x-3)} \leq 1$

A. $(-\infty, 0)$

B. $(-\infty, 0] \cup (2, 3)$

C. [2,3]

D. $(-\infty, 2) \cup (3, \infty)$

Answer: B

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16. Integral value of x for, which $(5x-1) < (x+1)^2 < 7x-3$

A. 0

B. 1

C. 2

D. 3

Answer: B

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17. If set A $= \left\{ x \mid \frac{x^2(x-5)(2x-1)}{(5x+1)(x+2)} < 0 \right\}$ and Set $B = \left\{ x \mid \frac{3x+1}{6x^3+x^2-x} > 0 \right\}$ then $A \cap B$ does not contain (a) (1,4) (b) (5,11) (c) $\left(-\frac{3}{2}, -\frac{1}{2} \right)$ (d) None of these

A. (1,4)

B. (5,11)

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

D. None of these

Answer: B

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18. Number of intergers satisfying the inequality

$x^4 - 29x^2 + 100 \leq 0$is

A. 2

B. 4

C. 6

D. 8

Answer: D

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19. If $n > 0$ and exactly 15 integers satisfying (x+6)(x-4) (x-5) $(2x - n) \leq 0$ then least possible value of n is

A. a. 10

B. b. 12

C. c. 14

D. d. 16

Answer: D

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20. The solution of the inequality $\left(\frac{x+7}{x-5}+\frac{3x+1}{2}\right) \geq 0$ is

A. a. $[1, 3] \cup (5, \infty)$

B. b. $(1, 3) \cup (5, \infty)$

C. c. $(-\infty, 1) \cup (5, \infty)$

D. d. None of these

Answer: A

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21. The complete solution set of inequality

$$\frac{(x-5)^{1005}(x+8)^{1008}(x-1)}{x^{1006}(x-2)^3(x-3)^5(x-6)(x+9)^{1010}} \leq 0$$

A. 1.$(-\infty, -9) \cup (-8, 0) \cup (0, 1) \cup (2, 3) \cup [5, 6]$

B. 2.$(-\infty, -9) \cup (-9, 0) \cup (0, 1) \cup (2, 3) \cup [5, 6)$

C. 3.$(-\infty, -9) \cup (-9, 0) \cup (0, 1] \cup (2, 3) \cup [5, 6)$

D. 4.$(-\infty, 0) \cup (0, 1] \cup (2, 3) \cup [5, 6)]$

Answer: C

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22. Sum of solution of the equation $|x|^3 - 4|x|^2 + 3|x| = 0$ is

A. 4

B. 3

C. 0

D. 1

Answer: C

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23. Number of integral roots of $|x-1||x^2-2|=2$ is

A. 0

B. 1

C. 2

D. 3

Answer: D

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24. The solution set of the inequlity $\frac{|x-2|-x}{x}<2$ is

A. 1.(0,1)

B. 2.[0,2]

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

D. 4.None of these

Answer: C

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25. Number of solutions of the equation $|2 - |x| \, | \, = x + 4$ is a.0 b.1 c.2 d.Infinite

A. 0

B. 1

C. 2

D. Infinite

Answer: B

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26. Number of intergal values of x satisfying the inequality $\frac{x^2+6x-7}{|x+2||x+3|}<0$is

A. 5

B. 6

C. 7

D. 8

Answer: A

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27. If $-4 \leq x < 2$ then ||x+2|-3| lies in the inerval

A. (1,3]

B. [1,3]

C. [0,3)

D. $[0, \infty)$

Answer: C

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28. Complete set of values of x satisfying inequality $||x-1|-5| < 2x-5$ is

A. $(5/2, \infty)$

B. $(11/3, \infty)$

C. $(-1, \infty)$

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

Answer: B

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29. If $\left|x^2-2x+2\right|-\left|2x^2-5x+2\right|=\left|x^2-3x\right|$ then the set of values of x is

A. $(-\infty,0]\cup[3,00)$

B. $\left[0,\frac{1}{2}\right]\cup[2,3]$

C. $\left[\frac{1}{2},2\right]$

D. $[0,2]\cup[3,\infty)$

Answer: B

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30. The complete solution set of the equation $\left|x^2-5x+6\right|+\left|x^2+12x+27\right|=|17x+21|$ is a.$x\in[-9,3]$ b. $x\in[-3,2)\cup(2,3]$ c.$x\in[-9,-3]\cup[2,3]$ d.$x\in(-2,3)$

A. $x\in[-9,3]$

B. $x\in[-3,2)\cup(2,3]$

C. $x \in [-9, -3] \cup [2, 3]$

D. $x \in (-2, 3)$

Answer: C

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Archives

1. If A,B and C are three sets such that $A \cap B = A \cap C$ and $A \cup B = A \cup C$ then

A. A=B

B. A=C

C. B=C

D. $A \cap B = \phi$

Answer: C

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