

# CLASS 7 MATHEMATICS

## Term 1 Question Bank Solutions (Chapters 1 - 4)

### Chapter 1: Integers

#### Section A: MCQ (1 Mark Each)

1. Which property is illustrated by the equation  $(-3) + 5 = 5 + (-3)$  ?

**Answer / Solution:** b) Commutative Property of Addition

*Explanation:* The commutative property states that changing the order of numbers being added does not change the sum:  $a + b = b + a$ .

2. If  $a = -7$  and  $b = 4$ , what is the value of  $a - b$ ?

**Answer / Solution:** a) -11

*Explanation:* Substituting the values:  $a - b = (-7) - 4 = -11$ .

3. Evaluate:  $(-6) \times (-2) + 8 \div (-4)$

**Answer / Solution:** c)  $12 + (-2) = 10$

*Explanation:* Following BODMAS/order of operations: First do multiplication  $(-6) \times (-2) = 12$  and division  $8 \div (-4) = -2$ . Then perform addition:  $12 + (-2) = 10$ .

4. What is the additive inverse of -15?

**Answer / Solution:** a) 15

*Explanation:* The additive inverse of an integer  $x$  is  $-x$ , because  $x + (-x) = 0$ . Therefore, the additive inverse of -15 is 15.

5. Which of the following is true regarding multiplication of integers?

**Answer / Solution:** c) Product of two negative integers is positive

*Explanation:* Multiplying a negative integer by another negative integer always gives a positive result:  $(-) \times (-) = (+)$ .

6. Assertion (A):  $(-4) + (-6) = -10$

Reason (R): Adding two negative numbers results in a positive number.

**Answer / Solution:** c) A is true, but R is false

*Explanation:* The assertion statement is mathematically correct  $(-4 - 6 = -10)$ . The reason statement is incorrect because adding two negative numbers always yields a negative sum.

7. Assertion (A): Multiplying any integer by zero always gives zero.

Reason (R): Zero is the additive identity.

**Answer / Solution:** b) Both A and R are true, but R is not the correct explanation of A

*Explanation:* Both statements are true facts independently, but R is not the reason for A. Multiplying by zero gives zero due to the multiplicative property of zero.

**8. Which integer is both an additive identity and a multiplicative identity?**

**Answer / Solution:** d) None of the above

*Explanation: 0 is the additive identity, and 1 is the multiplicative identity. No single number functions as both.*

**9. If  $-9 \div x = 3$ , what is the value of  $x$ ?**

**Answer / Solution:** a) -3

*Explanation: Rearranging the equation gives:  $x = -9 \div 3 = -3$ .*

**10. Find the value of  $(-5) + [(3 \times -2) - (4 \div 2)]$**

**Answer / Solution:** b) -13

*Explanation: Simplify inside brackets first:  $(3 \times -2) = -6$  and  $(4 \div 2) = 2$ . So the brackets evaluate to  $[-6 - 2] = -8$ . Finally,  $(-5) + (-8) = -13$ .*

### Section B: Short Answer Questions (2 Marks Each)

**a) Evaluate the following expression using suitable properties:  $26 \times (-48) + (-48) \times (-36)$**

**Answer / Solution:** 480

*Explanation: Apply the Distributive Property of Multiplication over Addition:  $a \times b + a \times c = a \times (b + c)$ . Taking  $(-48)$  as a common factor:  $(-48) \times [26 + (-36)] = (-48) \times [-10] = 480$ .*

**b) Simplify the expression:  $17 - \{8 \div (2 \times 3 - 4)\}$**

**Answer / Solution:** 13

*Explanation: Simplify parentheses first:  $(2 \times 3 - 4) = 6 - 4 = 2$ . Now substitute into curly braces:  $\{8 \div 2\} = 4$ . Finally,  $17 - 4 = 13$ .*

**c) The temperature of a chemical solution in a lab is recorded at  $18^\circ\text{C}$ . Due to a chemical reaction, the temperature drops by  $3^\circ\text{C}$  every 10 minutes. What will be the final temperature of the solution after 1 hour and 20 minutes?**

**Answer / Solution:**  $-6^\circ\text{C}$

*Explanation: Total time elapsed = 1 hour 20 minutes = 80 minutes. Number of 10-minute drop intervals =  $80 \div 10 = 8$  intervals. Total temperature drop =  $8 \times 3^\circ\text{C} = 24^\circ\text{C}$ . Final temperature =  $18^\circ\text{C} - 24^\circ\text{C} = -6^\circ\text{C}$ .*

**d) Arrange the following integers in ascending order: 7, -5, 4, 0, -4, 12**

**Answer / Solution:** -5, -4, 0, 4, 7, 12

*Explanation: Arranging from smallest to largest on the number line gives this sequence.*

**e) In a quiz, +5 marks are given for a correct answer and -2 marks for an incorrect answer. Teenu attempted all questions. If he got only 5 questions correct and his net total score was 11 marks, how many questions did he attempt in total?**

**Answer / Solution:** 12 questions

*Explanation: Marks earned from correct answers =  $5 \times 5 = 25$  marks. Net score = 11 marks. Marks lost from incorrect answers =  $11 - 25 = -14$  marks. Number of incorrect answers =  $-14 \div (-2) = 7$  questions. Total questions attempted =  $5$  correct +  $7$  incorrect =  $12$  questions.*

### Section C: Long Answer Questions (3 Marks Each)

**a) Evaluate the following product using a suitable property:  $(-47) \times 102$**

**Answer / Solution:** -4794

*Explanation: Using Distributive Property:  $(-47) \times (100 + 2) = (-47 \times 100) + (-47 \times 2) = -4700 + (-94) = -4794$ .*

**b) Verify the property  $a \times (b + c) = (a \times b) + (a \times c)$  for:  $a = -21, b = -6, c = -4$**

**Answer / Solution:** Verified (LHS = RHS = 210)

*Explanation: LHS:  $-21 \times [(-6) + (-4)] = -21 \times [-10] = 210$ . RHS:  $[(-21) \times (-6)] + [(-21) \times (-4)] = 126 + 84 = 210$ . Since LHS = RHS, the property is verified.*

**c) Find the numerical value of the following expression containing absolute values:  $|-6| + |4| - |-2|$**

**Answer / Solution:** 8

*Explanation: Absolute values are always positive:  $|-6| = 6, |4| = 4, |-2| = 2$ . Expression becomes:  $6 + 4 - 2 = 8$ .*

**d) (i) Write down the additive inverse of -15. (ii) Write down the additive inverse of 0. (iii) Find the value of  $-(-23)$ .**

**Answer / Solution:** (i) 15, (ii) 0, (iii) 23

**e) Rohit answers exactly 4 questions correctly and 6 questions incorrectly. (+5 for correct, -2 for incorrect). Calculate his net final score.**

**Answer / Solution:** 8 marks

*Explanation: Marks for correct answers =  $4 \times 5 = 20$ . Marks deducted for incorrect answers =  $6 \times (-2) = -12$ . Net score =  $20 + (-12) = 8$  marks.*

### Section D: Advanced Questions (4 Marks Each)

**a) Simplify the following expression:  $11 - [7 - \{5 - 3 \times (9 - 3 - 6)\}]$**

**Answer / Solution:** 9

*Explanation: 1) Small brackets:  $9 - 3 - 6 = 0$ . 2) Multiplication inside braces:  $3 \times 0 = 0$ . 3) Braces:  $\{5 - 0\} = 5$ . 4) Square brackets:  $[7 - 5] = 2$ . 5) Final expression:  $11 - 2 = 9$ .*

**b) An industrial cooling elevator inside a deep mine shaft descends at a steady rate of 6 m/min. Simultaneously, the ambient temperature drops inside the shaft by  $2^\circ\text{C}$  for every 6 metres descended below the surface. If the elevator begins its journey at 10 m above ground level where the temperature is  $10^\circ\text{C}$ , calculate: (i) The final position relative to the ground after 1 hour. (ii) The temperature recorded at that final deep underground position.**

**Answer / Solution:** (i) -350 m (350 m below ground level), (ii)  $-110^\circ\text{C}$

*Explanation: (i) Total time = 1 hour = 60 minutes. Descent distance = 60 min  $\times$  6 m/min = 360 m. Starting position was +10 m, so final position = 10 - 360 = -350 m.*

*(ii) Since it descends 360 m total, and temperature drops 2°C for every 6 m descended: Total drop intervals = 360  $\div$  6 = 60 intervals. Total temperature drop = 60  $\times$  2°C = 120°C. Final temperature = 10°C - 120°C = -110°C.*

**c) Evaluate using suitable property:  $(-25) \times 739 \times (-4) \times (-80)$**

**Answer / Solution:** -5,912,000

*Explanation: Group factors to make calculations easier:  $[(-25) \times (-4)] \times [739 \times (-80)] = 100 \times (-59,120) = -5,912,000$ .*

**d) Verify the distributive property of multiplication over addition,  $a \times (b + c) = (a \times b) + (a \times c)$  for:  $a = -250$ ,  $b = -600$ ,  $c = -400$**

**Answer / Solution:** Verified (LHS = RHS = 250,000)

*Explanation: LHS =  $-250 \times [(-600) + (-400)] = -250 \times [-1000] = 250,000$ . RHS =  $[(-250) \times (-600)] + [(-250) \times (-400)] = 150,000 + 100,000 = 250,000$ .*

**e) A corporate treasury account balance undergoes four large back-to-back shifts: Start: Deficit of ₹12,000 (-12000). Shift 1: A penalty fee of ₹3,500 is deducted. Shift 2: An automated transaction doubles the deficit. Shift 3: A clearance deposit of ₹40,000 is credited. Calculate the final balance step-by-step.**

**Answer / Solution:** ₹9,000

*Explanation: Start balance = -12,000*

*Shift 1:  $-12,000 - 3,500 = -15,500$*

*Shift 2:  $-15,500 \times 2 = -31,000$*

*Shift 3:  $-31,000 + 40,000 = +9,000$ .*

## Chapter 2: Fractions and Decimals

### Section A: MCQ (1 Mark Each)

**a) What fraction of an hour is a duration of 25 minutes?**

**Answer / Solution:** a)  $\frac{5}{12}$

*Explanation: 25 minutes / 60 minutes =  $\frac{5}{12}$  when simplified.*

**b) If 1 kg of pure milk contains 0.250 kg of fat, how much fat is present in a larger container containing 12 kg of milk?**

**Answer / Solution:** b) 3.0 kg

*Explanation:  $12 \times 0.250 \text{ kg} = 3.0 \text{ kg}$ .*

**c) Assertion: To divide any decimal number by 10, you shift the decimal point to the left side by exactly one place value slot.**

**Reason: To multiply a decimal number by 100, you shift the decimal point to the right side by exactly two place value slots.**

**Answer / Solution:** b) Both A and R are true, but R is not the correct explanation of A

**d) What is the place value of the digit 8 in the decimal number 7532.812?**

**Answer / Solution:** b) Eight-tenths ( $8/10$ )

**e) Convert the mixed fraction  $5\frac{4}{11}$  into its equivalent improper fraction form:**

**Answer / Solution:** c)  $59/11$

*Explanation:*  $(5 \times 11 + 4) / 11 = 59/11$ .

### **Section B: Short Answer Questions (2 Marks Each)**

**a) Arrange the following fractions in ascending order by converting them into equivalent like fractions:  $3/5$ ,  $7/10$ ,  $8/15$**

**Answer / Solution:**  $8/15$ ,  $3/5$ ,  $7/10$

*Explanation:* LCM of 5, 10, and 15 is 30. Converting gives:  $18/30$ ,  $21/30$ ,  $16/30$ . Arranging in ascending order:  $16/30$  ( $8/15$ ) <  $18/30$  ( $3/5$ ) <  $21/30$  ( $7/10$ ).

**b) Simplify the given fractional expression:  $7/10 + 2/5 - 1/4$**

**Answer / Solution:**  $17/20$

*Explanation:* LCM of 10, 5, 4 is 20. Expression becomes:  $14/20 + 8/20 - 5/20 = 17/20$ .

**c) Evaluate the following decimal expression:  $9.5 - 3.48 - 0.6125 + 1.83$**

**Answer / Solution:** 7.2375

*Explanation:* Combine positive terms:  $9.5 + 1.83 = 11.33$ . Combine negative terms:  $3.48 + 0.6125 = 4.0925$ . Difference:  $11.33 - 4.0925 = 7.2375$ .

**d) What specific decimal number must be added to 14.285 to obtain a perfect whole number result of 20?**

**Answer / Solution:** 5.715

*Explanation:* Required value =  $20 - 14.285 = 5.715$ .

**e) Evaluate the expression:  $4\frac{2}{3} \div 1\frac{2}{9}$**

**Answer / Solution:**  $42/11$  or  $3\frac{9}{11}$

*Explanation:* Convert to improper fractions:  $14/3 \div 11/9 = 14/3 \times 9/11 = 42/11 = 3\frac{9}{11}$ .

### **Section C: Long Answer Questions (3 Marks Each)**

**a) Evaluate the decimal expression:  $12.4 - 5.78 - 0.9124 + 3.65$**

**Answer / Solution:** 9.3576

*Explanation:*  $(12.4 + 3.65) - (5.78 + 0.9124) = 16.05 - 6.6924 = 9.3576$ .

**b) A transport vehicle covers exactly 21 km using 1 litre of premium biofuel.**

**(i) Calculate the distance it can travel if it consumes  $3\frac{4}{7}$  litres of biofuel.**

**(ii) If the fuel cost is ₹84.50 per litre, find the total exact cost of fuel consumed during this specific trip.**

**Answer / Solution:** (i) 75 km, (ii) ₹301.79

*Explanation:* (i)  $3\frac{4}{7} = 25/7$  litres. Distance =  $21 \times 25/7 = 3 \times 25 = 75$  km.

(ii) Total cost =  $25/7 \times 84.50 = 2112.5 / 7 = ₹301.79$ .

**c) What number should  $3\frac{5}{7}$  be multiplied to obtain a product value of exactly  $10\frac{5}{14}$ ?**

**Answer / Solution:**  $2\frac{41}{52}$

*Explanation:*  $3\frac{5}{7} = \frac{26}{7}$ , and  $10\frac{5}{14} = \frac{145}{14}$ . Let the multiplier be  $x$ .  $(\frac{26}{7}) * x = \frac{145}{14} \Rightarrow x = (\frac{145}{14}) * (\frac{7}{26}) = \frac{145}{52} = 2\frac{41}{52}$ .

**d) Simplify the following expression:  $(\frac{3}{5} \div \frac{9}{10}) \times 2\frac{1}{4} + \frac{5}{6}$**

**Answer / Solution:**  $2\frac{1}{3}$  or  $\frac{7}{3}$

*Explanation:* First do division inside brackets:  $\frac{3}{5} \times \frac{10}{9} = \frac{2}{3}$ . Next multiply by  $2\frac{1}{4}$  ( $\frac{9}{4}$ ):  $\frac{2}{3} \times \frac{9}{4} = \frac{3}{2}$ . Finally add  $\frac{5}{6}$ :  $\frac{3}{2} + \frac{5}{6} = \frac{9}{6} + \frac{5}{6} = \frac{14}{6} = \frac{7}{3} = 2\frac{1}{3}$ .

**e) Evaluate:  $5\frac{3}{4} - 2\frac{1}{6} - 1\frac{5}{12}$**

**Answer / Solution:**  $2\frac{1}{6}$  or  $\frac{13}{6}$

*Explanation:* Convert to common denominator 12:  $\frac{23}{4} - \frac{13}{6} - \frac{17}{12} = \frac{69}{12} - \frac{26}{12} - \frac{17}{12} = \frac{26}{12} = \frac{13}{6} = 2\frac{1}{6}$ .

### Section D: Advanced Questions (4 Marks Each)

**a) In an orchard,  $\frac{2}{7}$  of the area is planted with apple trees and  $\frac{3}{8}$  is planted with orange trees. Find the remaining fraction of the orchard left for banana trees.**

**Answer / Solution:**  $\frac{19}{56}$

*Explanation:* Total fraction filled =  $\frac{2}{7} + \frac{3}{8} = \frac{(16 + 21)}{56} = \frac{37}{56}$ . Leftover fraction for banana trees =  $1 - \frac{37}{56} = \frac{19}{56}$ .

**b) An industrial design workstation completes a rendering task in  $\frac{5}{6}$  of an hour. A secondary machine completes the identical rendering assignment in  $\frac{11}{14}$  of an hour.**

**(i) Determine which machine functions faster.**

**(ii) Find out exactly how many minutes faster it finishes the task.**

**Answer / Solution:** (i) The secondary machine functions faster, (ii)  $2\frac{6}{7}$  minutes faster

*Explanation:* (i) Compare fractions:  $\frac{5}{6} = \frac{35}{42}$ ,  $\frac{11}{14} = \frac{33}{42}$ . Since  $\frac{33}{42} < \frac{35}{42}$ , the secondary machine takes less time and is faster.

(ii) Difference =  $\frac{35}{42} - \frac{33}{42} = \frac{2}{42} = \frac{1}{21}$  of an hour. In minutes:  $\frac{1}{21} \times 60 = \frac{60}{21} = \frac{20}{7} = 2\frac{6}{7}$  minutes.

**c) Rahul is reading a novel that has exactly 420 pages. On Monday, he reads  $\frac{2}{7}$  of the book. On Tuesday, he reads  $\frac{1}{3}$  of the total book. On Wednesday, he reads exactly  $\frac{1}{4}$  of the remaining pages. Calculate the exact number of pages he has left to read for Thursday.**

**Answer / Solution:** 120 pages

*Explanation:* Monday:  $\frac{2}{7} \times 420 = 120$  pages. Tuesday:  $\frac{1}{3} \times 420 = 140$  pages. Total read so far =  $120 + 140 = 260$  pages. Remaining pages =  $420 - 260 = 160$  pages. Wednesday:  $\frac{1}{4} \times 160 = 40$  pages. Leftover for Thursday =  $160 - 40 = 120$  pages.

d) Reena can completely paint a wall in  $4\frac{1}{2}$  hours, while her brother Rohan takes  $3\frac{3}{4}$  hours to paint a wall of the exact same size. Determine who works faster by comparing their time fractions.

**Answer / Solution:** Rohan works faster

*Explanation:* Comparing their times: Reena takes 4.5 hours, Rohan takes 3.75 hours. Since Rohan takes less time to finish the exact same work, he works faster.

e) A tailor receives a large roll of uniform fabric measuring  $87\frac{3}{4}$  metres. He requires exactly  $4\frac{7}{8}$  metres of cloth to stitch one complete school uniform.

(i) How many complete uniforms can he stitch from this roll?

(ii) If the stitching cost for each uniform is ₹250.50, what is the total cost of stitching all the uniforms?

**Answer / Solution:** (i) 18 uniforms, (ii) ₹4,509.00

*Explanation:* (i) Total uniforms =  $87\frac{3}{4} \div 4\frac{7}{8} = \frac{351}{4} \div \frac{39}{8} = \frac{351}{4} \times \frac{8}{39} = 9 \times 2 = 18$  complete uniforms.

(ii) Total stitching cost =  $18 \times ₹250.50 = ₹4,509.00$ .

## Chapter 3: Rational Numbers

### Section A: MCQ (1 Mark Each)

Q1. Which of the following represents the rational number  $15 / -35$  in its standard form?

**Answer / Solution:** b)  $-3/7$

*Explanation:* Divide numerator and denominator by 5 to get  $3 / -7$ , then move the negative sign to the numerator for standard form.

Q2. What is the missing number in the equivalent rational numbers  $-4/9 = \dots / 27$ ?

**Answer / Solution:** b) -12

*Explanation:* Multiply the numerator and denominator by 3:  $-4 \times 3 = -12$ .

Q3. Statement 1: Zero is a rational number.

Statement 2: Every integer is a rational number.

**Answer / Solution:** a) Both Statement 1 and Statement 2 are true.

Q4. Statement 1: The reciprocal of a proper fraction is always a proper fraction.

Statement 2: The product of any non-zero fraction and its reciprocal is always exactly 1.

**Answer / Solution:** d) Statement 1 is false, but Statement 2 is true.

*Explanation:* The reciprocal of a proper fraction is always an improper fraction (e.g. reciprocal of  $2/3$  is  $3/2$ ).

Q5. What is the product of  $-5/8$  and  $16 / -15$ ?

**Answer / Solution:** a)  $2/3$

*Explanation:*  $(-5 \times 16) / (8 \times -15) = -80 / -120 = 2/3$ .

## Section B: Short Answer Questions (2 Marks Each)

a) A baker has a total of 15 kg of flour in his kitchen. If he requires exactly  $1\frac{1}{2}$  kg of flour to bake one large chocolate cake, how many complete cakes can he bake from the total flour available?

**Answer / Solution:** 10 complete cakes

*Explanation:*  $15 \div 1\frac{1}{2} = 15 \div \frac{3}{2} = 15 \times \frac{2}{3} = 10$ .

b) Evaluate:  $37.128 \div 1.24$

**Answer / Solution:** 29.94

c) Express  $-\frac{3}{8}$  as a rational number with: (i) denominator = 32, (ii) denominator = -40

**Answer / Solution:** (i)  $-\frac{12}{32}$ , (ii)  $\frac{15}{-40}$

*Explanation:* (i) Multiply numerator and denominator by 4:  $-\frac{3 \times 4}{8 \times 4} = -\frac{12}{32}$ . (ii) Multiply numerator and denominator by -5:  $-\frac{3 \times (-5)}{8 \times (-5)} = \frac{15}{-40}$ .

d) The sum of two rational numbers is -5. If one of the numbers is  $-\frac{13}{6}$ , find the other.

**Answer / Solution:**  $-\frac{17}{6}$

*Explanation:* Let the other number be  $x$ .  $x + (-\frac{13}{6}) = -5 \Rightarrow x = -5 + \frac{13}{6} = \frac{-30 + 13}{6} = -\frac{17}{6}$ .

e) Express in standard form:  $-\frac{32}{40}$

**Answer / Solution:**  $-\frac{4}{5}$

*Explanation:* Divide both numerator and denominator by their HCF of 8:  $-\frac{32 \div 8}{40 \div 8} = -\frac{4}{5}$ .

## Section C: Long Answer Questions (3 Marks Each)

a) Simplify:  $(\frac{13}{8} \times \frac{12}{13}) + (-\frac{4}{9} \times \frac{3}{-2})$

**Answer / Solution:**  $\frac{13}{6}$  or  $2\frac{1}{6}$

*Explanation:* First part simplifies to  $\frac{12}{8} = \frac{3}{2}$ . Second part simplifies to  $\frac{12}{18} = \frac{2}{3}$ . Sum =  $\frac{3}{2} + \frac{2}{3} = \frac{(9 + 4)}{6} = \frac{13}{6} = 2\frac{1}{6}$ .

b) Arrange the rational numbers in ascending order:  $-\frac{3}{7}$ ,  $\frac{5}{-14}$ ,  $\frac{7}{12}$

**Answer / Solution:**  $-\frac{3}{7}$ ,  $\frac{5}{-14}$ ,  $\frac{7}{12}$

*Explanation:* Standard forms:  $-\frac{6}{14}$ ,  $-\frac{5}{14}$ ,  $\frac{7}{12}$ . Finding the common denominator of 84 gives  $-\frac{36}{84}$ ,  $-\frac{30}{84}$ ,  $\frac{49}{84}$ . Ascending order is  $-\frac{36}{84} < -\frac{30}{84} < \frac{49}{84}$ .

c) Simplify:  $\frac{8}{-15} + \frac{7}{20} - (-\frac{11}{35}) + \frac{1}{5}$

**Answer / Solution:**  $\frac{139}{420}$

*Explanation:*  $-\frac{8}{15} + \frac{7}{20} + \frac{11}{35} + \frac{1}{5}$ . The LCM of 15, 20, 35, and 5 is 420. Converting gives  $(-\frac{224}{420} + \frac{147}{420} + \frac{132}{420} + \frac{84}{420}) = \frac{139}{420}$ .

d) Draw the number line and represent the following rational numbers on it: (i)  $\frac{3}{4}$ , (ii)  $-\frac{5}{8}$

**Answer / Solution:** Solved

*Explanation: (i)  $\frac{3}{4}$  is 3 parts out of 4 between 0 and 1 on the positive side. (ii)  $-\frac{5}{8}$  is 5 parts out of 8 between 0 and -1 on the negative side.*

**e) Subtract: (i)  $\frac{7}{8}$  from  $\frac{5}{12}$ , (ii)  $-\frac{4}{9}$  from  $-\frac{7}{18}$**

**Answer / Solution:** (i)  $-\frac{11}{24}$ , (ii)  $\frac{1}{18}$

*Explanation: (i)  $\frac{5}{12} - \frac{7}{8} = \frac{(10 - 21)}{24} = -\frac{11}{24}$ .*

*(ii)  $-\frac{7}{18} - (-\frac{4}{9}) = -\frac{7}{18} + \frac{8}{18} = \frac{1}{18}$ .*

### Section D: Advanced Questions (4 Marks Each)

**a) Simplify:  $(-\frac{5}{9} \times \frac{72}{-125}) - (\frac{11}{17} \times \frac{34}{55}) + (\frac{28}{-13} \times -\frac{52}{21})$**

**Answer / Solution:**  $\frac{394}{75}$  or  $5 \frac{19}{75}$

*Explanation: Term 1:  $\frac{8}{25}$ . Term 2:  $\frac{2}{5} = \frac{10}{25}$ . Term 3:  $\frac{16}{3}$ . Combining them:  $(\frac{8}{25} - \frac{10}{25}) + \frac{16}{3} = -\frac{2}{25} + \frac{16}{3} = \frac{(-6 + 400)}{75} = \frac{394}{75}$ .*

**b) Find: (i)  $\frac{6}{25} \div \frac{3}{10}$ , (ii)  $-\frac{9}{44} \div \frac{3}{11}$**

**Answer / Solution:** (i)  $\frac{4}{5}$ , (ii)  $-\frac{3}{4}$

*Explanation: (i)  $\frac{6}{25} \times \frac{10}{3} = \frac{4}{5}$ . (ii)  $-\frac{9}{44} \times \frac{11}{3} = -\frac{3}{4}$ .*

**c) A charitable trust has a total of  $45 \frac{1}{2}$  kg of rice to distribute to flood-affected families. If the trust decides to give exactly  $3 \frac{1}{4}$  kg of rice to each family, calculate the total number of families that will receive the aid.**

**Answer / Solution:** 14 families

*Explanation:  $45 \frac{1}{2} \div 3 \frac{1}{4} = \frac{91}{2} \div \frac{13}{4} = \frac{91}{2} \times \frac{4}{13} = 7 \times 2 = 14$  families.*

**d) A storybook contains exactly 200 pages. Neha reads  $\frac{3}{5}$  of the total pages during her weekend trip. Calculate: (i) the exact number of pages Neha has successfully read, (ii) how many pages she still has left to read.**

**Answer / Solution:** (i) 120 pages, (ii) 80 pages

*Explanation: (i)  $\frac{3}{5} \times 200 = 120$  pages. (ii)  $200 - 120 = 80$  pages.*

**e) A rectangular living room has a length of 12.5 m and a breadth of 8.2 m. Calculate the total floor area. If a cleaning service charges ₹15 per square metre to polish the floor, what will be the total cost of polishing?**

**Answer / Solution:** Area = 102.5 sq.m, Total Cost = ₹1,537.50

*Explanation: Area =  $12.5 \times 8.2 = 102.5$  square metres. Cost =  $102.5 \times ₹15 = ₹1,537.50$ .*

## Chapter 4: Exponents and Powers

### Section A: MCQ (1 Mark Each)

**a) In the exponential expression  $(-12)^7$ , what are the base and the exponent respectively?**

**Answer / Solution:** c) Base: -12, Exponent: 7

**b) Using the laws of exponents, simplify the expression:  $8^4 \times 8^5$**

**Answer / Solution:** c)  $8^9$

*Explanation:*  $8^{(4+5)} = 8^9$ .

**c) Find the value of x if  $(2)^x = 64$ .**

**Answer / Solution:** c) 6

*Explanation:*  $2^6 = 64$ , so  $x = 6$ .

**d) Assertion (A): The simplified value of  $(100^0 \times 50^0) / 25^0$  is 1.**

**Reason (R): For any non-zero rational number a,  $a^0 = 1$ .**

**Answer / Solution:** a) Both A and R are true, and R is the correct explanation of A.

**e) What is the value of  $(-1)^{55}$ ?**

**Answer / Solution:** b) -1

*Explanation:* An odd power of -1 always results in -1.

### Section B: Short Answer Questions (2 Marks Each)

**a) Which is greater  $3^2$  or  $2^3$ ?**

**Answer / Solution:**  $3^2$  is greater

*Explanation:*  $3^2 = 9$  and  $2^3 = 8$ . Since  $9 > 8$ ,  $3^2$  is greater.

**b) Express the following number as a power of prime factors: 225**

**Answer / Solution:**  $3^2 \times 5^2$

*Explanation:*  $225 = 9 \times 25 = 3^2 \times 5^2$ .

**c) Express the following in exponential form: (i)  $(-1) \times (-1) \times (-1) \times (-1) \times (-1)$ , (ii)  $a \times a \times b \times c \times c \times c \times d \times d$**

**Answer / Solution:** (i)  $(-1)^5$ , (ii)  $a^3 \times b \times c^3 \times d^2$

**d) Simplify:  $6^3 \times 7^0 + (-3)^4 - 9^0$**

**Answer / Solution:** 296

*Explanation:*  $216 \times 1 + 81 - 1 = 216 + 81 - 1 = 296$ .

**e) Simplify: (i)  $3^2 \times 10^4$ , (ii)  $2^4 \times 3^2$**

**Answer / Solution:** (i) 90,000, (ii) 144

*Explanation:* (i)  $9 \times 10,000 = 90,000$ . (ii)  $16 \times 9 = 144$ .

### Section C: Long Answer Questions (3 Marks Each)

**a) Express each of the following numbers as a product of powers of their prime factors: (i) 36, (ii) 675**

**Answer / Solution:** (i)  $2^2 \times 3^2$ , (ii)  $3^3 \times 5^2$

**b) Express each of the following numbers as a product of powers of their prime factors: (i) 450, (ii) 2800**

**Answer / Solution:** (i)  $2 \times 3^2 \times 5^2$ , (ii)  $2^4 \times 5^2 \times 7$

c) Simplify and express in exponential form: (ii)  $(8^2 \times 8^4) \div 8^3$ , (iii)  $(5^7 / 5^2) \times 5^3$

**Answer / Solution:** (ii)  $8^3$ , (iii)  $5^8$

*Explanation:* (ii)  $8^6 \div 8^3 = 8^3$ . (iii)  $5^5 \times 5^3 = 5^8$ .

d) Write  $16^4$  using exponents with base 2.

**Answer / Solution:**  $2^{16}$

*Explanation:*  $16^4 = (2^4)^4 = 2^{16}$ .

e) If  $a = 2$  and  $b = 3$ , find the values of each of the following: (i)  $(ab)^a$ , (ii)  $(b^a)^b$

**Answer / Solution:** (i) 216, (ii) 729

*Explanation:* (i)  $(2 \times 3)^2 = 6^2 = 36$ . (ii)  $(3^2)^3 = 3^6 = 729$ .

### Section D: Advanced Questions (4 Marks Each)

a) Simplify the following expression:  $(2^5 \times 15^4 \times 8) / (5^3 \times 6^4)$

**Answer / Solution:** 80

*Explanation:* Convert everything to base 2, 3, and 5:  $(2^5 \times 3^4 \times 5^4 \times 2^3) / (5^3 \times 2^4 \times 3^4) = (2^8 \times 3^4 \times 5^4) / (2^4 \times 3^4 \times 5^3) = 2^{(8-4)} \times 3^{(4-4)} \times 5^{(4-3)} = 2^4 \times 1 \times 5 = 16 \times 5 = 80$ .

b) Use the laws of exponents to find the exact value of  $x$  in the given exponential equation:  $(3/5)^3 \times (5/3)^{-6} = (3/5)^{(2x-1)}$

**Answer / Solution:**  $x = 5$

*Explanation:*  $(3/5)^3 \times (3/5)^6 = (3/5)^{(2x-1)} \Rightarrow (3/5)^9 = (3/5)^{(2x-1)} \Rightarrow 9 = 2x - 1 \Rightarrow 2x = 10 \Rightarrow x = 5$ .

c) A laboratory culture of bacteria is observed to multiply by a factor of 3 every hour. The initial observation records exactly  $3^4$  bacteria. (i) Express the total number of bacteria present after 5 hours in exponential form. (ii) Determine by what specific exponential factor the population has increased compared to a baseline count of  $3^2$  bacteria.

**Answer / Solution:** (i)  $3^9$  bacteria, (ii) Increased by a factor of  $3^7$

*Explanation:* (i)  $3^4 \times 3^5 = 3^9$ .

(ii)  $3^9 \div 3^2 = 3^7$ .

d) Simplify the following algebraic fraction to its lowest terms:  $[(x^2)^3 \times y^4 \times z^5] / [x^4 \times (y^2)^2 \times z]$

**Answer / Solution:**  $x^2 \cdot z^4$

*Explanation:*  $(x^6 \times y^4 \times z^5) / (x^4 \times y^4 \times z^1) = x^{(6-4)} \cdot y^{(4-4)} \cdot z^{(5-1)} = x^2 \cdot y^0 \cdot z^4 = x^2 \cdot z^4$ .

e) If  $a = 2$  and  $b = -3$ , evaluate the following expression as a fraction in its simplest form:  $(a^b \times b^2) / (a^2 \times b^0)$

**Answer / Solution:**  $9/32$

*Explanation:*  $(2^{-3} \times (-3)^2) / (2^2 \times (-3)^0) = (1/8 \times 9) / (4 \times 1) = (9/8) / 4 = 9/32$ .