



Einstein

PUBLIC SCHOOL

Nurturing a better tomorrow

SUMMER VACATION HOLIDAY HOMEWORK-2026

Class-XI

English

Instructions:

- Complete the work neatly in a separate notebook/file.
- Use creativity, pictures, charts, and proper presentation.
- Write in your own words.
- Mention sources wherever required.

Section A: Reading Skills

1. Newspaper Reading Activity

Read any English newspaper for 15 consecutive days and prepare a table:

Date. Headline. Type (Education/Environment/Politics etc.)

- Summary (50 words)
- Your Opinion
- Write one new vocabulary word daily with meaning and sentence.

2. Unseen Passage Practice

Find one unseen passage from newspaper/magazine and answer:

- Identify theme
- Write summary in 50 words
- Mention 5 difficult words with meanings
- Frame 3 comprehension questions

Section B: Writing Skills & Grammar

3. Poster Making

Prepare any one poster on:

- Save Environment
- Digital Education
- Importance of Reading Books
- Water Conservation

Include: Title, slogan, picture, message.

4. Formal Writing

Write any one:

- a) Job Application with Resume for a Teaching Post

OR

- b) Letter to Editor on excessive use of mobile phones among teenagers

5. Grammar Practice

Solve exercises on:

- Tenses
- Determiners
- Clauses
- Transformation of Sentences
- Error Correction

Write 10 examples of each.

Section C: Literature

Hornbill

6. Chapter: The Portrait of a Lady

- Describe grandmother's character.
- How did the author's relationship change with grandmother?
- What values does grandmother represent?
- Draw timeline of grandmother's life.
- Write a character sketch (120 words).
of kushwant singh and his grandmother

7. Poem: A Photograph

Do the following:

- Explain theme
- Find poetic devices
- Write central 2 idea (100 words)
- Prepare comparison chart between “Past” and “Present”

Snapshot

8. Chapter: The Summer of the Beautiful White Horse

Prepare:

- Character sketch of Aram
- Character sketch of Mourad
- Moral values learnt
- Mind map of story

9. Creative Activity

Choose any chapter and make:

- Storyboard
- OR**
- Character illustration with dialogues

10. Literature Project

Prepare project on:

“Importance of Family Values in Literature”

Include:

- Introduction
- Examples from chapters
- Personal opinion
- Conclusion
- Pictures

Section D: Speaking & Listening Skills

11. Reading Aloud Activity

Read one English article daily for 15 days and maintain record:

- Date
- Topic
- New Words Learnt

12. Presentation Activity

Prepare a 2–3 minute speech on:

- Role of Technology in Education
OR
- Women Empowerment
OR
- Importance of Mental Health.

Bonus Creative Work

Create an English Vocabulary Scrapbook:

- 30 new words
- Meaning
- Synonym
- Antonym
- Sentence
- Picture (optional)

Physical Education

Unit 1: Changing Trends & Career in Physical Education

Unit 2: Olympic Value Education / Olympic Movement

Section A: Short Answer Questions

Answer in 60-80 words each.

1. Define Physical Education and state its two main aims.
2. What are the changing trends in sports equipment and technology? Give two examples.
3. Mention any four career options in the field of Physical Education.
4. What is Olympism? Name the three Olympic values.
5. Write a short note on the Olympic Flag and its symbolism.

Section B: Long Answer Questions

Answer in 150-200 words each.

1. Explain the concept, aims, and objectives of Physical Education. How has it developed in India post-independence?
2. Discuss the changing trends in sports related to playing surfaces, wearable gear, and technological advancements.
3. Describe the Khelo India and Fit India Programs and their role in promoting sports in India.
4. Differentiate between Ancient and Modern Olympic Games. Also explain the Olympic motto, symbol, and oath.
5. Explain the structure of the Olympic Movement. Write about the role of IOC, NOC, and IFS.

Based on CBSE Class 11 Syllabus 2025-26 ce8a

Tips:

- For short questions, use headings and bullet points.
- For long questions, give definitions first, then explain with examples.
- Draw diagrams for Olympic rings and flag if possible.

Want me to make the answer key for this too so you can check after writing?

Computer Science

SR.NO	SUBJECT	TOPICS	ACTIVITY	MATERIAL REQUIRED
8	Computer Science	1. Secondary Storage Devices	1. Make a presentation on Secondary storage devices and take the print out of the slides and make a file of it.	Computer, sheets and printer.
		2. Operators	1. Make a chart of different types of operators with their logic gates and truth table.	Chart, pencil, colors etc
		3. Conversions	2. Write 4 examples of each conversion	Assignment sheets and pen.
			1. Decimal number system to other base. 2. Binary number system to other base . 3. Octal number system to other base. 4. Hexadecimal number system to other base.	

Hindi

सामान्य निर्देश:

- समस्त कार्य हिंदी की सुलेख व गृहकार्य उत्तर-पुस्तिका में सुंदर एवं स्पष्ट लिखावट में करें।
- प्रश्नों के उत्तर मौलिक, तार्किक और विश्लेषणात्मक होने चाहिए।
- परियोजना कार्य (Project Work) को रचनात्मक और कलात्मक बनाने के लिए रंगीन रेखाचित्रों या चित्रों का प्रयोग कर सकते हैं।

खंड 'क': रचनात्मक एवं परियोजना कार्य (Art-Integrated Activities)

1. कबीर का वैचारिक कोलाज: कबीरदास जी के बाह्याडंबरों और सामाजिक कुरीतियों पर प्रहार करने वाले किन्हीं पाँच दोहों/पदों को ए-4 साइज़ शीट पर कलात्मक ढंग से लिखिए और उनके संदेश को स्पष्ट करने वाला एक सुंदर चित्र या कोलाज बनाइए।
2. मीराबाई की भक्ति-भावना: मीराबाई के पदों में अभिव्यक्त 'दास्य' और 'माधुर्य' भाव की तुलना कीजिए। कृष्ण-भक्ति से ओत-प्रोत उनकी किन्हीं दो प्रसिद्ध पंक्तियों का सुंदर सुलेख चार्ट तैयार कीजिए।

खंड 'ख': आरोह (भाग-1) - काव्य खंड (कबीर एवं मीराबाई)

1. कबीर ने ऐसा क्यों कहा है कि "जग बौराना" (संसार पागल हो गया है)? पद के आधार पर उनके इस कथन की तार्किक समीक्षा कीजिए।
2. कबीर के अनुसार ईश्वर का स्वरूप क्या है? उन्होंने लकड़ी और आग के उदाहरण (जैसे बाढ़ी काठ ही कांटे...) से अपने अद्वैतवाद को किस प्रकार सिद्ध किया है?

3. "लोक-लाज खोने" से मीराबाई का क्या तात्पर्य है? समाज ने उन्हें 'कुलनासी' और 'बावरी' क्यों कहा? पद के संदर्भ में स्पष्ट कीजिए।
4. 'ऑसुअन जल सींचि-सींचि, प्रेम-बेलि बोई...' पंक्ति का काव्य-सौंदर्य स्पष्ट कीजिए। यहाँ किस रस की निष्पत्ति हो रही है?

खंड 'ग': आरोह (भाग-1) - गद्य खंड (नमक का दारोगा)

1. "धन के ऊपर धर्म की विजय" — 'नमक का दारोगा' कहानी के इस मुख्य संदेश को मुंशी वंशीधर और पंडित अलोपीदीन के चरित्र के माध्यम से सिद्ध कीजिए।
2. वंशीधर के पिता का चरित्र आज के समाज की किस कड़वी सच्चाई को उजागर करता है? जब वंशीधर ईमानदारी के कारण नौकरी से निलंबित होकर घर लौटे, तो उनके माता-पिता की क्या प्रतिक्रिया थी?
3. कहानी के अंत में पंडित अलोपीदीन द्वारा वंशीधर को अपनी सारी जायदाद का स्थायी मैनेजर नियुक्त करने के पीछे क्या कारण थे? क्या अलोपीदीन का हृदय परिवर्तन वास्तविक था? समीक्षा कीजिए।
4. 'नमक का दारोगा' कहानी का कोई अन्य उपयुक्त शीर्षक सुझाइए और अपने सुझाव के पक्ष में तर्क दीजिए।

खंड 'घ': अभिव्यक्ति और माध्यम (संचार एवं जनसंचार)

1. संचार (Communication) किसे कहते हैं? इसके प्रमुख तत्वों (स्रोत, एनकोडिंग, संदेश, माध्यम, डिकोडिंग, फीडबैक और शोर) को एक सुंदर प्रवाह चार्ट (Flow Chart) बनाकर समझाइए।
2. अंतःव्यक्तिक (Intrapersonal) और अंतर-व्यक्तिक (Interpersonal) संचार में उदाहरण सहित अंतर स्पष्ट कीजिए।
3. जनसंचार (Mass Communication) की प्रमुख विशेषताएँ क्या हैं? आधुनिक समाज पर जनसंचार के सकारात्मक और नकारात्मक प्रभावों की विस्तृत विवेचना कीजिए।
4. जनसंचार के विभिन्न माध्यमों (प्रिंट, रेडियो, टेलीविज़न, इंटरनेट) में से आपको कौन सा माध्यम सबसे अधिक प्रभावशाली और विश्वसनीय लगता है और क्यों?

5. लघु टिप्पणियाँ लिखिए (HOTS):

- येलो जर्नलिज़्म (पीत पत्रकारिता)
- सेंसरशिप और अभिव्यक्ति की स्वतंत्रता
- डिजिटल मीडिया और आज की युवा पीढ़ी

Chemistry

GENERAL INSTRUCTIONS:

- Attempt all questions systematically in your dedicated Chemistry assignment notebook.
- Show step-by-step logic, calculation pathways, relevant formulas, and standard units for all numerical problems.
- Maintain clear handwriting and neatly box final numerical values.

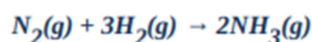
CHAPTER 1: SOME BASIC CONCEPTS OF CHEMISTRY

I. VERY SHORT & SHORT ANSWER TYPE QUESTIONS

1. State the **Law of Definite Proportions**. Provide a suitable experimental example to support and justify this fundamental law. [2]
2. Define and distinguish between **Molarity (M)** and **Molality (m)**. Explain scientifically why molality is preferred over molarity when conducting reactions across variable temperature parameters. [2]
3. Calculate both the total number of moles and the precise count of individual atoms present in a sample of **52 g** of Helium (**He**). (**Atomic mass of He = 4 u**) [2]
4. What is the distinction between **Precision** and **Accuracy** in scientific measurements? Illustrate with a brief example. [2]
5. Define the term **homogeneous mixture**. How does it structurally differ from a **heterogeneous mixture**? Provide two unique laboratory examples for each category. [3]

II. LONG ANSWER & NUMERICAL TYPE QUESTIONS

6. A chemical compound yields the following percentage composition upon quantitative analysis: **Na = 29.11%**, **S = 40.51%**, and **O = 30.38%**. Determine its true **empirical formula** and molecular formula if its molar mass is given as **158 g/mol**. (**Atomic masses: Na = 23, S = 32, O = 16**) [4]
7. Dinitrogen gas and dihydrogen gas are mixed to react with each other dynamically to synthesize ammonia according to the balanced chemical equation:



If **50.0 kg** of $N_2(g)$ and **10.0 kg** of $H_2(g)$ are thoroughly mixed together:

- a. Identify and prove which of the two reactants acts as the **limiting reagent**.
 - b. Calculate the maximum theoretical mass of $NH_3(g)$ produced by this mixture.
 - c. Calculate the mass of the remaining reactant left unreacted at the completion of the process.
8. Commercially available concentrated nitric acid used in laboratory work is **68%** nitric acid by mass in aqueous solution. What should be the molarity of such a sample of the acid if the density of the solution is **1.504 g/mL**? (**Molar mass of HNO_3 = 63 g/mol**) [5]

Physics

1. State the principle of homogeneity of dimensions. Test the dimensional homogeneity of the following equation: $h = h_0 + v_0t + \frac{1}{2}gt^2$.
2. Define dimensional formula. Give uses of dimensional analysis. Write down the limitations of dimensional analysis.
3. If the value of universal gravitational constant in SI is $6.6 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$, then find its value in CGS system.
4. In van der Waal's equation $(P + \frac{a}{V^2})(V - b) = RT$. Determine the dimensions of a and b?
5. If the velocity of light c, the constant of gravitation G and Planck's constant h be chosen as fundamental units, find the dimensions of mass, length and time in terms of c, G and h.
6. A calorie is a unit of heat (energy in transit) and it equals about 4.2 J where $1 \text{ J} = 1 \text{ kg m}^2 \text{ s}^{-2}$. Suppose we employ a system of units in which the unit of mass equals $\alpha \text{ kg}$, the unit of length equals $\beta \text{ m}$, the unit of time is $\gamma \text{ s}$. Show that a calorie has a magnitude of $4.2 \alpha^{-1} \beta^{-2} \gamma^2$ in terms of the new units.
7. **Assertion-Reason Type questions:**
 - (a) If both assertion and reason are true and reason is the correct explanation of assertion.
 - (b) If both assertion and reason are true but reason is not the correct explanation of assertion.
 - (c) If assertion is true but reason is false
 - (d) If both assertion and reason are false
 - (e) If assertion is false but reason is true.
 - (i) Assertion: When we change the unit of measurement of a quality, its numerical value changes. Reason: Smaller the unit of measurement smaller is its numerical value.
 - (ii) Assertion: The equation $y = x + t$ cannot be true, where x, y are distance and t is time.
Reason: Quantities with different dimensions cannot be added.
 - (iii) Assertion: Number of significant figure is 0.005 and is one and that in 0.500 is three.
Reason: Zeroes are not significant figures.

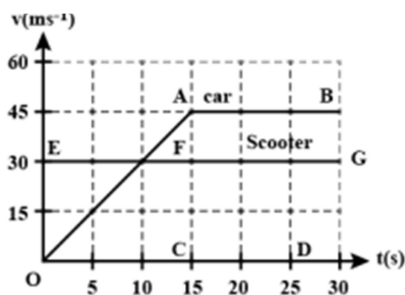
8. If displacement of particle is given by $x = t^2 + 5t + 3$. Find (i) Velocity of the particle at $t = 3s$ and (ii) Average velocity of the particle between $t = 1s$ to $t = 3s$.

9. A body travelling along a straight line traversed one-half of the total distance with velocity v_0 . The remaining part of the distance was covered with a velocity v_1 , for half the time and with velocity v_2 for the other half of time. Find the mean velocity averaged over the whole time of motion.

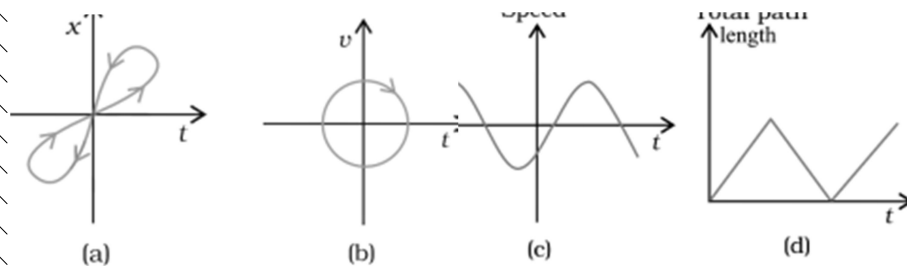
10. In a car race, car A takes time t second less than car B and finishes the finishing point with a velocity v more than that of the car B. Assuming that the cars start from rest and travel with constant acceleration a_1 and a_2 respectively show that $v = t\sqrt{a_1 a_2}$.

11. A woman starts from her home at 9.00 am, walks with a speed of 5 km h^{-1} on a straight road up to her office 2.5 km away, stays at the office up to 5.00 pm, and returns home by an auto with a speed of 25 km h^{-1} . Choose suitable scales and plot the x - t graph of her motion.

12. As soon as a car just starts from rest in a certain direction, a scooter moving with a uniform speed overtakes the car. Their velocity time graphs are shown in the figure. Calculate (i) the difference between the distances travelled by the car and the scooter in 15s (ii) the time when the car will catch up the scooter and (iii) the distance of car and scooter from the starting point at that instant.



13. Look at the graphs (a) to (d) (Fig.) carefully and state, with reasons, which of these cannot possibly represent one-dimensional motion of a particle.



14. Assertion-Reason Type questions:

- (a) If both assertion and reason are true and reason is the correct explanation of assertion.
- (b) If both assertion and reason are true but reason is not the correct explanation of assertion.

(c) If assertion is true but reason is false

(d) If both assertion and reason are false

(e) If assertion is false but reason is true.

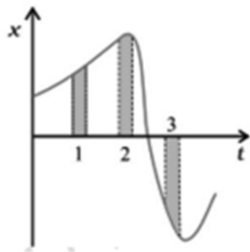
(i) Assertion: A body may be accelerated even when it is moving at uniform speed.

Reason: When direction of motion of the body is changing then body may have acceleration.

(ii) Assertion: A body falling freely many does so with constant velocity.

Reason: A body falls freely, when acceleration of the body is equal to acceleration due to gravity.

15. Figure gives the x - t plot of a particle in one-dimensional motion. Three different equal intervals of time are shown. In which interval is the average speed greatest, and in which is it the least? Give the sign of average velocity for each interval.



Mathematics

WORKSHEET-I

1. Describe each of the following sets in Roster form

(i) $\{x : x \text{ is a positive integer and a divisor of } 9\}$ [$\{1, 3, 9\}$]

(ii) $\{x : x \in \mathbb{Z} \text{ and } |x| \leq 2\}$ [$x = 0, \pm 1, \pm 2$]

(iii) $\{x : x \text{ is a letter of the word 'PROPORTION'}\}$ [$\{P, R, O, T, I, N\}$]

(iv) $\left\{x : x = \frac{n}{n^2 + 1} \text{ and } 1 \leq n \leq 3, \text{ where } n \in \mathbb{N}\right\}$ [$\left\{\frac{1}{2}, \frac{2}{5}, \frac{3}{10}\right\}$]

2. Write the set $\left\{\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \frac{5}{6}, \frac{7}{8}, \frac{8}{9}, \frac{9}{10}\right\}$ in the set-builder form.

$$[X = \left\{1, \frac{1}{4}, \frac{1}{9}, \frac{1}{16}, \frac{1}{25}, \dots\right\} \text{ in the set builder form.}]$$

3. Describe the following sets in Roster form:

(i) $\{x : x \text{ is a letter before } e \text{ in the English alphabet}\}$. [$\{a, b, c, d\}$]

(ii) $\{x \in \mathbb{N} : x^2 < 25\}$ [$\{1, 2, 3, 4\}$]

(iii) $\{x \in \mathbb{N} : x \text{ is a prime number, } 10 < x < 20\}$ [$\{11, 13, 17, 19\}$]

(iv) $\{x \in \mathbb{N} : x = 2n, n \in \mathbb{N}\}$ [$\{2, 4, 6, 8, \dots\}$]

(v) $\{x \in \mathbb{N} : x > x\}$ [ϕ]

(vi) $\{x : x \text{ is a prime number which is a divisor of } 60\}$. [$\{2, 3, 5\}$]

(vii) $\{x : x \text{ is a two digit number such that the sum of its digits is } 8\}$
[$\{17, 26, 35, 44, 53, 62, 71, 80\}$]

(viii) The set of all letters in the word 'Trigonometry'. [$\{T, R, I, G, O, N, M, E, Y\}$]

(ix) The set of all letters in the word 'Better'.
[$\{T, R, I, G, O, N, M, E, Y\}$](ix) $\{B, E, T, R\}$]

4. Describe the following sets in set-builder form:

(i) $A = \{1, 2, 3, 4, 5, 6\}$ [$\{x : x \in \mathbb{N}, x < 7\}$]

(ii) $B = \{1, 1/2, 1/3, 1/4, 1/5, \dots\}$ [$\{x : x = 1/n, n \in \mathbb{N}\}$]

(iii) $C = \{0, 3, 6, 9, 12, \dots\}$ [$\{x : x = 3n, n \in \mathbb{Z}^+\}$]

(iv) $D = \{10, 11, 12, 13, 14, 15\}$ [$\{x : x \in \mathbb{N}, 9 < x < 16\}$]

(v) $E = \{0\}$ [$\{x : x = 0\}$]

(vi) $\{1, 4, 9, 16, \dots, 100\}$ [$\{x^2 : x \in \mathbb{N}, 1 \leq x \leq 10\}$]

(viii) $\{2, 4, 6, 8, \dots\}$ [$\{x : x = 2n, n \in N\}$]

(viii) $\{5, 25, 125, 625\}$ [$\{5^n : n \in N, 1 \leq n \leq 4\}$]

5. List all the elements of the following sets:

(i) $A = \{x : x^2 \leq 10, x \in Z\}$ [$A = \{0, \pm 1, \pm 2, \pm 3\}$]

(ii) $B = \left\{x : x = \frac{1}{2n-1}, 1 \leq n \leq 5\right\}$ [$B = \left\{1, \frac{1}{3}, \frac{1}{5}, \frac{1}{7}, \frac{1}{9}\right\}$]

(iii) $\left\{C = x : x \text{ is an integer, } \frac{1}{2} < x < \frac{9}{2}\right\}$ [$C = \{0, 1, 2, 3, 4\}$]

(iv) $D = \{x : x \text{ is a vowel in the word "EQUATION"}\}$ [$X = \{A, E, I, O, U\}$]

(v) $E = \{x : x \text{ is a month of a year not having 31 days}\}$
[$E = \{\text{Feb., April, June, Sept., November}\}$]

(vi) $F = \{x : x \text{ is a letter of the word "MISSISSIPPI"}\}$ [$F = \{M, I, S, P\}$]

6. Write the set $\left\{\frac{1}{2}, \frac{2}{5}, \frac{3}{10}, \frac{4}{17}, \frac{5}{26}, \frac{6}{37}, \frac{7}{50}\right\}$ in the set-builder form. [$\left\{\frac{n}{n^2+1} : n \in N, n \leq 7\right\}$]

7. Which of the following sets are finite and which are infinite?

(i) Set of concentric circles in a plane. [Infinite]

(ii) Set of letters of the English Alphabets [Finite]

(iii) $\{x \in N : x > 5\}$ [Infinite]

(iv) $\{x \in N : x < 200\}$ [Finite]

(v) $\{x \in Z : x < 5\}$ [Infinite]

(vi) $\{x \in R : 0 < x < 1\}$ [Infinite]

8. Which of the following sets are equal?

(i) $A = \{1, 2, 3\}$

(ii) $B = \{x \in R : x^2 - 2x + 1 = 0\}$

(iii) $C = \{1, 2, 2, 3\}$

(iv) $D = \{x \in R : x^3 - 6x^2 + 11x - 6 = 0\}$ [$A = C = D$]

9. Two finite sets have m and n elements. The total number of subsets of the first set is 56 more than the total number of subsets of the second set. Find the values of m and n. [$X \subset Y$]

10. Write the following subsets of R as intervals:

(i) $\{x : x \in R, -4 < x \leq 6\}$ [$\{x : x \in R, -4 < x \leq 6\} = (-4, 6]$ Length = $6 - (-4) = 10$]

(ii) $\{x : x \in R, -12 < x < -10\}$

$$[\{x: x \in R, -12 < x < -10\}] = (-12, 10). \text{ Length} = -10 - (-12) = 2]$$

$$(iii) \quad \{x: x \in R, 0 \leq x < 7\} \qquad [\{x: x \in R, 0 \leq x < 7\}] = [0, 7). \text{ Length} = 7 - 0 = 7]$$

$$(iv) \quad \{x: x \in R, 3 \leq x \leq 4\} \qquad [\{x: x \in R, 3 \leq x \leq 4\}] = [3, 4]. \text{ Length} = 4 - 3 = 1]$$

Also, find the length of each interval.

11. Write the following intervals in the set-builder form:

$$(i) \quad (-7, 0) \qquad [(-7, 0) = \{x: x \in R \text{ and } -7 < x < 0\}]$$

$$(ii) \quad [6, 12] \qquad [[6, 12] = \{x: x \in R \text{ and } 6 \leq x \leq 12\}]$$

$$(iii) \quad (6, 12] \qquad [(6, 12] = \{x: x \in R \text{ and } 6 < x \leq 12\}]$$

$$(iv) \quad [-20, 3) \qquad [[-20, 3) = \{x: x \in R \text{ and } -20 \leq x < 3\}]$$

12. Let $A = \{a, b, \{c, d\}, e\}$. Which of the following statements are false and why?

$$(i) \quad \{c, d\} \subset A \qquad \text{[F]}$$

$$(ii) \quad \{c, d\} \in A \qquad \text{[T]}$$

$$(iii) \quad \{\{c, d\}\} \subset A \qquad \text{[T]}$$

$$(iv) \quad a \in A \qquad \text{[T]}$$

$$(v) \quad a \subset A \qquad \text{[F]}$$

$$(vi) \quad \{a, b, e\} \subset A \qquad \text{[T]}$$

$$(vii) \quad \{a, b, e\} \in A \qquad \text{[F]}$$

$$(viii) \quad \{a, b, c\} \subset A \qquad \text{[F]}$$

$$(ix) \quad \phi \in A \qquad \text{[T]}$$

$$(x) \quad \{\phi\} \subset A \qquad \text{[F]}$$

13. Let $A = \{\{1, 2, 3\}, \{4, 5\}, \{6, 7, 8\}\}$. Determine which of the following is true or false.

$$(i) \quad 1 \in A \qquad \text{[F]}$$

$$(ii) \quad \{1, 2, 3\} \subset A \qquad \text{[F]}$$

$$(iii) \quad \{6, 7, 8\} \in A \qquad \text{[T]}$$

$$(iv) \quad \{\{4, 5\}\} \subset A \qquad \text{[T]}$$

$$(v) \quad \phi \in A \qquad \text{[F]}$$

$$(vi) \quad \phi \subset A \qquad \text{[T]}$$

14. Let $A = \{\phi, \{\phi\}, 1, \{1, \phi, 2\}\}$. Which of the following are true?

$$(i) \quad \phi \in A \qquad \text{[T]}$$

$$(ii) \quad \{\phi\} \in A \qquad \text{[T]}$$

- (iii) $\{1\} \in A$ [F]
- (iv) $\{2, \phi\} \subset A$ [T]
- (v) $2 \subset A$ [F]
- (vi) $\{2, \{1\}\} \subset A$ [T]
- (vii) $\{\{2\}, \{1\}\} \subset A$ [T]
- (viii) $\{\phi, \{\phi\}, \{1, \phi\}\} \subset A$ [T]
- (ix) $\{\{\phi\}\} \subset A$ [T]

15. Write down all possible subsets of each of the following sets:

- (i) $\{a\}$ [$\phi, \{a\}$]
- (ii) $\{0, 1\}$ [$\phi, \{0\}, \{1\}, \{0, 1\}$]
- (iii) $\{a, b, c\}$ [$\phi, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{a, b, c\}$]
- (iv) $\{1, \{1\}\}$ [$\phi, \{1\}, \{\{1\}\}, \{1, \{1\}\}$]

16. If A and B are two sets such that $A \subset B$, then find:

- (i) $A \cap B$ (ii) $A \cup B$ [(i)A (ii)B]

17. Let $A = \{x : x \in N\}, B = \{x : x = 2n, n \in N\}, C = \{x : x = 2n - 1, n \in N\}$

and, $D = \{x : x \text{ is a prime natural number}\}$. Find

- (i) $A \cap B$ (ii) $A \cap C$
 - (iii) $A \cap D$ (iv) $B \cap C$
 - (v) $B \cap D$ (vi) $C \cap D$
- [(i)B (ii)C (iii)D (iv) ϕ (v)(A')' (vi)(B-C)']

18. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}, A = \{1, 2, 3, 4\}, B = \{2, 4, 8\}$ and $C = \{3, 4, 5, 6\}$

- (i) A' [$\{5, 6, 7, 8, 9\}$]
- (ii) B' [$\{1, 3, 5, 7, 9\}$]
- (iii) $(A \cap C)'$ [$\{1, 2, 5, 6, 7, 8, 9\}$]
- (iv) $(A \cap B)'$ [$\{5, 7, 9\}$]
- (v) $(A')'$ [A]
- (vi) $(B - C)'$ [$\{1, 3, 4, 5, 6, 7, 9\}$]

19. Let A, B and C be the sets such that $A \cup B = A \cup C$ and $A \cap B = A \cap C$. Show that $B = C$.

20. Using properties of sets, show that for any two sets A and B, $(A \cup B) \cap (A \cup B') = A$.

$$\begin{aligned} & [(A \cup B) \cap (A \cup B')] = ((A \cup B) \cap A) \cup ((A \cup B) \cap B') \\ & = (A \cup ((A \cup B) \cap B')) = A \cup (A \cap B') \cup (B \cap B') = A \cup (A \cap B') = A \end{aligned}$$

21. Show that for any sets A and B ,
- (i) $A = (A \cap B) \cup (A - B)$
- (ii) $A \cup (B - A) = A \cup B$
22. In a group of 50 people, 35 speak Hindi, 25 speak both English and Hindi and all the people speak at least one of the two languages. How many people speak only English and not Hindi? How many people speak English? [40]
23. There are 200 individuals with a skin disorder, 120 has been exposed to chemical C_1 , 50 to chemical C_2 and 30 to both the chemicals C_1 and C_2 . Find the number of individuals exposed to (i) Chemical C_1 or chemical C_2 (ii) Chemical C_1 but not chemical C_2 (iii) Chemical C_2 but not chemical C_1 .
[(i)140 (ii)90 (iii)20]
24. If A and B be two sets containing 3 and 6 elements respectively, when can be the minimum number of elements in $A \cup B$? Find Also, the maximum number of elements in $A \cup B$
[Maximum number of elements in $A \cup B = 9$.
Minimum number of elements in $A \cup B = 6$]
25. There are 40 students in a Chemistry class and 650 students in a Physics class. Find the number of students which are either in Physics class or Chemistry class in the following cases:
- (i) The two classes meet at the same hour.
- (ii) the two classes meet at different hours and 20 students are enrolled in both the subjects.
[(i)100 (ii)80]
26. In a survey of 700 students in a college, 180 were listed as drinking Limca, 275 as drinking Miranda and 95 were listed as both drinking Limca as well as Miranda. Find how many students were drinking neither Limca nor Miranda. [340]
27. A survey shows that 63% of the Americans like cheese whereas 76% like apples. If $x\%$ of the Americans like both cheese and apples, find the value of x . [$39 \leq x \leq 63$]
28. In a class of 35 students, 17 have taken Mathematics, 10 have taken Mathematics but not Economics. Find the number of students who have taken both Mathematics and Economics and the number of students who have taken Economics but not Mathematics, if it is given that each student has taken either Mathematics or Economics or both. [18]
29. In a town of 10,000 families it was found that 40% families buy newspaper A, 20% families buy newspaper B and 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 news papers, find the number of families which buy (i) A only (ii) B only (iii) none of A, B and C. [(i)3300 (ii)1400(iii)4000]
30. A college awarded 38 medals in Football, 15 in Basketball and 20 to Cricket. If these medals went to a total of 58 men and only three men got medals in all the three sports, how many received metals in exactly two of the three sports? [9]
31. In a survey of 25 students, it was found that 15 had taken Mathematics, 12 had taken Physics and 11 had taken Chemistry, 5 had taken Mathematics and Chemistry, 9 had taken Mathematics and Physics, 4 had taken Physics and Chemistry and 3 had taken all the three subjects. Find the number of students that had
- (i) Only Chemistry
- (ii) Only Mathematics
- (iii) Only Physics

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- (iv) Physics and Chemistry but not Mathematics
 - (v) Mathematics and Physics but not Chemistry
 - (vi) Only one of the subjects
 - (vii) At least one of the three subjects
 - (viii) None of the subjects. [(i)5 (ii)4 (iii)2 (iv)1 (v)6 (vi)11 (vii)23 (viii)2]
32. Let A and B be two sets such that : $n(A) = 20$, $n(A \cup B) = 42$ and $n(A \cap B) = 4$. Find
- (i) $n(B)$
 - (ii) $n(A - B)$
 - (iii) $n(B - A)$ [(i) 26 (ii) 16 (iii) 22]
33. In a survey of 60 people, it was found that 25 people read newspaper H, 26 read newspapers T, 26 read newspaper I, 9 read both H and I, 11 read both H and T, 8 read both T and I, 3 read all three newspapers. Find:
- (i) The numbers of people who reads at least one of the newspapers.
 - (ii) The number of people who read exactly one newspaper. [(i)52 (ii) 30]
34. Of the members of three athletic teams in a certain school, 21 are in the basketball team, 26 in hockey team and 29 in the football team. 14 play hockey and basketball, 15 play hockey and football, 12 play football and basketball and 8 play all the three games. How many members are there in all? [43]
35. In a survey of 10 persons it was found that 28 read magazine A, 30 read magazine B, 42 read magazine C, 8 read magazines A and B, 10 read magazines A and C, 5 read magazines B and C and 3 read all the three magazines. Find
- (i) How many read none of three magazine?
 - (ii) How many read magazine C only? [(i) 20 (ii) 30]

Ch.2 - Relations and Functions

WORKSHEET-I

- Find x and y , if $(x + 3, 5) = (6, 2x + y)$ [-1]
- Let $A = \{1, 2, 3\}$ and $B = \{x : x \in N, x \text{ is prime less than } 5\}$. Find $A \times B$ and $B \times A$.
 $A \times B = \{1, 2, 3\} \times \{2, 3\} = \{(1, 2), (1, 3), (2, 2), (2, 3), (3, 2), (3, 3)\}$
 $B \times A = \{2, 3\} \times \{1, 2, 3\} = \{(2, 1), (2, 2), (2, 3), (3, 1), (3, 2), (3, 3)\}$
- If $A \times B = \{(a, 1), (b, 3), (a, 3), (b, 1), (a, 2), (b, 2)\}$, find A and B .
[$A = \{a, b\}$ and $B = \{1, 2, 3\}$]
- Let A and B be two sets such that $A \times B$ consist of 6 elements. If three elements of $A \times B$ are : $(1, 4)$, $(2, 6)$, $(3, 6)$. Find $A \times B$ and $B \times A$.
 $A \times B = \{1, 2, 3\} \times \{4, 6\} = \{(1, 4), (1, 6), (2, 4), (2, 6), (3, 4), (3, 6)\}$
 $B \times A = \{4, 6\} \times \{1, 2, 3\} = \{(4, 1), (4, 2), (4, 3), (6, 1), (6, 2), (6, 3)\}$
- The Cartesian produce $A \times A$ has 9 elements among which are found $(-1, 0)$ and $(0, 1)$. Find the set A and the remaining elements of $A \times A$. [$A = \{-1, 0, 1\}$]
- Let A and B be two sets such that $n(A) = 5$ and $n(B) = 2$. If a, b, c, d, e are distinct and $(a, 2), (b, 3), (c, 2), (d, 3), (e, 2)$ are in $A \times B$, find A and B . [$A = \{a, b, c, d, e\}$, $B = \{2, 3\}$]
- Let $A = \{-1, 3, 4\}$ and $B = \{2, 3\}$. Represent the following products graphically i.e. by lattices:
(i) $A \times B$ (ii) $B \times A$ (iii) $A \times A$
- If the ordered pairs $(x, -1)$ and $(5, y)$ belong to the set $\{(a, b) : b = 2a - 3\}$, find the values of x and y .
[$X = 1, y = 7$]
- If $a \in \{-1, 2, 3, 4, 5\}$ and $b \in \{0, 3, 6\}$, write the set of all ordered pairs (a, b) such that $a + b = 5$.
[$\{(-1, 6), (2, 3), (5, 0)\}$]
- If $a \in \{2, 4, 6, 9\}$ and $b \in \{4, 6, 18, 27\}$, then form the set of all ordered pairs (a, b) such that a divides b and $a < b$.
[$\{(2, 4), (2, 6), (2, 18), (6, 18), (9, 18), (9, 27)\}$]
- If $A = \{1, 2, 3\}$ and $B = \{2, 4\}$, what are $A \times B, B \times A, A \times A, B \times B$, and $(A \times B) \cap (B \times A)$?
[$\{(2, 2)\}$]
- If A and B are two sets having 3 elements in common. If $n(A) = 5, n(B) = 4$, find $n(A \times B)$ and $n[(A \times B) \cap (B \times A)]$
[$n(A \times B) = 20, n[(A \times B) \cap (B \times A)] = 9$]
- If $A = \{-1, 1\}$, find $A \times A \times A$.
 $A \times A \times A = \{(-1, -1, -1), (-1, -1, 1), (-1, 1, -1), (-1, 1, 1), (1, -1, -1), (1, -1, 1), (1, 1, -1), (1, 1, 1)\}$
- Let $A = \{1, 2\}, B = \{1, 2, 3, 4\}, C = \{5, 6\}$ and $D = \{5, 6, 7, 8\}$. Verify that:
(i) $A \times C \subset B \times D$
(ii) $A \times (B \cap C) = (A \times B) \cap (A \times C)$
[$R = \{(1, 1), (1, 2), (1, 3), (1, 4), (2, 2), (2, 4), (3, 3), (4, 4)\}$]
- If $A = \{1, 3, 5, 7\}, B = \{2, 4, 6, 8, 10\}$ and let $R = \{(1, 8), (3, 6), (5, 2), (7, 4)\}$ be a relation from A to B . Then,
Domain $(R) = \{1, 3, 5\}$ and Range $(R) = \{8, 6, 2, 4\}$

16. Let $A = \{1, 3, 5, 7\}$ and $B = \{2, 4, 6, 8\}$ be two sets and let R be a relation from A to B defined by the phrase " $(x, y) \in R \Leftrightarrow x > y$ ". Under this relation R , we obtain $3R2, 5R2, 5R4, 7R2, 7R4$ and $7R6$.
17. Let A be the set of first ten natural numbers and let R be a relation on A defined by $(x, y) \in R \Leftrightarrow x + 2y = 10$ i.e. $R = \{(x, y) : x \in A, y \in A \text{ and } x + 2y = 10\}$. Express R and R^{-1} as sets of ordered pairs. Also, determine (i) domains of R and R^{-1} (ii) Ranges of R and R^{-1} . [Dom (R^{-1}).]
18. A relation R is defined on the set Z of integers as: $(x, y) \in R \Leftrightarrow x^2 + y^2 = 25$ [Dom(R^{-1}).]
19. Let R be the relation on the set N of natural numbers defined by $R = \{(a, b) : a + 3b = 12, a \in N\}$
 Find
 (i) R
 (ii) Domain of R
 (iii) Range of R
 [(i) $R = \{(9, 1), (6, 2), (3, 3)\}$ (ii) Domain of $R = \{9, 6, 3\}$ (iii) Range of $R = \{1, 2, 3\}$]
20. Let $A = \{1, 2, 3, 4, 5, 6\}$. Define a relation R on set A by $R = \{(x, y) : y = x + 1\}$
 (i) Depict this relation using an arrow diagram [$R = \{(1, 2), (2, 3), (3, 4), (4, 5), (5, 6)\}$]
 (ii) Write down the domain, co-domain and range of R .
 [Domain (R) = $\{1, 2, 3, 4, 5\}$ Range (R) = $\{2, 3, 4, 5, 6\}$]
21. Determine the domain and range of the relation R defined by
 (i) $R = \{(x, x + 5) : x \in \{0, 1, 2, 3, 4, 5\}\}$
 [Domain $R = \{0, 1, 2, 3, 4, 5\}$, Range $R = \{5, 6, 7, 8, 9, 10\}$]
 (ii) $R = \{(x, x^3) : x \text{ is a prime number less than } 10\}$
 [Domain $R = \{2, 3, 5, 7\}$, Range $R = \{8, 27, 125, 343\}$]
22. Let $A = \{a, b\}$. List all relations on A and find their number [16]
23. Let $A = \{x, y, z\}$ and $B = \{a, b\}$. Find the total number of relations from A into B . [64]
24. Let $A = \{1, 2, 3, \dots, 14\}$. Define a relation on a set A by
 $R = \{(x, y) : 2x - y = 0, \text{ where } x, y \in A\}$
 Depict this relationship using an arrow diagram. Write down its domain, co-domain and range.
 [Domain (R) = $\{1, 2, 3, 4\}$, Co-domain (R) = A , Range (R) = $\{3, 6, 9, 12\}$]
25. Define a relation R on the set N of natural numbers by
 $R = \{(x, y) : y = x + 5, x \text{ is a natural number less than } 4, x, y \in N\}$
 Depict this relationship using
 (i) roster form [$R = \{(1, 6), (2, 7), (3, 8)\}$]
 (ii) an arrow diagram. Write down the domain and range of R
 [Domain (R) = $\{1, 2, 3\}$, Range (R) = $\{6, 7, 8\}$]
26. Let $A = \{1, 2, 3, 4, 5, 6\}$. Let R be a relation on A defined by
 $R = \{(a, b) : a, b \in A, b \text{ is exactly divisible by } a\}$
 (i) Write R in roster form

$$[R = \{(1, 1), (1, 2), (1, 3), (1, 4), (1, 5), (1, 6), (2, 2), (2, 4), (2, 6), (3, 3), (3, 6), (4, 4), (5, 5), (6, 6)\}]$$

(ii) Find the domain of R [Domain (R) = {1, 2, 3, 4, 5, 6}]

(iii) Find the range of R. [Range (R) = {1, 2, 3, 4, 5, 6}]

27. Let R be the relation on Z defined by $R = \{(a, b) : a, b \in Z, a - b \text{ is an integer}\}$. Find the domain and range of R. [(i) Domain (R) = Z, Range (R) = Z.]

28. Find the domain for which the function $f(x) = 2x^2 - 1$ and $g(x) = 1 - 3x$ are equal. [$\{-2, 1/2\}$]

29. Is $g = \{(1, 1), (2, 3), (3, 5), (4, 7)\}$ a function? If this is described by the formula, $g(x) = \alpha x + \beta$, then what values should be assigned to α and β ? [$\alpha = 2, \beta = -1$]

30. Let $f = \{(1, 1), (2, 3), (0, -1), (-1, -3)\}$ be a function described by the formula $f(x) = ax + b$ for some integers a, b. Determine a, b. [a = 2 and b = -1.]

31. If $f : R \rightarrow R$ be defined as follows: $f(x) = \begin{cases} 1, & \text{if } x \in Q \\ -1, & \text{if } x \notin Q \end{cases}$

Find (i) $f(1/2), f(\pi), f(\sqrt{2})$ (ii) Range of f.

(iii) pre-image of 1 and -1

[(i) -1 (ii) $f = \{1, -1\}$ (iii) $f^{-1}(-1) = R - Q = \text{Set of irrational numbers.}$]

32. If a function $f : R \rightarrow R$ be defined by

$$f(x) = \begin{cases} 3x - 2, & x < 0 \\ 1, & x = 0 \\ 4x + 1, & x > 0 \end{cases}$$

Find: $f(1), f(-1), f(0), f(2)$

[$f(1) = 5, f(-1) = -5, f(0) = 1, f(2) = 9$]

33. If $f(x) = 3x^4 - 5x^2 + 9$, find $f(x-1)$ [$3x^4 - 12x^3 + 13x^2 - 2x + 7$]

34. If $f(x) = x + \frac{1}{x}$, prove that $[f(x)]^3 = f(x^3) + 3f\left(\frac{1}{x}\right)$

35. If $f(x) = \frac{1}{2x+1}, x \neq -\frac{1}{2}$, then show that $f(f(x)) = \frac{2x+1}{2x+3}$, provide that $x \neq -\frac{3}{2}$.

36. If f is a real function defined by $f(x) = \frac{x-1}{x+1}$, then prove that: $f(2x) = \frac{3f(x)+1}{f(x)+3}$

37. If $f(x) = (a - x^n)^{1/n}, a > 0$ and $n \in N$, then prove that $f(f(x)) = x$ for all x.

38. If $f(x) = x^3 - \frac{1}{x^3}$, show that $f(x) + f\left(\frac{1}{x}\right) = 0$.

39. If for non-zero x, $af(x) + bf\left(\frac{1}{x}\right) = \frac{1}{x} - 5$, where $a \neq b$, then find f(x). [$\frac{1}{a^2 - b^2} \left\{ \frac{a}{x} - bx \right\} - \frac{5}{a+b}$]

40. Find the domain of each of the following real valued functions:

(i) $f(x) = \frac{1}{x+2}$ [Domain (f) = $R - \{-2\}$]

(ii) $f(x) = \frac{x-1}{x-3}$ [Domain (f) = $R - \{3\}$]

(iii) $f(x) = \frac{2x-3}{x^2-3x+2}$ [Domain (f) = $R - \{1, 2\}$]

(iv) $f(x) = \frac{x^2+3x+5}{x^2-5x+4}$ [Domain (F) = $[-2, 2]$]

41. Find the domain of each of the following functions:

(i) $f(x) = \sqrt{x-2}$ [Domain (f) = $[2, \infty)$]

(ii) $f(x) = \frac{1}{\sqrt{1-x}}$ [Domain (f) = $(-\infty, 1)$]

(iii) $f(x) = \sqrt{4-x^2}$ [Domain (f) = $[-2, 2]$]

42. Find the domain of the function $f(x)$ defined by $f(x) = \sqrt{4-x} + \frac{1}{\sqrt{x^2-1}}$
[Domain (f) = $(-\infty, -1) \cup (1, 4]$]

43. Find the domain and range of the function $f(x)$ given by $f(x) = \frac{x-2}{3-x}$
[Domain (f) = $R - \{3\}$, Range (f) = $R - \{-1\}$].

44. Find the range of each of the following functions:

(i) $f(x) = \frac{1}{\sqrt{x-5}}$ [Domain (f) = $(5, \infty)$, Range (f) = $(0, \infty)$]

(ii) $f(x) = \sqrt{16-x^2}$ [Domain (f) = $[-4, 4]$, Range (f) = $[0, 4]$]

(iii) $f(x) = \frac{x}{1+x^2}$ [Domain (f) = R , Range (f) = $[-1/2, 1/2]$]

(iv) $f(x) = \frac{3}{2-x^2}$ [Domain (f) = $R - \{-\sqrt{2}, \sqrt{2}\}$, Range (f) = $(-\infty, 0) \cup [3/2, \infty)$]

45. Find the domain and range of the function $f(x) = \frac{x^2-9}{x-3}$
[Domain (f) = $R - \{3\}$, Range (f) = $R - \{6\}$]

46. Find the Domain and Range of the function $f(x) = \frac{1}{2 - \sin 3x}$
[Domain (f) = R , Range (f) = $[1/3, 1]$]

47. Find the domain and range of each of the following real valued functions:

(i) $f(x) = \frac{ax+b}{bx-a}$ [Domain $R - \left\{ \frac{a}{b} \right\}$ Range $R - \left\{ \frac{a}{b} \right\}$]

(ii) $f(x) = \frac{ax-b}{cx-d}$ [Domain $R - \left\{ \frac{d}{c} \right\}$ Range $R - \left\{ \frac{a}{c} \right\}$]

- (iii) $f(x) = \sqrt{x-1}$ [Domain $[1, \infty)$ Range $[0, 8]$]
- (iv) $f(x) = \sqrt{x-3}$ [Domain $[3, \infty)$ Range $[0, 8]$]
- (v) $f(x) = \frac{x-2}{2-x}$ [Domain $\mathbb{R} - \{2\}$ Range $\{-1\}$]
- (vi) $f(x) = |x-1|$ [Domain \mathbb{R} Range $[0, 8]$]
- (vii) $f(x) = -|x|$ [Domain \mathbb{R} Range $(-\infty, 0]$]
- (viii) $f(x) = \sqrt{9-x^2}$ [Domain $[-3, 3]$ Range $[0, 3]$]

48. Let f and g be two real functions defined by $f(x) = \frac{1}{x+4}$ and $g(x) = (x+4)^3$.

Find the following:

- (i) $f + g$ [$\frac{(x+4)^4}{x+4}$]
- (ii) $f - g$ [$\frac{1-(x+4)^4}{x+4}$]
- (iii) fg [$(x+4)^2$]
- (iv) $\frac{f}{g}$ [$\mathbb{R} - \{-4\}$]
- (v) $2f$ [$x \in \mathbb{R} - \{-4\}$]
- (vi) $\frac{1}{f}$ [$(x+4)$]
- (vii) $\frac{1}{8}$ [$\frac{1}{(x+4)^3}$]

49. Find the domain of each of the following functions given by

- (i) $f(x) = \frac{1}{\sqrt{x-|x|}}$ [Domain $(f) = \emptyset$]
- (ii) $f(x) = \frac{1}{\sqrt{x+|x|}}$ [Domain $(f) = (0, \infty)$]
- (iii) $f(x) + \frac{1}{\sqrt{x-[x]}}$ [Domain $(f) = \mathbb{R} - \mathbb{Z}$]
- (iv) $f(x) + \frac{1}{\sqrt{x+[x]}}$ [Domain $(f) = (0, \infty)$]

50. Find the domain of definition of the function $f(x)$ given by $f(x) = \frac{1}{\log_{10}(1-x)} + \sqrt{x+2}$.

$$[\text{Domain } (f) = (-\infty, 0) \cup (0, 1) \cap [-2, \infty) = [-2, 0) \cup (0, 1]]$$

51. Find the range of each of the following functions:

(i) $f(x) = |x - 3|$ [Range $(f) = [0, \infty)$]

(ii) $f(x) = 1 - [x - 2]$ [Range $(f) = (-\infty, 1]$]

(iii) $f(x) = \frac{|x - 4|}{x - 4}$ [Range $(f) = \{-1, 1\}$]

52. Find the domain and range of each of the following functions given by

(i) $f(x) = \frac{1}{\sqrt{x - [x]}}$ [Domain $(f) = \mathbb{R} - \mathbb{Z}$ Range $(f) = (1, \infty)$]

(ii) $f(x) = 1 - |x - 3|$ [Domain $(f) = \mathbb{R}$ Range $(f) = (-\infty, 1]$]

53. Find the domain of the real function $f(x)$ defined by $f(x) = \sqrt{\frac{1 - |x|}{2 - |x|}}$
 [(f) = $(-\infty, -2) \cup (2, \infty) \cup [-1, 1]$]

54. Find the domain and range of the functions

(i) $f(x) = \sqrt{\frac{(2x + 1)(2x + 3)}{x + 1}}$
 [Domain : $\left[\frac{-3}{2}, 1\right) \cup \left[\frac{-1}{2}, \infty\right)$, Range : set of all positive real numbers]

(ii) $f(x) = \frac{1}{\sqrt{x^2 - 1}}$ [Domain : $\mathbb{R} - [-1, 1]$, Range : set of all positive real numbers]

(iii) $\frac{1}{\sqrt{x - 3}}$ [Domain : $(3, \infty)$, Range : set of real positive numbers.]

55. Draw the graphs of the following functions in the given domains:

$y = |x + 1|$

56. (i) If $f(x) = \frac{1 + x}{1 - x}$, $x \neq 1$, show that $(f \circ f \circ f \circ f)(x) = x$.

(ii) If $f(x) = 4x^2$ and $g(x) = \frac{\sqrt{x}}{2}$, then find $(f \circ g)(x)$ and $(g \circ f)(x)$. [(ii) $(f \circ g)(x) = x = (g \circ f)(x)$]

57. A function is of the form $f(x) = ax + b$. If $(f \circ f)(x) = 4x - 9$, find the values of a and b .

[$a = 2, b = -3$, or $a = -2, b = 9$.]

58. If $y = f(x) = \frac{x + 2}{x - 1}$, show that $x = f(y)$. Also find $f \circ f(2)$. [f of (2) = 2]

59. Given the function $f(x) = \frac{a^x + a^{-x}}{2}$, $a > 0$, show that $f(x + y) + f(x - y) = 2 f(x) f(y)$.

60. Let $f : [0, 1] \rightarrow [0, 1]$ be defined by $f(x) = \frac{1 - x}{1 + x}$, $0 \leq x \leq 1$ and let $g : [0, 1] \rightarrow [0, 1]$ be defined by $g(x) = 4x(1 - x)$, $0 \leq x \leq 1$. Determine the composite function $f \circ g$ and $g \circ f$.