

Student Workbook



2017



CONNECTED LEARNING INITIATIVE

An initiative seeded by

TATA TRUSTS



Founding Partners



MATHEMATICS

Proportional Reasoning

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The Connected Learning Initiative (CLIX) is a technology enabled initiative at scale for high school students. The initiative was seeded by Tata Trusts, Mumbai with Tata Institute of Social Sciences, Mumbai and Massachusetts Institute of Technology, Cambridge as founding partners

Collaborators:

Centre for Education Research & Practice – Jaipur, Mizoram University – Aizawl, Eklavya – Madhya Pradesh, Homi Bhabha Centre for Science Education – Mumbai, National Institute of Advanced Studies – Bengaluru, State Council of Education Research and Training (SCERT) of Telangana – Hyderabad, Tata Class Edge – Mumbai, Inter-University Centre for Astronomy and Astrophysics - Pune, Govt. of Rajasthan, Govt. of Mizoram, Govt. of Chhattisgarh and Govt. of Telangana

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UNIT 2

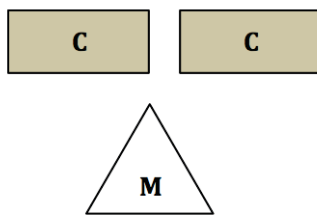
Lesson 1: Discrete quantities to continuous quantities: Coffee-Milk Activity [Hands-on]

Activity 1

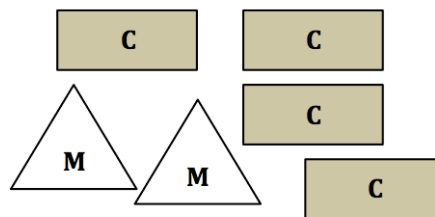
In the image, each group of shapes represents a cup of coffee. The rectangular shapes represent coffee packets and the triangular shapes represent milk packets.

Study each cup of coffee carefully and find out which of the 4 cups of coffee is most milky.

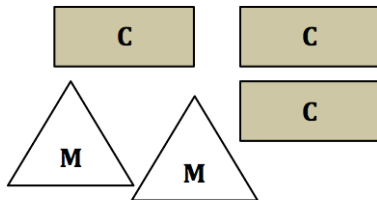
Cup 1:
2 packets of coffee and 1
packet of milk



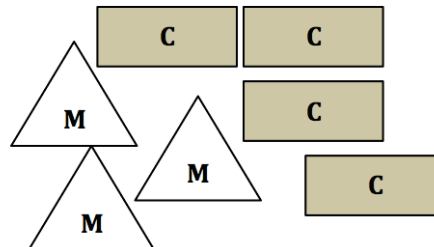
Cup 2:
4 packets of coffee and 2
packets of milk



Cup 3:
3 packets of coffee and 2
packets of milk



Cup 4:
4 packets of coffee and 3
packets of milk

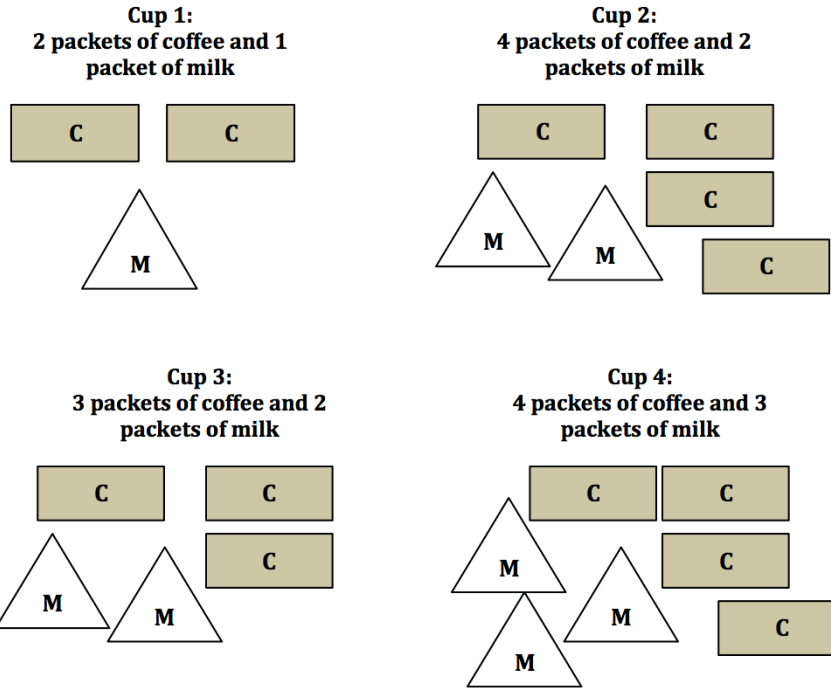


Activity 2

In the image, each group of shapes represents a cup of coffee. The triangles represent milk packets and the rectangles represent coffee packets.

You are given 6 packets of coffee. How many packets of milk would you need to make a cup of coffee that is exactly the same as:

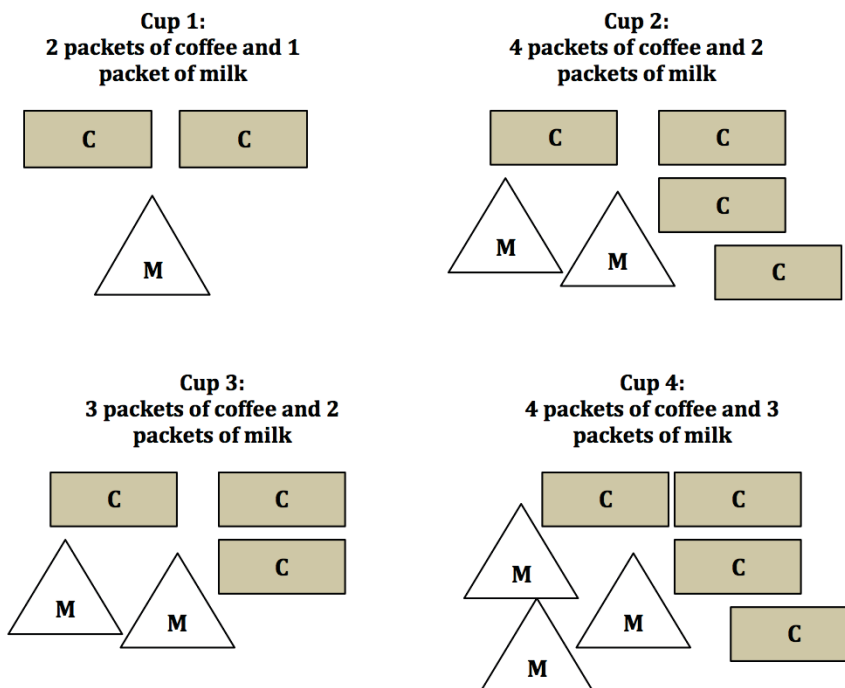
- The one shown in Cup 3
- The one shown in Cup 4



Activity 3 - Part 1

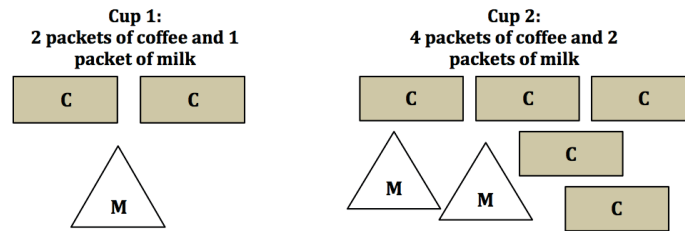
In the image, each group of shapes represents a cup of coffee. The triangles represent milk packets and the rectangles represent coffee packets.

You have 15 packets of coffee and 11 packets of milk. How many packets of coffee and milk will you need to make 4 cups of coffee that are as milky as the one shown in Cup 4?



Activity 3 - part 2

Study the following pictures of cups of coffee. Each rectangle represents a packet of coffee and each triangle represents a packet of milk. Which cup has less milkier coffee?



Lesson 3: Discrete and continuous quantities

Activity 1

Jamuni and her friends are at an egg shop in the mela.

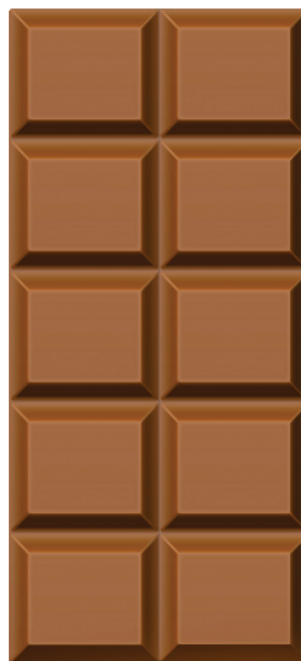
- They see a tray of eggs. The tray contains 12 eggs and costs Rs. 36. Now if they want an egg tray that has one and half times more eggs than this tray, how much will they need to pay?
- Shabana is Jamuni's friend and she wants to buy two egg trays. She finds that there is a mix of both white and brown eggs in each tray. The first tray holds 12 eggs of which 4 are brown and 8 are white. The second tray holds 18 eggs. If the proportion of brown and white eggs is same in both trays, how many eggs of each colour does the second tray would have?

	Tray 1	Tray 2
Total number of eggs	12	18
Number of white eggs	4	
Number of brown eggs	8	

Activity 2

Aman, Jamuni's friend, loves chocolates! He decides to buy a bar of chocolate to share with his friends. Help him solve some problems he faced when he went to a chocolate shop.

- 1 A white chocolate bar contains 10 small pieces. If Aman decides to give each of his friends 2 such small pieces, how many children can share the bar?
- 2 The shopkeeper sells 3 small pieces of white chocolate for Rs. 4. If Aman spends Rs. 40, how many such pieces of chocolate can he buy?
- 3 The shopkeeper charges Rs. 4 for a small piece of brown chocolate. If Aman decides to buy 10 such pieces, how much money he would need?



Activity 3

Jamuni and her friends were thirsty and went to a juice shop. The juice shop had two options for orange juice: 6-litre cartons for Rs. 200 and 4-litre cartons for Rs. 150.

Which of the two cartons is cheaper?

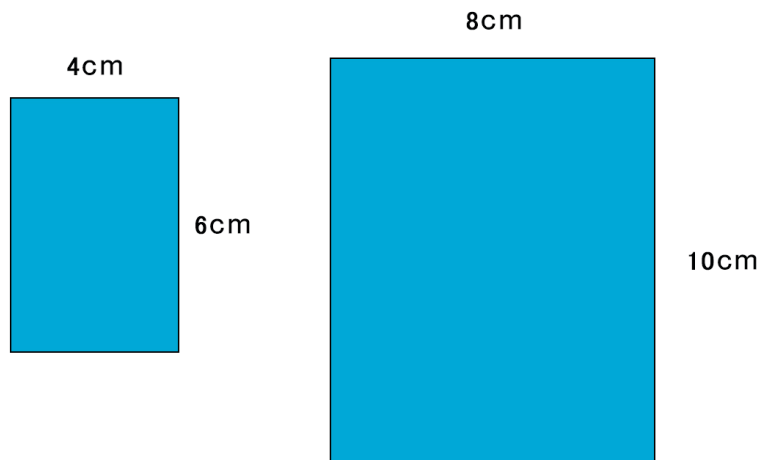
- 6-litre carton
- 4-litre carton

Tell your partner how you found the answer. Find out what method your partner used.



Activity 4

Jamuni wants to buy a square paper napkin but the shopkeeper only has rectangular ones. Look at the two rectangular paper napkins shown here. Which of them is more squarish? Why?



Unit 3: Ratios and Direct/Inverse Variations

Lesson 1: Introducing ratio notation (Worksheet)

Activity 1

Jamuni is sitting on the giant wheel ride. She is able to scan the entire mela scene whenever she goes to the top. She makes many observations. Can you write out Jamuni's observations in the form of a ratio?

- There is 1 boy for every 2 girls in the fair. _____
- Leena's mother is thrice as tall as her. _____
- A farmer is standing with 4 cows and 8 pigs. _____
- Geo is $2\frac{1}{2}$ times shorter than Inspector Kaata. _____

Activity 2

27 children are sitting inside a video game parlour at the mela. The ratio of girls to boys is 3:6. Which of the following statements is/are true?

- The ratio of boys to girls is 6:3. _____
- Half the children in the parlour are female. _____
- We know exactly how many boys are in the parlour. _____
- We know exactly how many girls are in the parlour. _____
- If we randomly choose 9 children in the parlour, we can expect that 3 will be girls. _____
- We can figure out how many boys there would be if the parlour was visited by 36 children. _____

Activity 3

A circus hall in the mela has 100 seats. It is divided into two zones. zone 1 has 30 seats and zone 2 has 70 seats. A total of 80 tickets was sold for a show. All the seats in zone 1 were filled.

- What is the ratio of seats in zone 1 to seats in zone 2? _____
- What is the ratio of empty seats to occupied seats? _____
- What is the ratio of empty seats to occupied seats in zone 2? _____

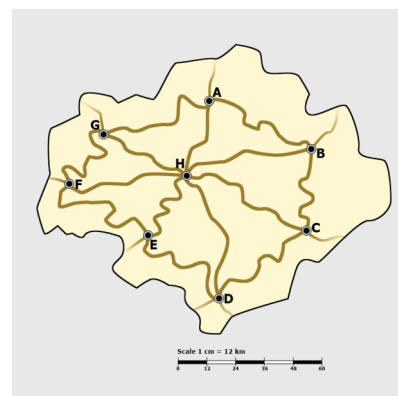
Lesson 2: Map making and scaling

Jamuni has an interest in map reading and a curiosity to find distance between two places using different possible routes. She likes reading her world Atlas and uses the scaling factor given in the map to calculate the exact distance between two places.

Activity 1

Carefully look at the map-scale (scale given in the map). What do you see? Compare 1 unit of the map-scale with 1 unit of the ruler (scale) you have. Now fill the following table and put correct unit-name.

	Map-scale	Real distance
1 unit		



The ratio between map-scale and real distance can be written as __:__. This ratio is called the “scale factor” for a given map. It is a matter of convenience that we choose different scaling factors for showing or calculating distance between places. Now use the above scale factor to find distance between any two cities of your choice on the map. Think about different ways of doing this task. Fill in the following table:

(Hint: Use a thread to measure the circuitous route and using a ruler and the given map-scale, find the actual distance between these two cities.)

Map-scale	Length of the thread used	Real distance
1 cm = 12 km	_____	_____
1 cm = 12 km	_____	_____
1 cm = 12 km	_____	_____

The other way in which a map-scale is shown on a map is by expressing a unit distance and a real distance, for example, 1 cm = 50 km which indicates that 1 cm in the map distance is equivalent to 50 km in actual distance.

Map-scale (1 cm = 15 km)	Distance on the map	Real distance
	6 cm	
	10.5 cm	
	50 cm	

Activity 2

In one map, Jamuni saw the map-scale was given in ratio form. Fill in the table by calculating the real distance.

	Thread length	Real distance
Map-scale (1:25000)	10 cm	_____
	18 cm	_____
Map-scale (1 cm = 2.5 km)	12 cm	_____
	21 cm	_____

Activity 3

In this task, thread length or the real distance between two places are given below in the table. Fill in the missing value.

Map-scale	Distance on the map	Real distance
1:1500	50 cm	_____
10:2000	25 cm	_____
1 cm = 12 km	_____	1800 km
1:250	_____	500km
_____	10 cm	75 km
_____	32 cm	960 km

Activity 4

Jamuni found that the scale for the distance is represented differently in four different maps. Help her locate the map in which the distance between the cities A and B is different from all the other maps.

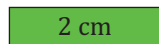
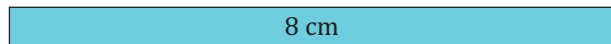
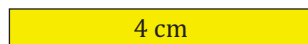
[Hint: Use a method other than cross-multiplication.]

Map	Map Distance between location A and B	Map-scale	Scaled distance between location A and B
Map 1	25 cm	1:600	_____
Map 2	12 cm	1:1250	_____
Map 3	24 cm	3:1800	_____
Map 4	30 cm	5:2500	_____

Lesson 3

Activity 1

Aman, Sahir, and Leena are trying to measure the length of a sheet using strips. One of them uses only green strips; another uses only pink strips; and the third uses brown strips.



Aman found the length as 7 units.
Leena found the length as 11 units.
Sahir found the lengths as 5 units.

Given these conditions, predict:
Who used the green strips?
Who used the pink strips?
Who used the brown strips?

Activity 2

Place the strips in line along the sheet's length to verify your prediction.

Now complete the following table:

Length of strip (l)	Number of strips used (n)	$l \times n$	l/n

If the strip is bigger, the number of strips used is _____ (smaller/bigger).

If the strip is smaller, the number of strips used is _____ (smaller/bigger).

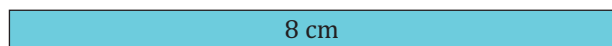
Do you see any pattern in the 1st and 2nd columns of the above table?

Do you see any pattern in the 3rd and 4th columns of the above table?

We see that the ___ column contains all equal values. What does this value signify?

Activity 3

Aman, Sahir, and Leena bought 3 sheets of different lengths from the stationery shop. They are now using the pink strip (size: 8 units) to measure its length.



Aman found the length as 24 units.

Leena found the length as 16 units.

Sahir found the lengths as 48 units.

Given these conditions, predict:

Who had the longest sheet?

Who had the shortest sheet?

Activity 4

Place the strips in line along the sheet's length to verify your prediction.

Now complete the following table:

Length of strip (l)	Number of strips used (n)	$l \times n$	l/n

If the sheet is bigger, the number of strips used is _____ (smaller/bigger).

If the sheet is smaller, the number of strips used is _____ (smaller/bigger).

Do you see any pattern in the 1st and 2nd columns of the above table?

Do you see any pattern in the 3rd and 4th columns of the above table?

We see that the ___ column contains all equal values. What is this value?

Unit 4 (Buffer): Application

Lesson 1

Activity 1

Jamuni and her friends are planning to return home from the mela via train. They are checking the train time-table and found the following train:

	Station Name	Arrival time	Departure time	Distance (in km)
Train 12345	A		08:00	0
	B	12:30	13:00	225
	C	14:30	14:40	300
	D	16:40	17:00	400
	E	19:00		500

1. Plot a curve by putting distance travelled on the x-axis and time taken on the y-axis. Plot different stations A, B, C, D, E on the curve.
2. Find the distance that the train covers between station A and B and the time it takes. Similarly, find these values for other stations in the following table.

Stations	Distance travelled (x)	Time taken (y)	x/y
A to B			
B to C			
C to D			
D to E			

3. Find the value of x/y in each case. What are the different values that you get? Do you see a pattern? Can you give a name to x/y ? Think and discuss with your friends.
4. Now write an equation that satisfies the above data table in terms of x and y .

Activity 2

Jamuni visits a stall where 3 buckets are kept. Bucket A has 2 red balls and 4 yellow balls. Bucket B has 4 red balls and 8 yellow balls. Bucket C has 7 red balls and 14 yellow balls. In order to win the prize, Jamuni has to answer the stall owner's questions correctly.

The stall owner asks: "If you pick out one ball from each bucket, what is the probability that the ball will be red?" Enter your answers in the table below:

	Red balls	Yellow balls	Probability of finding a red ball
Bucket A	2	4	
Bucket B	4	8	
Bucket C	7	14	

Do you see any pattern in the last column of the table? Can you explain why you see this pattern?

Lesson 2

Activity 3: Compound Proportion

1. Jamuni's parents are construction workers. She observed that a team of construction workers can construct a wall of 400 metre in 12 days by working 8 hours everyday. How long will it take if the wall size is 600 metre and the workers put in 9 hours everyday?
2. Jamuni's mother deposited Rs 4500 in a bank and received Rs 360 after two years. How much interest amount will she get in 5 years if she deposited Rs 6000?

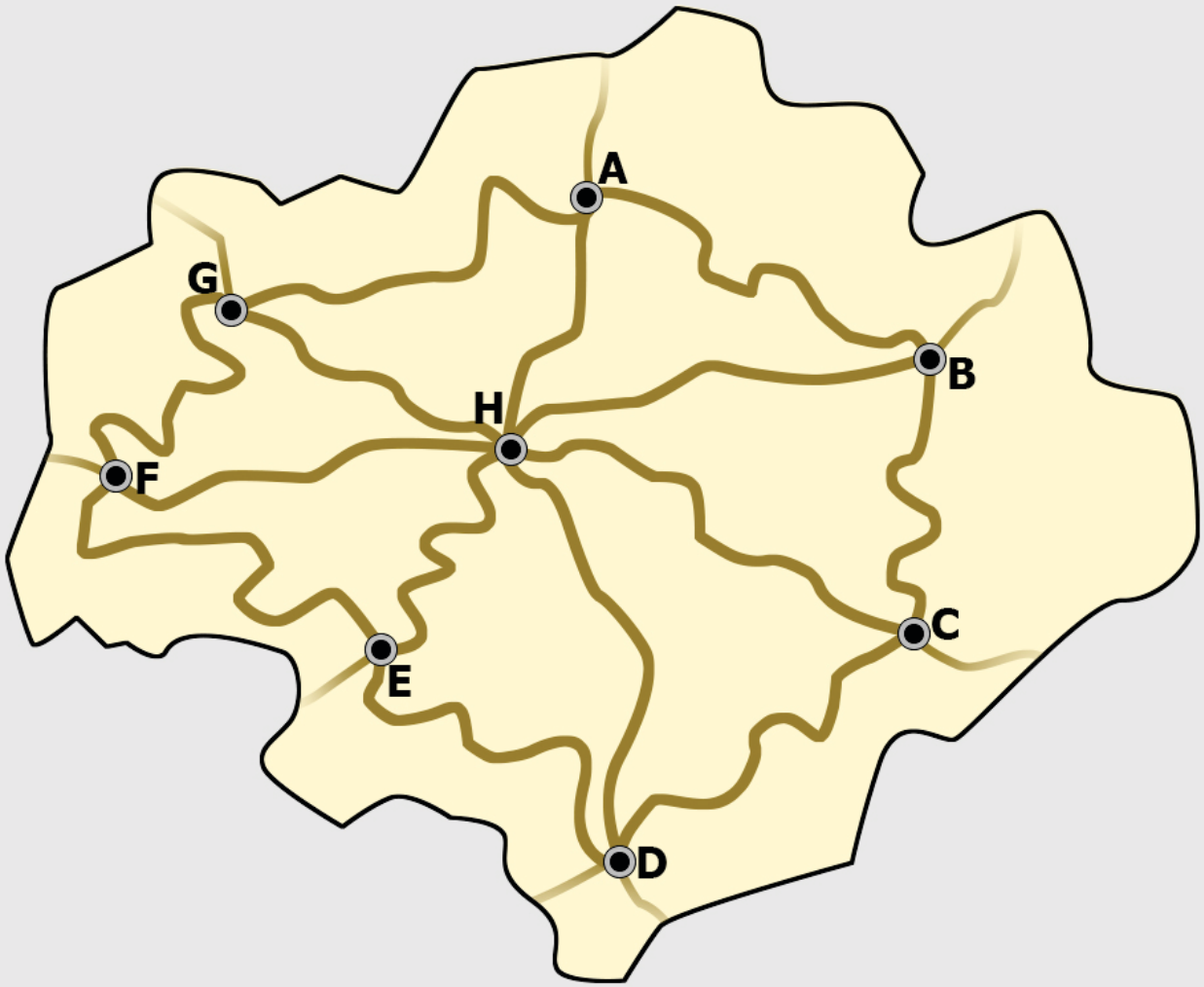
Activity 4: Mixture problem - Mini recipe problem

Jamuni, Aman, Leena, Sahir are sitting at a chai ki dukaan. The recipe used for making tea for 4 persons is provided here:

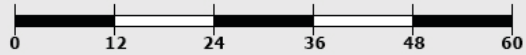
- Tea powder - 2 teaspoons
- Sugar - 4 teaspoons
- Milk - 12 teaspoons
- Water - 20 teaspoons

After half an hour, Jamuni's parents also join the group, and they all decide to have a cup of tea. List the ingredients and their amounts to make tea for 6 persons now, which would taste exactly the same as the tea made earlier.

- Tea powder - ____ teaspoons
- Sugar - ____ teaspoons
- Milk - ____ teaspoons
- Water - ____ teaspoons



Scale 1 cm = 12 km





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