Collins

Maths Zone 7

Updated Edition

Series Editor
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Preface

Maths Zone* (Updated Edition)** is a series of eight books for Classes 1 to 8. The series conforms to the objectives outlined in *National Curriculum Framework*. The updated edition of ***Maths Zone, trying to make a difference with its new features, incorporates the latest requirements across various boards. With its activity-oriented approach, the series aims to inculcate lateral thinking, analytical, research and deduction skills in students, thus urging them to explore beyond the boundaries of textual knowledge.

Based on the NCERT syllabus, the series follows a coherent and structured approach. It provides a seamless continuity in the Maths curriculum for classes 1 to 8, laying emphasis on developing problem-solving skills.

The series has been updated in view of the extensive feedback received from the user schools and experienced teachers. Wherever necessary, content has been simplified to cater to the needs of all kinds of learners in a classroom.

Key Features

Mental Maths to help practise calculation skills and deductive reasoning

Cross-curricular Links (Classes 1 to 5) integrate knowledge across subjects

Exercises after each topic and **Revision Exercises** at the end of each chapter for a comprehensive review of the concepts

Summary (Classes 6 to 8) gives a snapshot of the chapter for quick recapitulation

Maths Lab Activity to test skills of investigation, observation and deduction

Worksheets to reinforce practice with fun exercises

Consolidated **Practice Worksheets** and **Reasoning Worksheet** at the end of the book for further practice

Latest **International Mathematics Olympiad** paper to help students prepare for competitive exams

Maths Tales (Classes 1 to 5) at the end of the book give colourful cartoon spreads

Vedic Maths (Classes 3 to 8) to master shortcut techniques which aid in faster calculations

Poster, at the end as a pull-out, for a quick revision of important points and formulae

Remember, **Common Errors**, **Challenge** and **Projects** are a few other features included in the books.

Four **assessment papers** and two **comprehensive assessment papers** have been given at the end of each book, in addition to the exercises within and at the end of each chapter.

In line with the CBSE guidelines, evaluation features along with the tools of assessment have been provided extensively to the teachers and learners in a well-integrated manner.

Feedback, valuable comments and suggestions from the users are welcome.

Authors

Key Features

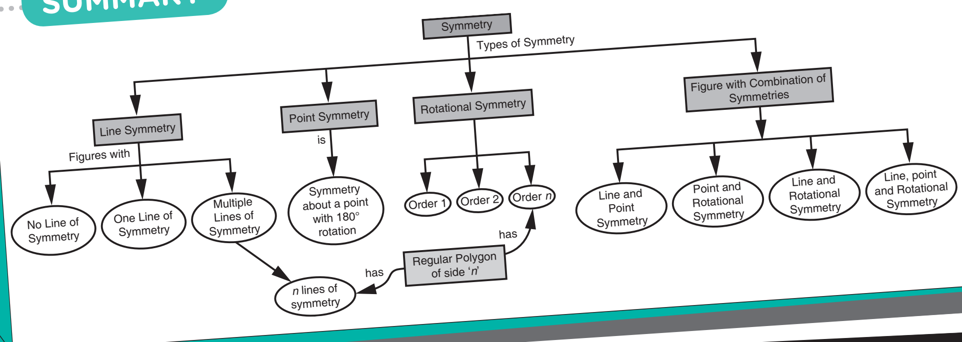
Cross-curricular Link: What is the difference in the meaning of the words 'remainder' and 'reminder'?

Mental Maths

Which is greater? $\frac{1}{2}$ [ ] $\frac{1}{4}$

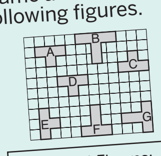
Which is lesser? $\frac{1}{11}$ [ ] $\frac{3}{11}$

SUMMARY

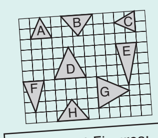


Exercise 12.1

1 Name all the congruent shapes given in the following figures.



Congruent Figures:



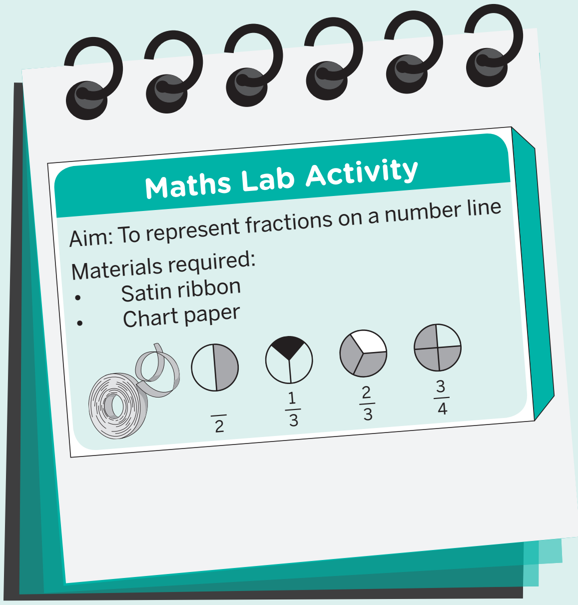
Congruent Figures:

Revision Exercise

1 Classify the following expressions into monomials, binomials and trinomials.

(a) $4x^2 - 7$ (b) $-10x$

(c) $\frac{2x}{7} + 5y + 6$ (d) $\frac{3}{5}abc$



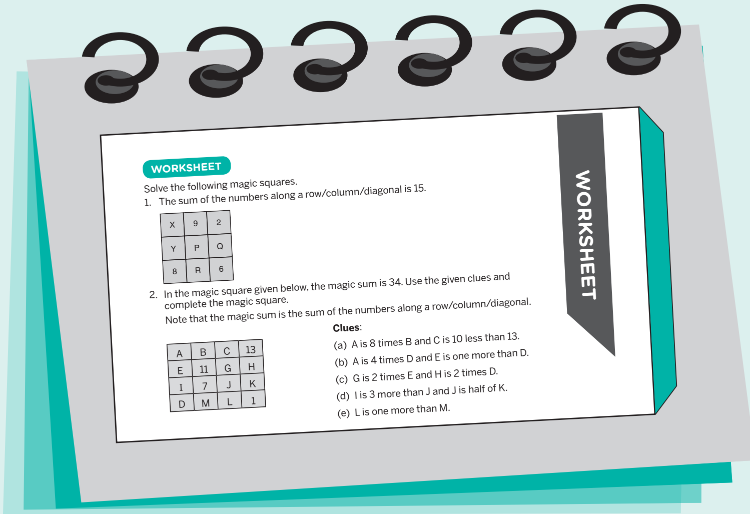
Maths Lab Activity

Aim: To represent fractions on a number line

Materials required:

- Satin ribbon
- Chart paper

$\frac{\ }{2}$ $\frac{1}{3}$ $\frac{2}{3}$ $\frac{3}{4}$



WORKSHEET

Solve the following magic squares.

1. The sum of the numbers along a row/column/diagonal is 15.

X	9	2
Y	P	Q
8	R	6

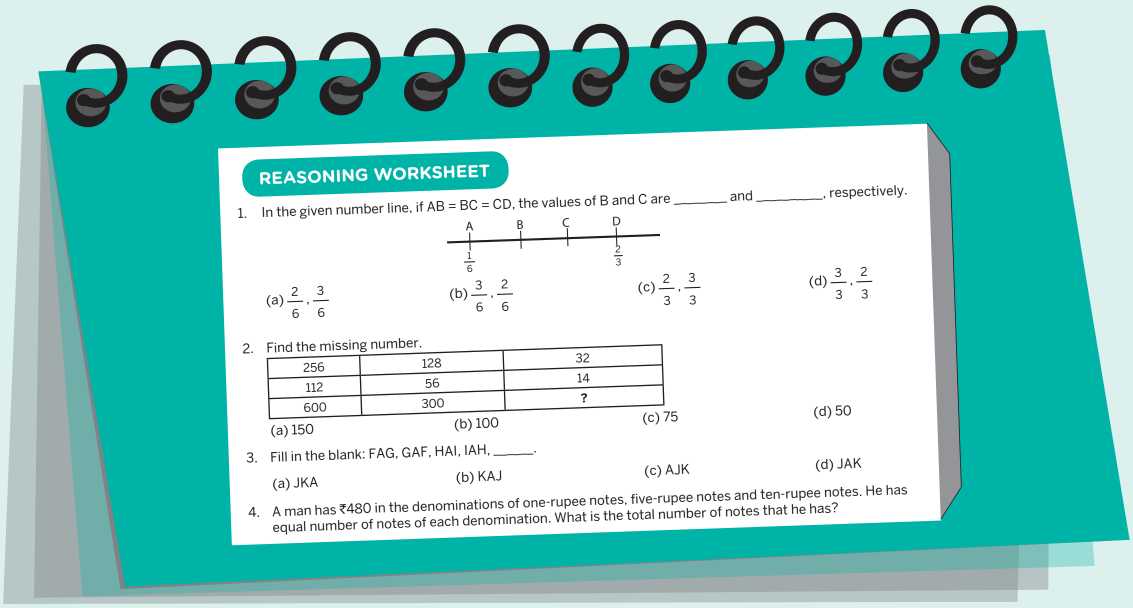
2. In the magic square given below, the magic sum is 34. Use the given clues and complete the magic square.
Note that the magic sum is the sum of the numbers along a row/column/diagonal.

A	B	C	13
E	11	G	H
I	7	J	K
D	M	L	1

Clues:

(a) A is 8 times B and C is 10 less than 13.
(b) A is 4 times D and E is one more than D.
(c) G is 2 times E and H is 2 times D.
(d) I is 3 more than J and J is half of K.
(e) L is one more than M.

WORKSHEET



REASONING WORKSHEET

1. In the given number line, if AB = BC = CD, the values of B and C are ______ and ________, respectively.

A B C D; $\frac{1}{6}$, $\frac{2}{3}$

(a) $\frac{2}{6}, \frac{3}{6}$ (b) $\frac{3}{6}, \frac{2}{6}$ (c) $\frac{2}{3}, \frac{3}{3}$ (d) $\frac{3}{3}, \frac{2}{3}$

2. Find the missing number.

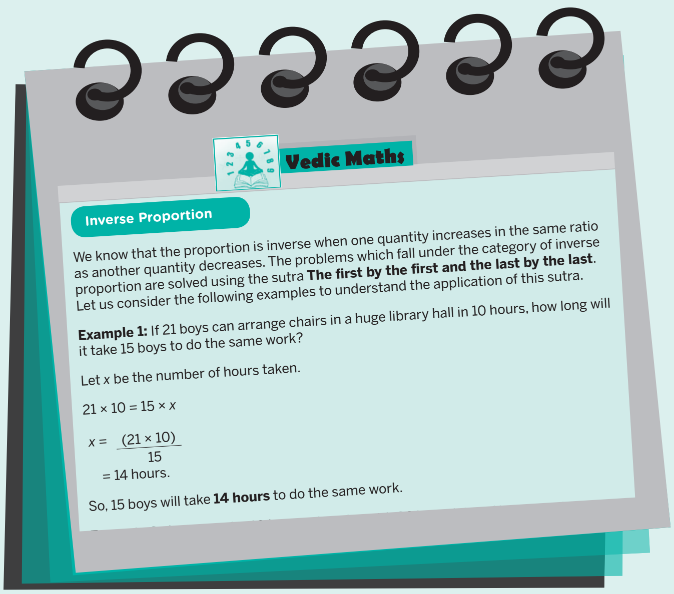
256	128	32
112	56	14
600	300	?

(a) 150 (b) 100 (c) 75 (d) 50

3. Fill in the blank: FAG, GAF, HAI, IAH, ______.

(a) JKA (b) KAJ (c) AJK (d) JAK

4. A man has ₹480 in the denominations of one-rupee notes, five-rupee notes and ten-rupee notes. He has equal number of notes of each denomination. What is the total number of notes that he has?



Vedic Maths

Inverse Proportion

We know that the proportion is inverse when one quantity increases in the same ratio as another quantity decreases. The problems which fall under the category of inverse proportion are solved using the sutra **The first by the first and the last by the last**. Let us consider the following examples to understand the application of this sutra.

Example 1: If 21 boys can arrange chairs in a huge library hall in 10 hours, how long will it take 15 boys to do the same work?

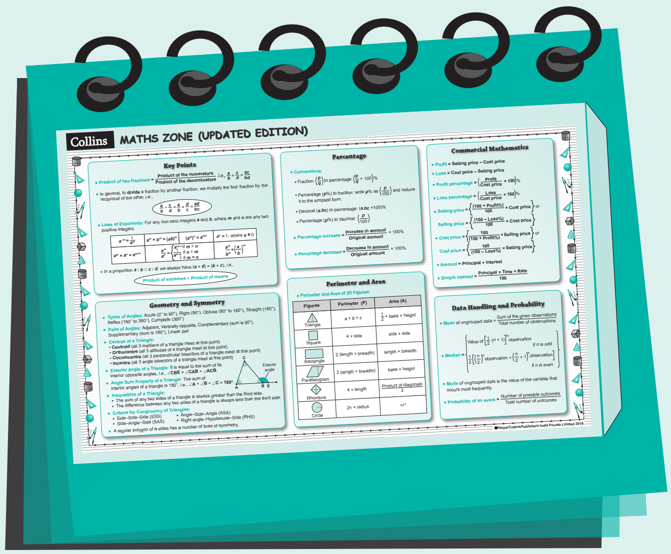
Let x be the number of hours taken.

$21 \times 10 = 15 \times x$

$x = \frac{(21 \times 10)}{15}$

$= 14$ hours.

So, 15 boys will take **14 hours** to do the same work.



Contents

1 Integers

Learning Objectives

- To infer properties of integers−closure, commutative and associative—under all operations
- To infer distributive properties of multiplication of integers under addition and subtraction

Let's Get Started

In our earlier classes, we have learned about integers and their representation on a number line. We have also discussed the four fundamental operations of addition, subtraction, multiplication and division on integers. Let us revise them here.

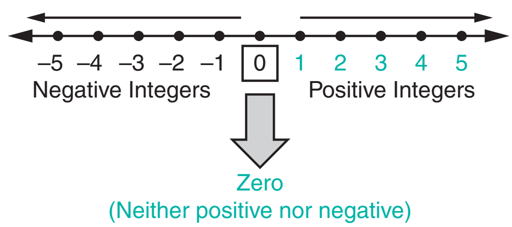
Counting numbers 1, 2, 3, ... are called **natural numbers**.

Whole numbers is the set of natural numbers along with 0. So, every natural number is a whole number. As 0 is not a natural number, we cannot say that every whole number is a natural number.

INTEGERS

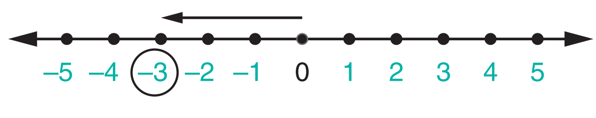
The collection of whole numbers and negative numbers together are called **integers**. The set of all integers is denoted by the capital letter Z.

Z = {... −2, –1, 0, 1, 2 ...} is the set of all integers.

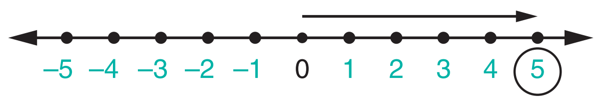


Representation of Integers on the Number Line

Now, let us remember the method of representing integers on a number line. All the positive integers lie to the right of zero and all the negative integers lie to the left of zero on the number line. For example,



−3 is marked 3 units to the left of 0 on the number line.



Similarly, +5 is marked 5 units to the right of 0 on the number line.

Interesting fact:

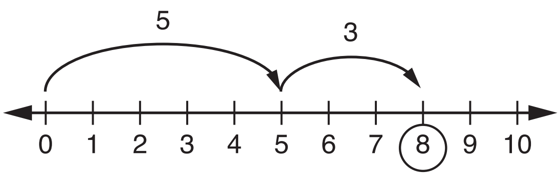
The sign before the number indicates its direction to be placed to the right or left of 0 on the number line, while the number indicates its distance from 0 on the number line. For this reason, integers are also called as **directed numbers.**

FUNDAMENTAL OPERATIONS ON INTEGERS

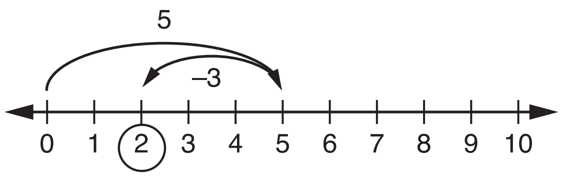
Addition of Integers

On a number line, when we add a positive integer to a given number, we move to the right and when we add a negative integer, we move to the left.

Example 1: 5 + 3 = 8



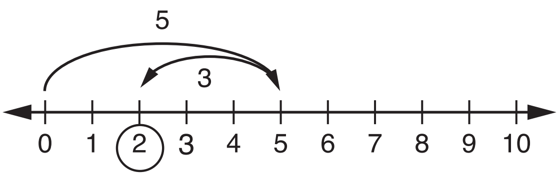
Example 2: 5 + (–3) = 2



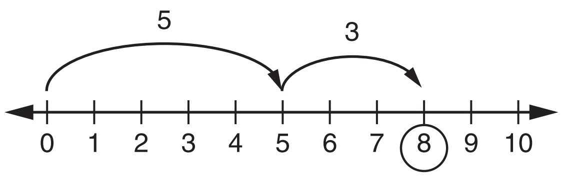
Subtraction of Integers

On a number line, when we subtract a positive integer, we move to the left and when we subtract a negative integer, we move to the right.

Example 3: 5 – 3 = 2



Example 4: 5 – (–3) = 8



Remember

1. To add two integers of the same sign, add their absolute values and put the common sign.
2. To add two integers of the opposite signs, find the difference in their absolute values and put the sign of the number with greater absolute value.

Multiplication of Integers

1. The product of two positive integers is a positive integer.
2. The product of two negative integers is a positive integer.
3. The product of a positive integer and a negative integer is a negative integer.

Example 5: 9 × 8 = 72; (–19) × (–5) = 95; 17 × (–3) = –51; (–13) × 4 = –52

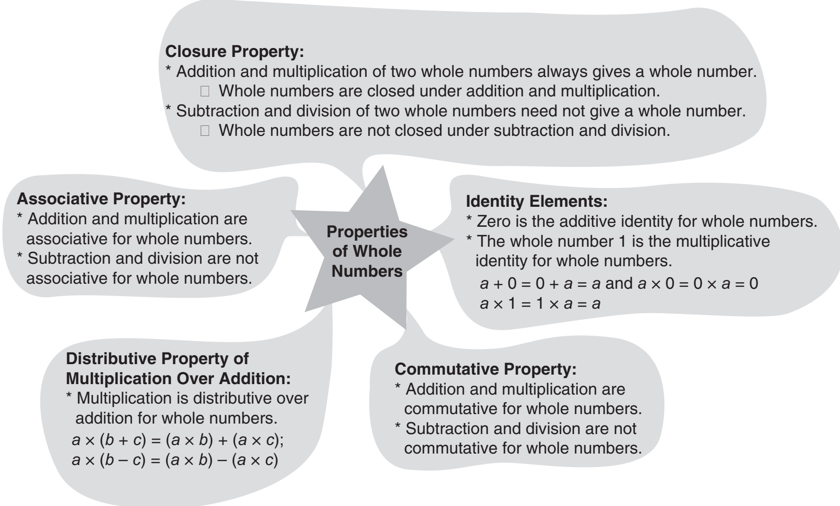
Division of Integers

For any two integers a and b where $b \neq 0$, we have $a \div (-b) = (-a) \div b$ and $(-a) \div (-b) = a \div b$.

Example 6: $-144 \div 12 = -\dfrac{144}{12} = -12$; $-128 \div -8 = 16$

PROPERTIES OF INTEGERS

Let us recall different properties of different operations for whole numbers.



Now, let us check whether these properties hold for integers or not.

Closure Property

Under addition: Observe the following examples.

$(-8) + 2 = (-6)$	$15 + (-10) = 5$	$7 + 3 = 10$	$-25 + (-20) = -45$

We observe that integers are closed under addition.

In general, for any two integers *a* and *b*, *a* + *b* is also an integer.

Under subtraction: Now, evaluate the following problems. One has been done for you.

$10 - 5 = 5$	$7 - 20 = (\quad)$	$-50 - (-20) = (\quad)$	$10 - (-3) = (\quad)$

We observe that integers are closed under subtraction.

In general, for any two integers *a* and *b*, *a* – *b* is also an integer.

Under multiplication: Complete the multiplication problems below. One has been done for you.

$10 \times 5 = 50$	$(-3) \times (-18) = (\quad)$	$10 \times (-8) = (\quad)$	$(-13) \times 19 = (\quad)$

We observe that integers are closed under multiplication.

In general, *a* × *b* is also an integer for all integers *a* and *b*.

Under division: Again, let us check the closure property for division of two integers. Complete the following division table. One has been done for you.

$56 \div 8 = 7$	$4 \div 24 = (\quad)$
$(-42) \div (-12) =$	$(-36) \div 6 = (\quad)$
$(-4) \div (-16) = (\quad)$	$(-600) \div (-50) = (\quad)$

In general, for any two integers *a* and *b*, where b is not zero, $a \div b$ need not be an integer.

We observe that integers are not closed under division.

Do it yourself

Complete the following table by putting ✓ or ✗.

Numbers	Closed Under			
	Addition	Subtraction	Multiplication	Division
Integers				

Commutative Property

Under addition: Take any two integers and write them under columns *a* and *b*. Then, find $a + b$ and $b + a$.

a	**b**	**a + b**	**b + a**	**Is a + b = b + a? (Yes/No)**
+7	–10	–3	–3	Yes
–5	+8			
+2	+4			
–2	–7			

We can observe that two integers can be added in any order. Therefore, addition is commutative for integers. It is called the **commutative property of addition**.

In general, for any two integers *a* and *b*, $a + b = b + a$.

Under subtraction: Take any two integers and write them under columns *a* and *b*. Then, find the value of $a - b$ and $b - a$. Also, check whether $a - b = b - a$. One has been done for you.

a	**b**	**a – b**	**b – a**	**Is a – b = b – a? (Yes/No)**
+7	–10	17	–17	No
–5	+8			
+2	+4			
–2	–7			

We observe that integers are not commutative under subtraction.

In general, for any two distinct integers a and b, $a - b \neq b - a$.

Under multiplication: Now, let us check the commutative property for the product of two integers. For the given integers a and b, find the values of $a \times b$ and $b \times a$. Also, check whether $a \times b = b \times a$. Complete the following table. One has been done for you.

a	**b**	**a × b**	**b × a**	**Is a × b = b × a? (Yes/No)**
+7	–10	–70	–70	Yes
5	2			
–3	8			
12	–4			

We observe that integers are commutative under multiplication.

In general, for any two integers a and b, $a \times b = b \times a$.

Under division: For the given non-zero integers a and b, find $a \div b$ and $b \div a$. Also, check whether $a \div b$ and $b \div a$ are equal. Enter the answers in the following table. One has been done for you.

a	**b**	**a ÷ b**	**b ÷ a**	**Is a ÷ b = b ÷ a? (Yes/No)**
–4	2	–2	$-\frac{1}{2}$	No
–3	–3			
8	–9			
–4	–6			

Are all the values in the columns $a \div b$ and $b \div a$ integers? Observe the last column.

We observe that integers are not commutative under division.

In general, for any two distinct integers a and b, $a \div b \neq b \div a$.

Do it Yourself

Complete the following table by putting ✓ or ✗.

Numbers	**Commutative Under**			
	Addition	Subtraction	Multiplication	Division
Integers				

Associative Property

Under addition: Observe the following example.

Example 7: Consider three negative integers, say –4, –2 and –7. Then, find whether $(-4) + [(-2) + (-7)] = [(-4) + (-2)] + (-7)$.

Now, let us verify by actual addition.

$$(-4) + [(-2) + (-7)] = [(-4) + (-2)] + (-7)$$
$$(-4) + [-9] = [-6] + (-7)$$
$$-13 = -13$$

Therefore, addition of integers is associative.

In general, for any integers a, b and c, we can say that $a + (b + c) = (a + b) + c$.

Under subtraction: Consider any three integers, for example, 6, 5 and 2.

$6 - (5 - 2) = 6 - 3 = 3$
$(6 - 5) -2 = 1 - 2 = -1$
Therefore, we can observe that $6 - (5 - 2) \neq (6 - 5) -2$. That is, subtraction of integers is not associative.

Mental Maths

What value of c satisfies the following equation?

$a - (b - c) = (a - b) - c$

In general, for any three distinct integers a, b and c, $a - (b - c) \neq (a - b) - c$.

Under multiplication: Take any three integers and write them under columns a, b and c. Then, find the value of $(a \times b)$, $(a \times b) \times c$, $(b \times c)$ and $a \times (b \times c)$ and write them in the given table. Also, check whether $a \times (b \times c) = (a \times b) \times c$. One has been done for you.

a	b	c	$(b \times c)$	$a \times (b \times c)$	$(a \times b)$	$(a \times b) \times c$	Is $a \times (b \times c) = (a \times b) \times c$? (Yes/No)
+7	–10	–6	60	420	–70	420	Yes

You can observe that, the product of the three integers is the same irrespective of the order. Therefore, multiplication is associative for integers.

In general, for any three integers a, b and c, $a \times (b \times c) = (a \times b) \times c$.

Under division: Observe the following example.

Consider any three integers, say, 16, 8 and 2, we have:

$16 \div (8 \div 2) = 16 \div 4 = 4$ and $(16 \div 8) \div 2 = 2 \div 2 = 1$
$\therefore\ 16 \div (8 \div 2) \neq (16 \div 8) \div 2$

From the above example, we observe that integers are not associative under division.

Mental Maths

What value of c satisfies the following equation?

$a \div (b \div c) = (a \div b) \div c$

In general, for any three distinct non-zero integers a, b and c, $a \div (b \div c) \neq (a \div b) \div c$.

Do it Yourself

Complete the following table by putting ✓ or ✗.

Numbers	Associative Under			
	Addition	Subtraction	Multiplication	Division
Integers				

Special Properties of Zero and 1

Under addition:

1. **Property of 1 or Successor of an integer**

   Addition of 1 to any integer gives its successor.

   Examples: $4 + 1 = 5$, $-3 + 1 = -2$

   Hence, 5 is the successor of 4 and -2 is the successor of -3.

   In general, for any integer a, $a + 1$ is called the successor of a.

2. **Additive Identity**

   Complete the following.

   $16 + (\ ) = 16$; $0 + (\ ) = 19$; $-5 + (\ ) = -5$

   You can observe that when you add zero to any integer, you get the same integer.

The **additive identity** for integers is that number which when added to any integer gives the same integer. Hence, 0 is the additive identity.

In general, for any integer a, $a + 0 = 0 + a = a$.

3. **Additive Inverse**

The **additive inverse** of an integer is that number which when added to its opposite gives the result as zero.

Therefore, an integer and its opposite are called **additive inverse** of each other.

Example: 5 + (–5) = 0 = (–5) + 5

Hence, 5 and –5 are additive inverse of each other.

In general, for any integer a, $-a$ is its opposite (or vice-versa) such that $a + (-a) = 0 = (-a) + a$

Under subtraction:

1. **Property of 1 or Predecessor of an integer**

Subtraction of 1 from any integer gives its predecessor.

Example: 8 –1 = 7; (–2) – 1 = (–3)

Hence, 7 is predecessor of 8 and (–3) is predecessor of (–2).

In general, for any integer a, $a - 1$ is called the predecessor of a.

2. **Property of Zero**

Subtraction of 0 from any integer gives the same integer.

Example: 9 – 0 = 9; (–3) – 0 = (–3)

In general, for any integer a, $a - 0 = a$.

Under multiplication:

Look at the integer multiplication table below:

Observe the coloured row and column.

×	−5	−4	−3	−2	−1	0	1	2	3	4	5
−5	25	20	15	10	5	0	−5	−10	−15	−20	−25
−4	20	16	12	8	4	0	−4	−8	−12	−16	−20
−3	15	12	9	6	3	0	−3	−6	−9	−12	−15
−2	10	8	6	4	2	0	−2	−4	−6	−8	−10
−1	5	4	3	2	1	0	−1	−2	−3	−4	−5
0	0	0	0	0	0	0	0	0	0	0	0
1	−5	−4	−3	−2	−1	0	1	2	3	4	5
2	−10	−8	−6	−4	−2	0	2	4	6	8	10
3	−15	−12	−9	−6	−3	0	3	6	9	12	15
4	−20	−16	−12	−8	−4	0	4	8	12	16	20
5	−25	−20	−15	−10	−5	0	5	10	15	20	25

$0 \times 0 = (\quad)$

$-100 \times 0 = (\quad)$

$(-3) \times 1 = (\quad)$

$(-5) \times 4 = (\quad)$

1. Property of Zero

The product of any integer with zero is zero.

In general, for any integer a, $a \times 0 = 0 \times a = 0$

2. Multiplicative Identity

Now, what is the product of any integer say a and 1? What is the product of 1 and a?

The answer is a.

Therefore, 1 is the **multiplicative identity** for integers.

In general, for any integer a, $a \times 1 = 1 \times a = a$.

Remember
The **multiplicative identity** for integers is that number which when multiplied by any integer gives the same integer.

3. Multiplicative Inverse

The product of any non-zero integer and its reciprocal gives the result as 1.

Example: for any integer, say 5, its reciprocal is $\frac{1}{5}$.

Therefore, $5 \times \frac{1}{5} = 1$ (Multiplicative Identity).

Hence, 5 and $\frac{1}{5}$ are multiplicative inverse of each other.

In general, if a is any non-zero integer, then $a \times \frac{1}{a} = \frac{1}{a} \times a = 1$.

Under division:

1. **Property of 1**

   Division by 1 gives the same integer as the quotient.

   Examples: $5 \div 1 = 5$, $(-15) \div 1 = (-15)$.

   In general, if a is any integer, then $a \div 1 = a$.

2. **Property of Zero**

   When zero is divided by any non-zero integer, the result is always zero.

   Examples: $0 \div 5 = 0$; $0 \div (-7) = 0$

   In general, if a is any non-zero integer, then $0 \div a = 0$.

Solved Examples

Example 8: Verify $[7 \times (-5)] \times 6 = 7 \times [(-5) \times 6]$.

Consider LHS $= [7 \times (-5)] \times 6 = (-35) \times 6 = -210$

RHS $= 7 \times [(-5) \times 6] = 7 \times (-30) = -210$

$\therefore$ LHS = RHS

$\therefore [7 \times (-5)] \times 6 = 7 \times [(-5) \times 6]$

Hence, verified.

Exercise 1.1

1. **Fill in the blanks.**

   (a) $(-9) + (\_\_\_\_\_\_) = (5) + (\_\_\_\_\_\_)$

   (b) $(\_\_\_\_\_\_) + 25 = 0$

   (c) $12 - (\_\_\_\_\_\_) = 24$

   (d) $(\_\_\_\_\_\_) + (-15) = (\_\_\_\_\_\_) + (-3)$

   (e) $(-54) - (-21) = -(\_\_\_\_\_\_)$

   (f) $(-255) \div \_\_\_\_\_\_$ is not defined

   (g) $(-21) \div \_\_\_\_\_\_ = -21$

   (h) $\_\_\_\_\_\_ \div (-98) = 0$

2. **Evaluate the following.**

   (a) $(-1) \times (-2) \times (-3) \times (-4) \times (-5)$

   (b) $(-1) \times (-5) \times (-4) \times (-6)$

   (c) $-245 + 90 + (-140)$

   (d) $(-9) \times 5 \times (-1) \times 1$

3. Subtract the sum of -1878 and 878 from 2000.

4. What will be the value of a if $a \times (-2) = (-30)$?

5. The product of two integers is -51. If one integer is -17, find the other.

Distributive Laws

Distributive law of multiplication over addition

Multiplication of integers is distributive over addition.

For any integers a, b and c, we have $a \times (b + c) = (a \times b) + (a \times c)$.

Example 9: Use distributive property of multiplication of integers and simplify the following: $18 \times [7 + (-3)]$.

According to the distributive property, we have, $a \times (b + c) = (a \times b) + (a \times c)$.

$$18 \times [7 + (-3)] = (18 \times 7) + (18 \times -3) = 126 + (-54) = 126 - 54 = 72$$

Therefore, $18 \times [7 + (-3)] = 72$.

Distributive law of multiplication over subtraction

Multiplication of integers is distributive over subtraction.

For any integers a, b and c, we have $a \times (b - c) = (a \times b) - (a \times c)$.

Example 10: Use distributive property of multiplication of integers and evaluate $(-21) \times [(-4) - (-6)]$.

Note: Division by zero is not defined or possible.

According to distributive property, we have $a \times (b - c) = (a \times b) - (a \times c)$.

$$(-21) \times [(-4) - (-6)] = (-21 \times -4) - (-21 \times -6) = 84 - 126 = -42$$

Therefore, $(-21) \times [(-4) - (-6)] = -42$.

Exercise 1.2

1. **Verify the distributive property of multiplication of integers over addition and subtraction for the values of *a, b* and *c* given in the table.**

a	*b*	*c*
−2	5	−3
7	−9	−11
−24	−12	−5

2. **Evaluate the following.**

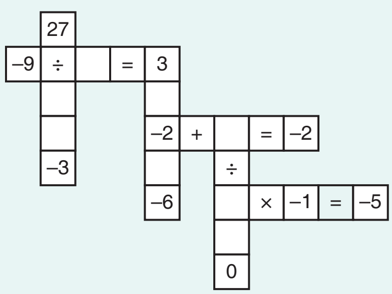
   (a) $12 \div [(13) + (-13)]$

   (b) $[(56) \div (-2)] \div (-4)$

   (c) $[(-100) + (60)] \div [(29) - (9)]$

   (d) $(-6) \div [(36) \div (-12)]$

3. **Complete the puzzle.**



WORD PROBLEMS

We have learnt different operations on integers and their properties. Let us solve some problems on them.

Solved Examples

Example 11: Mithra has attempted civil services preliminary exam in which every correct answer is assigned +2 marks and for every 3 incorrect answers 2 marks will be reduced. No negative marking for questions that are not attempted. Out of 180 questions if she has answered 130 correct, 45 wrong and left 20 un-attempted what is her score?

Number of questions answered correctly = 130

Marks assigned for each correct answer = 2

Total marks scored for correct answers = 130 × 2 = 260

Number of questions answered incorrectly = 45

For every 3 incorrect answers 2 marks are deducted.

Therefore, for 45 incorrect answers the marks that are deducted is $\left(\frac{45}{3}\times 2\right) = 15 \times 2 = 30$

Hence, the total score of Mithra in the civil services preliminary exam is 260 – 30 = 230.

Example 12: The temperature on a particular day of a city is as follows. In the morning it was 5°C, then it went down to –7°C by 11 a.m. It continued at that temperature for 4 hours and then increased by 5°C. What is the temperature of the city at 4 p.m.? Is it above the freezing point or below the freezing point?

Temperature of the city in the morning = 5°C

Temperature of the city at 11 a.m. = –7°C

Temperature after 4 hours from 11 a.m. = –7°C + 5°C = –2°C (Since the temperature is increased by 5°C)

Therefore, the temperature of the city at 4 p.m. is –2°C which is below the freezing point.

Example 13: A submarine has reached 5200 ft below the sea level. If it rises at a rate of 15 ft per minute, what is the position of the submarine after 2 hours?

Depth of the submarine = –5200 ft (5200 ft below the sea level)

Rate at which the submarine is rising = 15 ft per minute = 15 ft × 60 per hour = 900 ft per hour

Distance travelled by the submarine in 2 hours = 2 × 900 ft = 1800 ft.

The position of the submarine after 2 hours = –5200 ft + 1800 ft = –3400 ft.

Therefore, the submarine is at a depth of 3400 ft below the sea level after 2 hours.

Example 14: Sharan has taken a loan of amount ₹2,00,000 from 4 different banks. If he has taken the same amount from all the banks what is the loan amount in each bank?

Total loan amount = ₹2,00,000

Loan amount in each bank = ₹2,00,000 ÷ 4 = ₹50,000

Exercise 1.3

Solve the following word problems.

1. The statement of a savings account of Ms. Ananya is as follows. Fill in the blank spaces.

Ms. Ananya,
6th cross, 3rd Main,
MR Nagar,
Bangalore.

Account No: xxxxxxxxx3075

From: 1/06/2019 To: 5/06/2019 Statement of account

Date	Narration	Withdrawal amt.	Deposit Amt.	Closing Balance
01/06/2019	Salary Credited		10,000.00	10,000.00
02/06/2019	Monthly EMI	2500.00		
03/06/2019	NEFT Cr.		3,500.00	
04/06/2019	ATM Withdrawl	5,000.00		
05/06/2019	Monthly Interest Credit		120.00	

What is the balance amount as on 05 June 2019?

2. The highest record in long jump at a particular place is 9 m. If Mr. X has recorded 7 m in long jump, by how much is he short to reach the record?

3. In a competitive exam consisting of 100 questions, each correct answer gets 2 marks and each wrong answer gets –1 mark. If a student has written 70 correct answers and 30 wrong answers, what is his/her score?

4. A submarine has gone 4000 ft deep into the sea. If it rises at a rate of 30 ft per minute what is its position after 45 minutes?

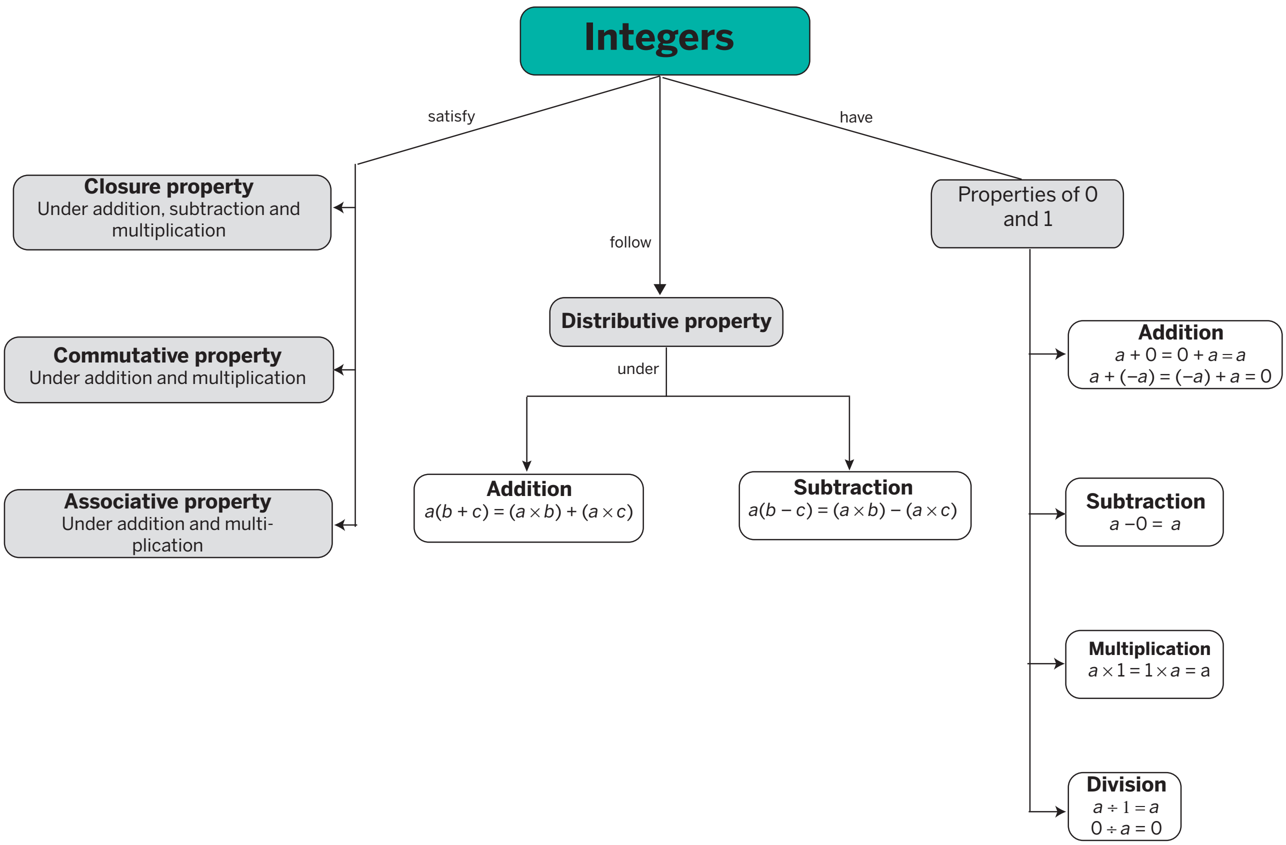
5. The temperature of Bangalore on a sunny day was 20°C in the morning. The temperature is increased by 19°C and reached to maximum temperature by noon. It remained at that temperature for 5 hours and then decreased by 15°C. What is the temperature of the city at 6 p.m.?

6. A scuba diver has set a record of reaching 320 m depth in a sea. If another scuba diver has reached 280 m depth, how much more he has to dive to reach the record?

7. Five friends have contributed an amount of ₹1000 to an orphanage. What is the contribution of each person if all of them have contributed equally?

8. Anagha and her four friends went to an exhibition. They paid a total of ₹75 as entry fees. What is the entry fee per person?

SUMMARY



Revision Exercise

1 **Complete the following statements. State the property used to complete each of these.**

(a) –17 + (   ) = –17

(b) (   ) × 1 = 16

(c) (51 × 75) × 43 = 51 × [(   ) × 43]

(d) –65 + (   ) = 0

(e) 36 + 112 = (   ) + 36

(f) 145 × (   ) = 73 × 145

(g) 41 × 54 = (   ) × (   )

(h) 0 + (   ) = 24

2 **State whether the following statements are true (T) or false (F). Give reasons.**

(a) 50 × 56 = 56 × 50

(b) 73 + 0 = 73

(c) 34 × (9 × 15) = (34 × 9) × 15

(d) 28 – (31 – 11) = (28 – 31) – 11

(e) 81 ÷ 8 = 8 ÷ 81

(f) 37 × 1 = 37

3 **Write an expression equal to each one of the following expressions using the commutative or associative property of addition or multiplication of integers. Name the property.**

(a) 4 + (–6)

(b) (12 + 16) + 10

(c) [15 × (–9)] × 13

(d) (4 + 6) + (–6)

(e) 15 × 104

(f) (–4) + (–12)

4 **Complete the following tables using integers. Check whether the closure and commutative properties hold true for the said operations.**

+	–2	–1	0	1	2
–2					
–1					
0					
1					
2					

×	–2	–1	0	1	2
–2					
–1					
0					
1					
2					

5 **Solve the following word problems.**

(a) A submarine is situated at a depth of 630 ft below the sea level. If it goes 125 ft further deep into the sea, what is the position of the submarine?

(b) The melting points of some metals are given in the following table.

Metal	Melting point (°C)
Aluminum	660
Magnesium	650
Copper	1084
Tin	232

(i) What is the difference in the melting points of aluminum and tin?

(ii) What is the difference in the melting points of magnesium and copper?

(iii) Which is more, the difference between the melting points of magnesium and tin or the difference between the melting points of aluminum and copper?

(c) The credit card bill of a person is ₹5000. He repaid an amount of ₹4200 and again purchased an item of worth ₹1500. What is the outstanding amount in the credit card of that person?

(d) On a particular day, the stock market value has reached to a maximum of 28,000. If it loses 150 points every hour for 5 hours, what is its value after 5 hours?

(e) Mukesh's breakfast costs ₹30 per day at a restaurant. If he deposits an amount of ₹210 in that restaurant how many days can he have his breakfast there?

Maths Lab Activity

Aim: To prove that multiplication is distributive over addition and subtraction for integers

Materials required: Playing cards

Procedure: Divide the class into groups of five. Provide one set of cards to all the groups and ask each group to sit in circles and place the stack of cards at the centre, face down. Explain the following rules to all the groups.

(a) Every black card represents a positive number. Black 7 means +7.

(b) Every red card represents a negative number. Red 3 means –3.

(c) Joker is zero, Jack (J) is 11, Queen (Q) is 12, King (K) is 13 and Ace (A) is 14.

Pick any three numbers from the set and write them under columns a, b and c. Then, find the values of $(b + c)$, $a \times (b + c)$, $(a \times b)$, $(a \times c)$ and $(a \times b) + (a \times c)$ and write them in the given table. Also, check whether $a \times (b + c) = (a \times b) + (a \times c)$.

Similarly, find the values of $(b - c)$, $a \times (b - c)$, $(a \times b)$, $(a \times c)$, $(a \times b) - (a \times c)$ and write them in the given table. Check whether $a \times (b - c) = (a \times b) - (a \times c)$.

Help students to arrive at the fact that multiplication is distributive over addition of integers and multiplication is distributive over subtraction of integers.

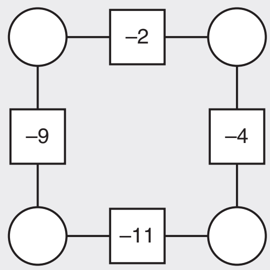
a	b	c	$(b+c)$	$a \times (b+c)$	$(a \times b)$	$(a \times c)$	$(a \times b) + (a \times c)$	Is $a \times (b+c) = (a \times b) + (a \times c)$? (Yes/No)

a	b	c	$(b-c)$	$a \times (b-c)$	$(a \times b)$	$(a \times c)$	$(a \times b) - (a \times c)$	Is $a \times (b-c) = (a \times b) - (a \times c)$? (Yes/No)

Conclusion: Multiplication is distributive over addition and subtraction for integers.

Challenge

Write a number in each circle so that the number in each box is equal to the sum of the two numbers in circles on either side of it.



2 Fractions and Decimals

Learning Objectives

- To perform multiplication and division on fractions
- To perform multiplication and division on decimals

Let's Get Started

Fraction is a part of a whole. Fractions are in the form $\frac{p}{q}$ $(q \neq 0)$, where the digit above the horizontal line (p) is called the **numerator** and the digit below the horizontal line (q) is called the **denominator**.

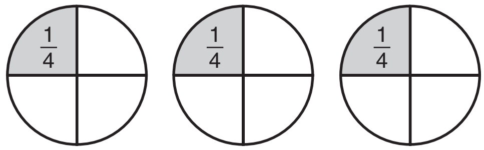
Let us recall the types of fractions which we learnt in the previous class.

Types of Fractions	Definition	Examples
Proper Fraction	A fraction where the numerator is less than the denominator	$\frac{3}{4}, \frac{2}{5}, \frac{1}{2}, \frac{7}{8}, \frac{6}{11}, \ldots.$
Improper Fraction	A fraction where the numerator is greater than the denominator	$\frac{3}{2}, \frac{6}{5}, \frac{11}{7}, \frac{5}{3}, \frac{10}{9},$ □ .
Mixed Fraction	A fraction which is a combination of a whole number and a proper fraction	$1\frac{3}{4}, 1\frac{1}{2}, 2\frac{1}{5}, 5\frac{1}{3}, 3\frac{9}{10}, \ldots.$
Like Fractions	A set of fractions having same denominators	$\frac{3}{4}, \frac{4}{4}, \frac{1}{4}, \frac{7}{4}, \frac{2}{4}, \ldots.$
Unlike Fractions	A set of fractions having different denominators	$\frac{3}{5}, \frac{4}{7}, \frac{12}{15}, \frac{7}{9}, \frac{8}{7}, \ldots.$
Unit Fractions	Fractions which have 1 as their numerator	$\frac{1}{5}, \frac{1}{4}, \frac{1}{10}, \frac{1}{8}, \frac{1}{7}, \ldots.$

MULTIPLICATION OF FRACTIONS

Multiplication of a Whole Number by a Fraction

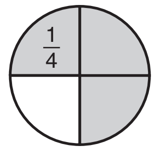
Consider the following examples.



Example 1: Find $3 \times \frac{1}{4}$.

Look at the figures given here.

Here, each shaded portion represents $\frac{1}{4}$ of the whole. When these three parts are taken together, they will represent $\frac{3}{4}$ of the whole.



Thus, it can be written as $\frac{1}{4} \times 3 = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{1+1+1}{4} = \frac{3}{4}$

So, $\frac{1}{4} \times 3 = \frac{1 \times 3}{4} = \frac{3}{4}$.

Therefore, $\frac{1}{4} \times 3 = \frac{3}{4}$.

> To multiply a fraction by a whole number, multiply the numerator of the fraction by the whole number and express the resultant fraction in the simplest form.

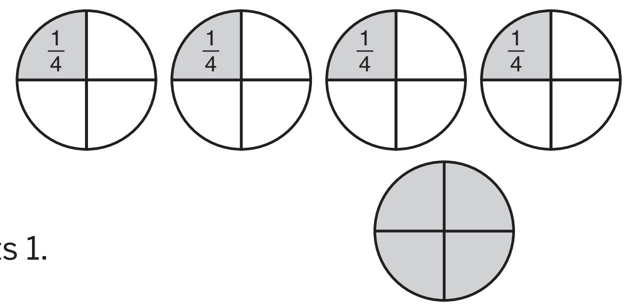
Example 2: Find $4 \times \frac{7}{8}$.

$4 \times \frac{7}{8} = \frac{4 \times 7}{8} = \frac{28}{8} = \frac{7}{2}$

Example 3: Find $4 \times 2\frac{3}{4}$.

$4 \times 2\frac{3}{4} = 4 \times \frac{11}{4} = \frac{4 \times 11}{4} = \frac{44}{4} = 11$

Fraction as an operator 'of'



Each shaded portion represents $\frac{1}{4}$ of 1.

So, the shaded portions together will represent $\frac{1}{4}$ of 4.

Combine the four shaded $\frac{1}{4}$ parts. It represents 1.

Therefore, $\frac{1}{4}$ of 4 is 1.

It can also be written as $\frac{1}{4}$ of $4 = \frac{1}{4} \times 4 = 1$.

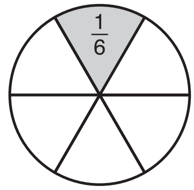
Example 4: Find $\frac{3}{6}$ of 9.

$\frac{3}{6}$ of $9 = \frac{3}{6} \times 9 = \frac{3 \times 9}{6} = \frac{27}{6} = \frac{9}{2} = 4\frac{1}{2}$

Example 5: Find $\frac{4}{12}$ of 20.

$\frac{4}{12}$ of $20 = \frac{4}{12} \times 20 = \frac{4 \times 20}{12} = \frac{80}{12} = \frac{20}{3} = 6\frac{2}{3}$

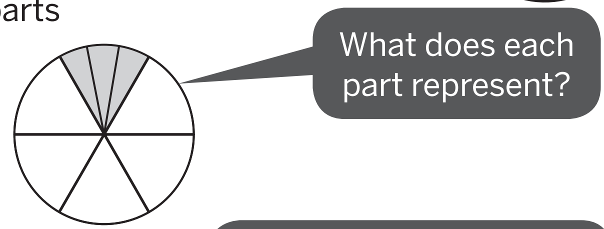
Multiplication of a Fraction by a Fraction



Find $\frac{1}{3} \times \frac{1}{6}$.

Look at the adjacent figure.

Here, the whole figure is divided into six equal parts and one part of it is shaded.

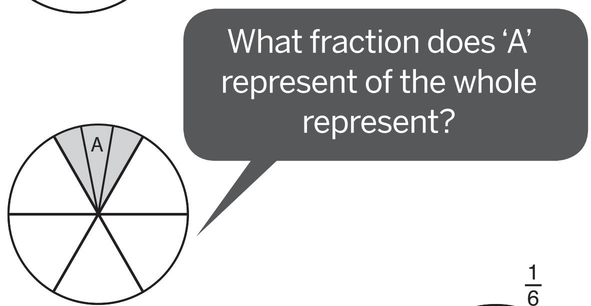


How do you find $\frac{1}{3}$ in $\frac{1}{6}$?

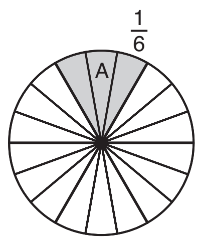
Divide $\frac{1}{6}$ into three equal parts as shown.

Each part represents $\frac{1}{3}$ of $\frac{1}{6}$.

Take out one part of it and label it as A as shown in the figure.



Remember '**A**' represents $\frac{1}{3} \times \frac{1}{6}$.



How many $\frac{1}{3}$ equal parts are there? What does 'A' represent?

For this, divide each of the remaining $\frac{1}{6}$ parts into three equal parts and observe them.

'A' represents $\frac{1}{18}$ of the whole. The whole is divided into 18 equal parts (18 = 6 × 3) and one part (1 = 1 × 1) is taken out of it.

Thus, it can be written as $\frac{1}{3} \times \frac{1}{6} = \frac{1 \times 1}{3 \times 6} = \frac{1}{18}$.

Interesting facts:

1. When two proper fractions are multiplied, the product is less than each of the two fractions.
2. When two improper fractions are multiplied, the product is greater than each of the two fractions.
3. The product of a proper and an improper fraction is less than the improper fraction and greater than the proper fraction.

Example 6: Find the product of the following:

a) $2\frac{1}{4}$ and $3\frac{1}{6}$ b) $1\frac{1}{5}$, $3\frac{4}{7}$ and $\frac{9}{7}$

Solution:

a) $2\frac{1}{4} \times 3\frac{1}{6} = \frac{9}{4} \times \frac{19}{6} = \frac{\overset{3}{\cancel{9}} \times 19}{4 \times \underset{2}{\cancel{6}}} = \frac{57}{8}$ or $7\frac{1}{8}$

b) $1\frac{1}{5} \times 3\frac{4}{7} \times \frac{9}{7} = \frac{6}{5} \times \frac{25}{7} \times \frac{9}{7} = \frac{6 \times \overset{5}{\cancel{25}} \times 9}{{}_{1}\cancel{5} \times 7 \times 7} = \frac{270}{49}$ or $5\frac{25}{49}$.

$$\text{Product of two fractions} = \frac{\text{Product of the numerators}}{\text{Product of the denominators}}$$

Exercise 2.1

1 Multiply the following.

(a) $6 \times \frac{2}{5}$ (b) $4 \times \frac{7}{10}$ (c) $8 \times \frac{3}{5}$ (d) $\frac{4}{6} \times 5$ (e) $2 \times 2\frac{1}{2}$

2 Find the following.

(a) $\frac{3}{5}$ of 5 (b) $\frac{2}{3}$ of 6 (c) $\frac{3}{12}$ of 8 (d) $\frac{12}{24}$ of 21 (e) $2\frac{4}{5}$ of 5

3 Multiply the following fractions.

(a) $\frac{1}{6} \times \frac{2}{3}$ (b) $\frac{3}{5} \times \frac{5}{6}$ (c) $\frac{2}{12} \times \frac{1}{2}$ (d) $3\frac{3}{11} \times 1\frac{2}{9}$ (e) $5\frac{5}{6} \times 1\frac{2}{7}$

(f) $2\frac{1}{7} \times 1\frac{4}{5} \times \frac{1}{3}$ (g) $3\frac{1}{2} \times \frac{3}{7} \times \frac{5}{4}$

Reciprocal of a Fraction

The reciprocal of a fraction $\frac{a}{b}$ is the fraction $\frac{b}{a}$. Reciprocal $\frac{b}{a}$ is obtained by interchanging the position of the numerator and the denominator of the fraction $\frac{a}{b}$. Here, a and b are not equal to zero.

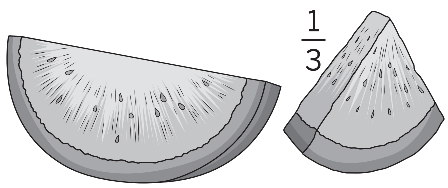
For example, the reciprocal of $\frac{5}{7}$ is $\frac{7}{5}$ and the reciprocal of $\frac{8}{9}$ is $\frac{9}{8}$.

Note: Reciprocal of zero does not exist.

DIVISION OF FRACTIONS

Division of a Fraction by a Whole Number

Equal pieces of one-fourth of a watermelon are distributed to three children. How much does each one get?



$\frac{1}{3}$

To find this, we have to divide $\frac{1}{4}$ by 3.

So, $\frac{1}{4} \div 3 = \frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

Reciprocal of $\frac{3}{1}$ is $\frac{1}{3}$. Instead of dividing by 3, multiply by the reciprocal of 3, which is $\frac{1}{3}$.

Therefore, each one gets $\frac{1}{12}$ of the watermelon.

Example 7: Find $\frac{1}{5} \div 15$.

$\frac{1}{5} \div 15 = \frac{1}{5} \times \frac{1}{15} = \frac{1}{75}$

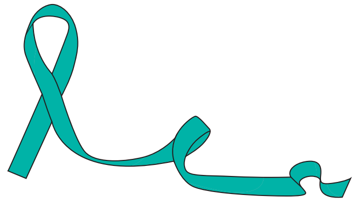
Example 8: Find $\frac{3}{4} \div 9$.

$\frac{3}{4} \div 9 = \frac{3}{4} \times \frac{1}{9} = \frac{3}{36} = \frac{1}{12}$

In general, to divide a fraction by a whole number, we multiply the fraction by the reciprocal of the whole number.

Division of a Fraction by Another Fraction

A ribbon is $\frac{9}{12}$ m long. How many pieces of one-fourth metre can you cut out of it?



Length of the ribbon $= \frac{\cancel{9}^{3}}{\cancel{12}_{4}}$ m $= \frac{3}{4}$ m

Write it in the simplest form.

Required length for the piece $= \frac{1}{4}$ m

Required answer $= \frac{3}{4} \div \frac{1}{4} = \frac{3 \times 4}{4} = 3$

Therefore, the number of pieces got by cutting the ribbon is 3.

Alternate method:

Length of the ribbon $= \frac{9}{12}$ m $= \frac{3}{4}$ m $= \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$.

Clearly, the number of $\frac{1}{4}$ pieces got by cutting the ribbon of length $\frac{9}{12}$ m is 3.

Example 9: Find $\frac{3}{8} \div \frac{3}{4}$.

To find $\frac{3}{8} \div \frac{3}{4}$, write the reciprocal of $\frac{3}{4}$ as $\frac{4}{3}$.

That is, $\frac{3}{8} \div \frac{3}{4}$ is written as $\frac{3}{8} \times \frac{4}{3}$. Now, find the answer and keep it in the simplest form.

That is, $\frac{3}{8} \times \frac{4}{3} = \frac{3 \times 4}{8 \times 3} = \frac{\cancel{12}^{1}}{\cancel{24}_{2}} = \frac{1}{2}$

In general, to divide a fraction by another fraction, we multiply the first fraction by the reciprocal of the other.

Mental Maths

Divide the following.

(a) $\frac{3}{5} \div \frac{2}{3}$ (b) $\frac{1}{2} \div \frac{1}{4}$ (c) $\frac{1}{2} \div \frac{1}{5}$ (d) $\frac{1}{2} \div \frac{2}{10}$

Exercise 2.2

1 **Find the reciprocal of the following.**

(a) $\frac{2}{5}$ (b) $\frac{12}{15}$ (c) 6 (d) $\frac{9}{2}$

2 **Divide the following fractions.**

(a) $\frac{15}{24} \div \frac{1}{3}$ (b) $\frac{18}{28} \div \frac{3}{4}$ (c) $\frac{2}{7} \div \frac{4}{21}$ (d) $\frac{5}{9} \div \frac{45}{36}$ (e) $\frac{2}{5} \div \frac{6}{16}$

(f) $\frac{5}{6} \div \frac{25}{36}$ (g) $\frac{17}{18} \div \frac{3}{9}$ (h) $\frac{5}{6} \div \frac{2}{3}$ (i) $\frac{15}{16} \div \frac{15}{32}$ (j) $\frac{5}{14} \div \frac{3}{7}$

APPLICATIONS OF MULTIPLICATION AND DIVISION OF FRACTIONS

Now, let us learn to solve a few word problems on multiplication of fractions.

Example 10: In a city, $\frac{3}{4}$ of the people own pets. Of those who own pets, $\frac{4}{6}$ own dogs. What fraction of the people in the city owns dogs?

$\frac{3}{4}$ of the people own pets and $\frac{4}{6}$ of those people who own pets own dogs.

Therefore, number of people in the city who own dogs = $\frac{3}{4} \times \frac{4}{6} = \frac{12}{24} = \frac{1}{2}$

Therefore, the fraction of people in the city who own dogs is $\frac{1}{2}$.

Example 11: For stitching uniform of one girl, $2\frac{1}{4}$ m of cloth is required. In a school, $105\frac{3}{4}$ m of cloth was received for stitching uniforms for girls. For how many girls can the uniform be stitched?

Cloth received for uniforms = $105\frac{3}{4}$ m

Each girl's requirement = $2\frac{1}{4}$ m

To find out the number of uniforms that can be stitched, divide the total length of cloth by the length of cloth required for a girl. That is, divide $105\frac{3}{4} \div 2\frac{1}{4}$.

Convert into improper fractions.

$$105\frac{3}{4} \div 2\frac{1}{4} = \frac{423}{4} \div \frac{9}{4}$$

Take reciprocal of the second fraction.

$$= \frac{423}{4} \times \frac{4}{9} = 47$$

Therefore, the uniform can be stitched for 47 girls.

Exercise 2.3

Solve the following word problems.

1. Harish had 30 pieces of sweets. If he ate $\frac{7}{10}$ of them in one week, how many pieces of sweets did he eat?
2. A hotel uses $\frac{1}{2}$ of a cup of vinegar in a salad recipe. How much vinegar would the hotel use to make $\frac{2}{3}$ of the recipe?
3. Sunita reads $\frac{1}{5}$ of a book in one hour. How much part of the book will she read in $2\frac{1}{5}$ hours?
4. In a students' hostel, each inmate is given $\frac{2}{5}$ litre of milk. Among how many children can $16\frac{4}{10}$ litres of milk be distributed?
5. An aeroplane covers 50 km in $\frac{1}{5}$ hours. How many kilometres can the aeroplane cover in 5 hours?
6. Ramesh rides his bike for $\frac{5}{4}$ km to reach his school. He can ride $\frac{3}{8}$ km in one minute. How long will it take him to reach the school?

DECIMALS

You have already learned that decimals such as 0.1, 0.01 and 0.001 can be expressed in the form of fractions as $\frac{1}{10}, \frac{1}{100}$ and $\frac{1}{1000}$ respectively.

A decimal number can be written in expanded form. For example,

$$12.12 = 1 \times 10 + 2 \times 1 + 1 \times \frac{1}{10} + 2 \times \frac{1}{100}$$

Comparison of Decimals

Two decimal numbers can be compared by comparing their whole number parts. If their whole number parts are different, the decimal number with greater whole number part is greater.

For example, 25.43 > 21.35 since 25 > 21.

Addition and Subtraction of Decimals

Two decimal numbers can be added or subtracted. For example,

	O		Ots	Ohs
	1	•	2	3
+	4	•	1	0
	5	•	3	3

	O		Ots	Ohs
	4	•	5	0
−	3	•	1	0
	1	•	4	0

MULTIPLICATION OF DECIMAL NUMBERS

Multiplication of a Decimal Number by a Whole Number

A newspaper delivery boy earns ₹35.5 per day. How much does he earn per week?

We know that one week has 7 days. Therefore, the amount earned by the newspaper delivery boy in a week is given by 35.5 × 7.

Let us learn how to multiply a decimal number by the whole number.

Consider 355 × 7 = 2485

Since there is one digit after the decimal point in 35.5, we get,

35.5 × 7 = 248.5
Therefore, the newspaper delivery boy earns ₹248.5 per week.

Method:

- Multiply the decimal number as a whole number by ignoring the decimal point.
- Count the number of digits after the decimal point in the decimal number.
- Place the decimal point in the product by counting the same number of digits from the right most digit.

Example 12: Multiply 4.28 × 12

Consider 428 × 12 = 5136

Since there are 2 digits after the decimal point in 4.28, we get,
4.28 × 12 = 51.36

Multiplication by 10, 100 or 1000

Observe the following table.

Multiplication by 10	Multiplication by 100	Multiplication by 1000
38.25 × 10 = 382.5	38.25 × 100 = 3825	38.25 × 1000 = 38250
25.369 × 10 = 253.69	25.369 × 100 = 2536.9	25.369 × 1000 = 25369
0.369 × 10 = 3.69	0.369 × 100 = 36.9	0.369 × 1000 = 369

When a decimal number is multiplied by 10, 100 or 1000, the digits in the product are the same as in the decimal number. The decimal point in the product is shifted to the right by the same number of places as there are zeros after one.

Multiplication of a Decimal Number by another Decimal Number

Example 13: Multiply 15.6 by 0.9

Step 1: Consider 156 × 09

156 × 9 = 1404

Step 2: Total number of decimal places in 15.6 and 0.9 is 2.

Therefore, 15.6 × 0.9 = 14.04

Method:

- Multiply the decimal numbers as whole numbers by ignoring the decimal point.
- Count the total number of digits after the decimal point in both the decimal numbers.
- Place the decimal point in the product by counting the same number of digits from the right most digit.