CHAPTER

10

Multiply and Divide Fractions

Vocabulary:

simplify
product
factor
reciprocal
inverse
operations

Chapter Outcomes:

- Develop and apply procedures to solve problems involving fractions and the four operations.

Multiplying and dividing fractions are used in many jobs and in everyday activities. Cooking, shopping, constructing homes and buildings cannot be done without the use of these operations. Even the fish vendor needs to use multiplication and division of fractions to figure out prices per kilogram at the market.

Getting Ready for Chapter 10

Find an equivalent fraction.

1. $\frac{3}{4} = \frac{\square}{\square}$	**2.** $\frac{2}{3} = \frac{\square}{\square}$	**3.** $\frac{3}{5} = \frac{\square}{\square}$

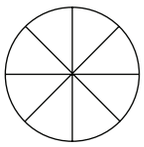
Write each fraction in its simplest form.

4. $\frac{4}{8}$	**5.** $\frac{6}{9}$	**6.** $\frac{15}{25}$

Express each improper fraction as a mixed number.

7. $\frac{14}{4}$	**8.** $\frac{12}{5}$	**9.** $\frac{14}{3}$

10. Shade $\frac{1}{2}$ of the shape on the right.



11. What are the common factors of 8 and 6?

12. Find the product of 12 and 5.

Multiply Fractions by Whole Numbers

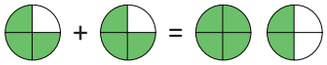
Teaching Point 1:

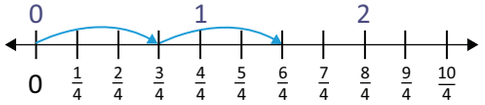
What are some ways to multiply fractions and whole numbers?

Two friends eat $\frac{3}{4}$ of a sandwich each. How many sandwiches did they eat?

Find the product of $2 \times \frac{3}{4}$.

Method 1: Use repeated addition.





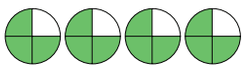
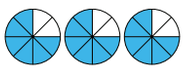
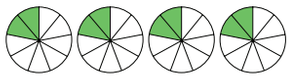
$\frac{3}{4} + \frac{3}{4} = \frac{3+3}{4} = \frac{6}{4}$ *or* $1\frac{2}{4}$

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

So, they ate $1\frac{1}{2}$ sandwiches.

Activity 1:

Use models or repeated addition to multiply.

1. $3 \times \frac{1}{2}$ 	**2.** $4 \times \frac{3}{4}$ 
3. $5 \times \frac{2}{3}$ 	**4.** $3 \times \frac{6}{8}$ 
5. $4 \times \frac{2}{9}$ 	**6.** $3 \times \frac{11}{12}$ 

7. $3 \times \frac{3}{5}$

8. $4 \times \frac{2}{3}$

9. $4 \times \frac{3}{5}$	**10.** $10 \times \frac{4}{6}$	**11.** $9 \times \frac{3}{7}$
12. $5 \times \frac{5}{6}$	**13.** $8 \times \frac{6}{8}$	**14.** $6 \times \frac{5}{9}$

15. Jamal is making 5 glasses of juice. He needs $\frac{3}{10}$ litre of water for each glass. How many litres of water does he need?

Teaching Point 2:

What are some ways to multiply fractions and whole numbers?

Find the product of $2 \times \frac{3}{4}$.

Method 2: Use a rule.

$2 \times \frac{3}{4}$ ← **Think:** I need to find 2 groups of 3 quarter sized pieces.

$2 \times \frac{3}{4} = \frac{2}{1} \times \frac{3}{4}$ ← Write the whole number 2 as a fraction. $2 \rightarrow \frac{2}{1}$.

$= \frac{2 \times 3}{1 \times 4}$ ← Multiply the numerator. ← Multiply the denominator.

$= \frac{6}{4}$

$= 1\frac{2}{4}$ *or* $1\frac{1}{2}$ ← Simplify your answer.

So, $2 \times \frac{3}{4} = 1\frac{1}{2}$

Activity 2:

Use any method to solve. Write the answer in simplest form.

1. Each child eats $\frac{4}{6}$ of a small pizza. How many pizzas are needed to feed 12 children?

2. Narveen walks $\frac{4}{5}$ km each day to go to school. How many kilometres would he walk in 10 days?

3. The salt in one bag has a mass of $\frac{3}{4}$ kg. What is the mass of 7 of the same size bags of salt?

4. Kianna is making bread and wants to triple the recipe. The recipe calls for $\frac{2}{3}$ kg of flour. How much flour would she need?

5. Ameena jogs for $\frac{1}{2}$ hour each day for 6 days in a row. Altogether how many hours does she exercise during the 6 days?

6. One lap around the playground is $\frac{1}{4}$ km. Josiah ran around the playground 12 times. How far did he run?

7. Anika lives $\frac{5}{8}$ km from the school. Vinai lives three times as far as Anika from school. How many kilometres does Vinai live away from school?

8. The caterer wants to have enough chicken to feed 24 people. If he wants to provide $\frac{2}{8}$ of a chicken for each person, how much chicken does he need?

9. Kiara studied Science for $\frac{1}{4}$ hour every day last week and studied Mathematics for $\frac{3}{4}$ hour for five days last week. How many hours did Kiara study in total last week?

10. Sandra exercised $\frac{2}{3}$ hour every day for first two weeks of her vacation. Then she exercised $\frac{3}{6}$ hour every day for the next two weeks of her vacation. How many hours did Sandra exercise over the four weeks?

11. Priya uses $\frac{1}{2}$ of a lemon and $\frac{3}{4}$ of an orange to make one glass of juice. How many oranges and lemons will she need to make 8 glasses of juice?

Fractional Parts of a Set

Teaching Point 1:

How can you find the fractional part of a group or collection?

In a set of 10 marbles, $\frac{3}{5}$ of them are red. How many of the marbles are red?

Find $\frac{3}{5}$ of 10.

$\frac{3}{5} \times 10 = \frac{3 \times 10}{5}$ ← Think of the word "of" as a multiplication symbol.

$= \frac{30}{5}$ ← Simplify

$= 6$

So, 6 marbles are red.

Finding the **fractional part** of a number is the same as multiplying the number by that fraction.

Activity 1:

1. $\frac{1}{2}$ of 36	2. $\frac{2}{5}$ of 15	3. $\frac{2}{3}$ of 24
4. $\frac{3}{4}$ of 12	5. $\frac{4}{6}$ of 30	6. $\frac{3}{7}$ of 42
7. $\frac{4}{10}$ of 100	8. $\frac{3}{8}$ of 48	9. $\frac{6}{9}$ of 18
10. $\frac{5}{8}$ of 24	11. $\frac{2}{6}$ of 18	12. $\frac{3}{5}$ of 25

13. Lianne bought 21 rubber bands from a shop. She gave $\frac{2}{3}$ of them to her brother. How many rubber bands did she have left?

14. There are 30 students in Mr. Samuel's class. $\frac{4}{6}$ of the students are boys. How many of the students in the class are girls?

15. Marika spent $\frac{3}{8}$ of a day sleeping. How many hours did Marika spend sleeping?

16. Alisha had 10 days to do her Science project. She spent $\frac{3}{5}$ of the time collecting data. How much time did she have left to complete the project?

17. Huan had 18 stickers. She gave away $\frac{1}{3}$ of them to her friend. How many stickers does she have left?

18. Mrs. Ramroop bought 16 kg of flour. She used $\frac{3}{8}$ of the flour to make bread.
    a) How much flour did she use?
    b) How much flour does she have left?

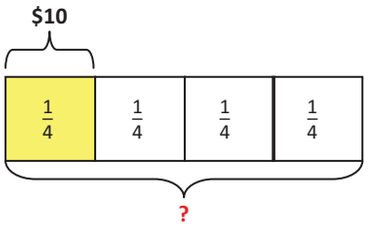
19. Jenny has 24 marbles. $\frac{1}{3}$ of them are blue. The rest of the marbles are either red or yellow. If $\frac{3}{4}$ of the rest are red, how many marbles are yellow?

Teaching Point 2:

How can you find the whole given a unit fraction?

One quarter of Alisha's money is \$10. How much money does she Alisha have altogether?

Use **a model**.



1 unit or $\frac{1}{4} \rightarrow$ \$10

4 units or $\frac{4}{4} \rightarrow$ \$10 × 4 = \$40

So, Alisha has \$40 altogether.

Activity 2:

Use bar models to solve the following problems.

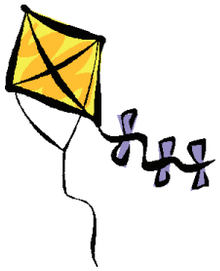
1. Marissa spent $\frac{1}{6}$ of her daily allowance on a drink. The drink costs \$6. How much money did she have at first?

2. The 18 cans of sardine left on the grocery shelf is $\frac{1}{3}$ of the cans that were offered for sale. How many cans of sardines were offered for sale at the beginning?

3. $\frac{1}{8}$ of the students of a class walk to school every day. If 3 children walk to school, how many children are in the class?

4. A glass contains a liquid mixture of water and grapefruit juice. The grapefruit juice makes up $\frac{1}{5}$ of the amount of the liquid mixture. There are 75 ml of grapefruit juice in the glass. How much water is in the glass?

5. $\frac{1}{5}$ of the weight of a ten year old boy is 6 kg. What is the total weight of the boy?



6. Doug has 13 metres of string, which is $\frac{1}{9}$ of the length of string that he needs to fly his kite. How many metres of string does he need to fly his kite?

7. $\frac{1}{9}$ of the students of a class each ate one banana during recess time. $\frac{1}{3}$ of remaining students ate one apple each and the rest ate one portugal each. If 3 bananas were eaten, how many students ate portugals?

Multiply Fractions

Teaching Point 1:

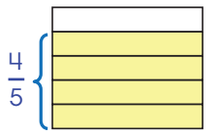
How can you multiply fractions with models?

Aleke has $\frac{4}{5}$ of a litre of juice. He shares $\frac{3}{4}$ of it with his friend Jamie. How much juice did he share?

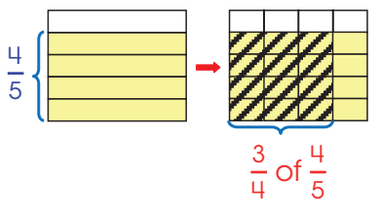
Find $\frac{3}{4}$ of $\frac{4}{5}$.

Model $\frac{3}{4} \times \frac{4}{5}$.

1. Draw a picture to represent fifths. Shade $\frac{4}{5}$.



2. Draw three vertical lines to show quarters. Draw stripes over $\frac{3}{4}$ of the shaded parts.



$\frac{3}{4} \times \frac{4}{5} = \frac{3}{4}$ of $\frac{4}{5}$

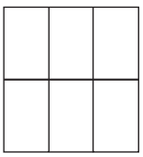
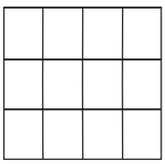
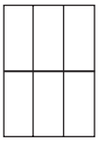
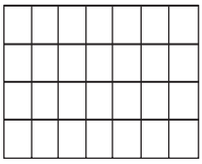
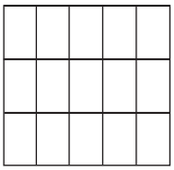
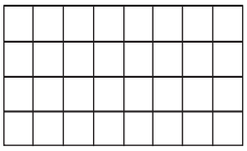
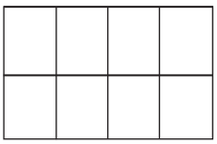
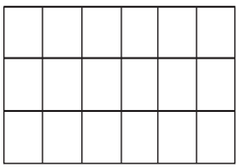
$= \frac{12}{20}$

$= \frac{3}{5}$

So, Aleke shared $\frac{3}{5}$ of his juice.

Activity 1:

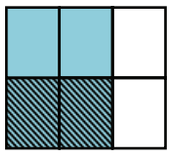
Shade the models to find each product. Write in simplest form.

1. $\frac{1}{2} \times \frac{2}{3} =$ 	**2.** $\frac{1}{4} \times \frac{2}{3} =$ 
3. $\frac{2}{3} \times \frac{1}{2} =$ 	**4.** $\frac{1}{4} \times \frac{2}{7} =$ 
5. $\frac{1}{3} \times \frac{2}{5} =$ 	**6.** $\frac{1}{4} \times \frac{4}{8} =$ 
7. $\frac{3}{4} \times \frac{1}{2} =$ 	**8.** $\frac{2}{3} \times \frac{4}{6} =$ 

Draw models to find each product. Write each product in simplest form.

9. $\frac{1}{3} \times \frac{5}{6} =$	**10.** $\frac{2}{5} \times \frac{5}{10} =$	**11.** $\frac{2}{6} \times \frac{6}{8} =$
12. $\frac{1}{2} \times \frac{4}{9} =$	**13.** $\frac{2}{7} \times \frac{3}{4} =$	**14.** $\frac{1}{6} \times \frac{4}{5} =$
15. $\frac{1}{2} \times \frac{3}{4} =$	**16.** $\frac{3}{8} \times \frac{4}{6} =$	**17.** $\frac{7}{8} \times \frac{1}{2} =$

18. A product of two fractions is represented by the model below. What are the fractions?



Teaching Point 2:

How can you multiply fractions without models?

Find $\frac{3}{4} \times \frac{8}{9}$.

Method 1: Multiply first. Then simplify.

$\frac{3}{4} \times \frac{8}{9} = \frac{3 \times 8}{4 \times 9}$ Multiply the numerators and the denominator.

$= \frac{24 \div 12}{36 \div 12}$

$= \frac{2}{3}$ Simplify the fraction.

Method 2: Simplify first. Then multiply.

$\frac{3}{4} \times \frac{8}{9} = \frac{3 \div 3}{4} \times \frac{8}{9 \div 3}$ Divide **3** and **9** by the **common factor 3**.

$= \frac{1}{4 \div 4} \times \frac{8 \div 4}{3}$ Divide **4** and **8** by the **common factor 4**.

$= \frac{1 \times 2}{1 \times 3}$ Multiply.

$= \frac{2}{3}$

Activity 2:

Multiply. Write in simplest form.

1. $\frac{4}{9} \times \frac{3}{8} =$	**2.** $\frac{3}{5} \times \frac{10}{15} =$	**3.** $\frac{5}{6} \times \frac{4}{5} =$
4. $\frac{2}{5} \times \frac{5}{8} =$	**5.** $\frac{5}{10} \times \frac{3}{9} =$	**6.** $\frac{4}{10} \times \frac{5}{12} =$
7. $\frac{4}{8} \times \frac{3}{6} =$	**8.** $\frac{5}{7} \times \frac{7}{9} =$	**9.** $\frac{7}{12} \times \frac{4}{6} =$
10. $\frac{1}{2} \times \frac{4}{21} =$	**11.** $\frac{2}{3} \times \frac{9}{12} =$	**12.** $\frac{3}{4} \times \frac{6}{12} =$

Solve the problems.

13. Priya has $\frac{4}{8}$ of a chocolate bar. She eats $\frac{1}{2}$ of it. What fraction of the chocolate did she eat?

14. Mala had a piece of string that is $\frac{2}{3}$ metre long. She used $\frac{1}{2}$ of it to tie a package. What length of string did she use to tie the package?

15. Mother bought $\frac{8}{9}$ of a kilogram of chicken at the grocery. She cooked $\frac{3}{4}$ of the chicken for lunch. How much chicken did she cook for lunch?

16. Kimberley made $\frac{4}{5}$ litre of lemonade. She gave $\frac{1}{3}$ of this amount to her friends. How much lemonade did she give away?

17. Jamal spent $\frac{7}{10}$ of his allowance at the mall. If he bought a story book with $\frac{3}{5}$ of the money he spent at the mall, what fraction of all his money did he use to buy the story book?

18. Mr. Khan has a plot of land. He plants vegetables on $\frac{3}{4}$ of the land. $\frac{2}{3}$ of the vegetables are tomatoes. What fraction of the land is planted with tomatoes?

19. $\frac{1}{4}$ of the students of a class did not go on the field trip. Of the students who did not go, $\frac{3}{5}$ of them are boys and rest are girls. What fraction of the class are girls?

Multiply Mixed Numbers

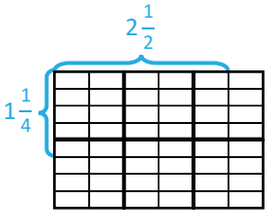
Teaching Point 1:

How can you multiply mixed numbers with models?

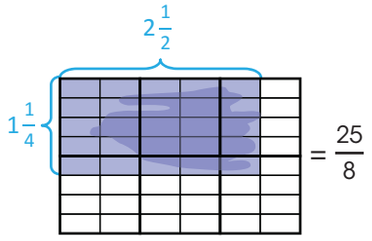
Mark jogged $1\frac{1}{4}$ kilometres. His brother jogged $2\frac{1}{2}$ times the distance Mark jogged. How far did Mark's brother jog?

Find $1\frac{1}{4} \times 2\frac{1}{2}$.

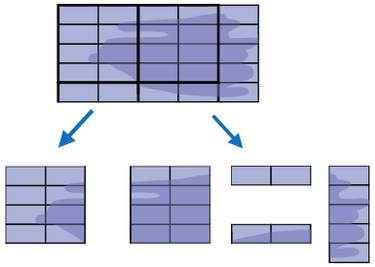
1. Use a **Model** to show $1\frac{1}{4} \times 2\frac{1}{2}$.



2. **Shade** the parts that represent the product. **Count** the shaded parts.



3. **Rearrange** the shaded parts.



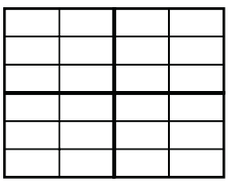
$$1 + 1 + \frac{9}{8} = 3\frac{1}{8}$$

So, Mark's brother jogged $3\frac{1}{8}$ kilometres.

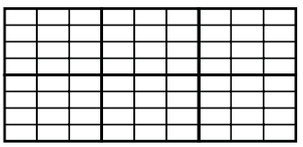
Activity 1:

Shade the models to find each product. Write in simplest form.

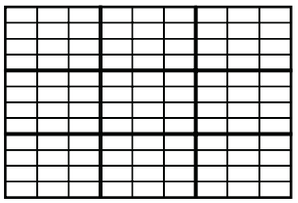
1. $1\frac{2}{3} \times 1\frac{1}{2} =$



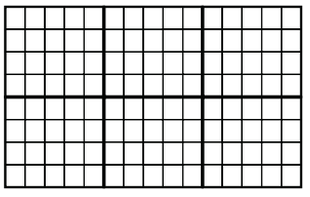
2. $1\frac{1}{4} \times 1\frac{1}{3} =$



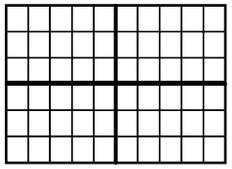
3. $2\frac{1}{4} \times 2\frac{2}{3} =$



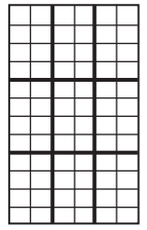
4. $1\frac{1}{4} \times 2\frac{2}{5} =$



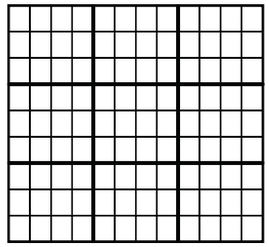
5. $1\frac{1}{3} \times 1\frac{2}{5} =$



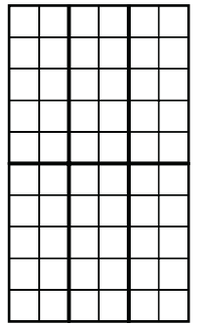
6. $2\frac{3}{4} \times 2\frac{1}{2} =$



7. $2\frac{1}{3} \times 2\frac{3}{4} =$



8. $1\frac{2}{5} \times 2\frac{1}{2} =$



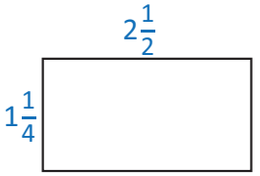
Teaching Point 2:

How can you multiply mixed numbers with area models?

Find $1\frac{1}{4} \times 2\frac{1}{2}$.

1. Use an Area Model to show

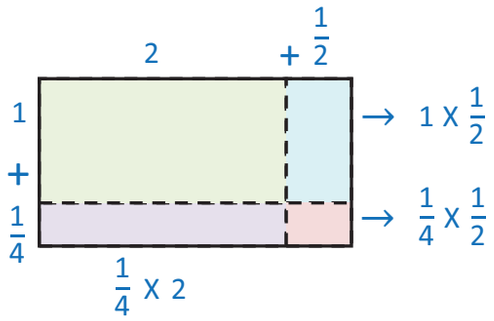
$1\frac{1}{4} \times 2\frac{1}{2}$



2. **Rewrite** each factor as the sum of a whole number and a fraction.

$1\frac{1}{4} = 1 + \frac{1}{4}$ and $2\frac{1}{2} = 2 + \frac{1}{2}$

3. **Label** area model to show how you broke apart the mixed numbers above.



4. Find the **area** of each section.

$1 \times 2 = 2$ $1 \times \frac{1}{2} = \frac{1 \times 1}{1 \times 2} = \frac{1}{2}$	$\frac{1}{4} \times 2 = \frac{1 \times 2}{4 \times 1} = \frac{2}{4}$ $\frac{1}{4} \times \frac{1}{2} = \frac{1 \times 1}{4 \times 2} = \frac{1}{8}$

5. **Add** the areas of each section to find the total area of the model.

$$2 + \frac{1}{2} + \frac{2}{4} + \frac{1}{8} = 2 + \frac{1 \times 4}{2 \times 4} + \frac{2 \times 2}{4 \times 2} + \frac{1}{8}$$

$$2 + \frac{4}{8} + \frac{4}{8} + \frac{1}{8} = 2\frac{9}{8} \text{ or } 2 + \frac{8}{8} + \frac{1}{8} \text{ or } 3\frac{1}{8}$$

So, $1\frac{1}{4} \times 2\frac{1}{2} = 3\frac{1}{8}$

Activity 2:

Use a model to find each product.

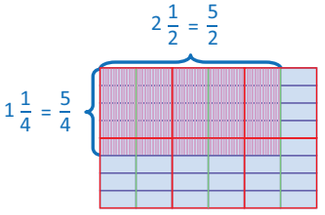
1. $1\frac{1}{4} \times 3\frac{5}{8} =$	**2.** $2\frac{1}{2} \times 4\frac{3}{5} =$	**3.** $1\frac{2}{3} \times 3\frac{3}{4} =$
4. $2\frac{1}{4} \times 4\frac{1}{5} =$	**5.** $1\frac{1}{3} \times 3\frac{2}{3} =$	**6.** $1\frac{1}{4} \times 4\frac{2}{5} =$
7. $2\frac{4}{5} \times 3\frac{1}{3} =$	**8.** $1\frac{1}{4} \times 3\frac{3}{5} =$	**9.** $1\frac{3}{4} \times 2\frac{7}{8} =$
10. $1\frac{3}{9} \times 3\frac{6}{12} =$	**11.** $2\frac{5}{8} \times 1\frac{2}{5} =$	**12.** $1\frac{3}{4} \times 5\frac{4}{11} =$
13. $1\frac{4}{6} \times 2\frac{3}{8} =$	**14.** $3\frac{2}{6} \times 1\frac{6}{12} =$	**15.** $3\frac{9}{10} \times 3\frac{5}{12} =$

Teaching Point 3:

How can you multiply mixed numbers without models?

Find $1\frac{1}{4} \times 2\frac{1}{2}$.

1. **Write** each mixed number as an **improper fraction**.



2. **Multiply** the improper fractions.

$$\frac{5}{4} \times \frac{5}{2} = \frac{5 \times 5}{4 \times 2}$$

$$= \frac{25}{8}$$

3. **Simplify**.

$$\frac{25}{8} = 3\frac{1}{8}$$

So, $1\frac{1}{4} \times 2\frac{1}{2} = 3\frac{1}{8}$

Activity 3:

Solve the problems. Write in simplest form.

1. What is $2\frac{3}{5} \times 3\frac{3}{4}$?

2. Mother bought $1\frac{1}{4}$ kilograms of sugar and flour that was $2\frac{3}{4}$ times the weight of the sugar. How much did the flour weigh?

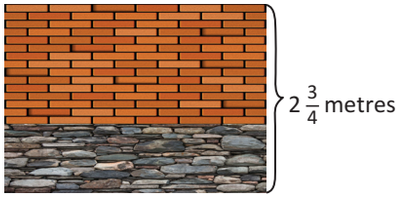
3. The living room rug is $2\frac{2}{5}$ metres long and $1\frac{1}{4}$ metres wide. What is the area of the rug?

4. Kevin's favourite movie is $1\frac{3}{4}$ hours long. He watched it $3\frac{1}{2}$ times. How many hours has Kevin spent watching the movie?

5. The height of a mango tree is $5\frac{4}{8}$ metres while the coconut tree is $2\frac{1}{4}$ the height of the mango tree. How tall is the coconut tree?

6. Jian is making a sign to advertise the school walkathon. The width of the sign is $1\frac{2}{3}$ metres. If the length is $4\frac{2}{10}$ times the width of the sign, what is the length of the sign?

7. The wall at the side of a building is shown below. If $1\frac{1}{4}$ of the height of the wall is made from brick, what is the height of the brick portion of the wall?



Relate Fractions to Division

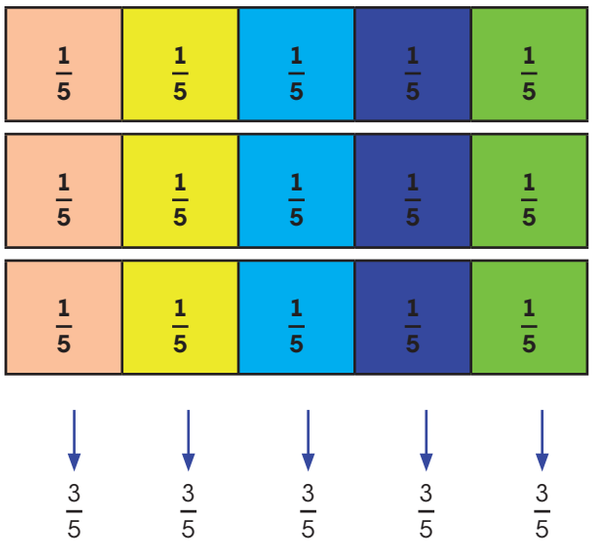
Teaching Point 1:

How do you divide a whole number by a unit fraction?

Three chocolate bars are shared equally among 5 children. How many of the chocolate bars did each child eat?

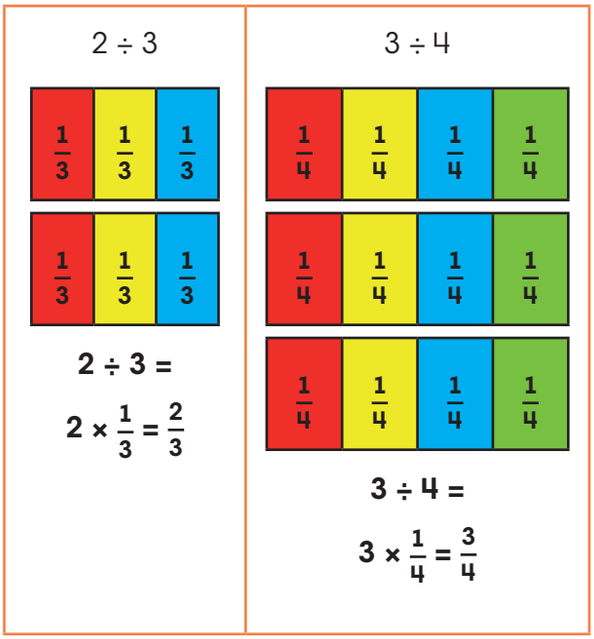
Find 3 ÷ 5.

Use **a model** to represent **3 ÷ 5**. **Divide** each chocolate bar into 5 equal parts.



Each child's share of one chocolate bar is $\frac{1}{5}$. Since there are 3 chocolate bars, each child gets 3 of the $\frac{1}{5}$s, or $\frac{3}{5}$ of a whole chocolate bar.

$$3 \div 5 = 3 \times \frac{1}{5} = \frac{3}{5}$$



The denominator represents the number of shares, and the numerator represents the number of objects being shared.

Activity 1:

Tell what fraction each person gets.

1. Three children share two sandwiches.
2. Two students share 1 sheet of paper.
3. Five friends share 2 chocolate bars.
4. Eight boys run an equal part of a 5 kilometre race.
5. Six friends share 5 bottles of water.

Solve the problems below.

6. A group of friends went on an outing. They shared 3 sandwiches equally. If each person got $\frac{3}{4}$ of a sandwich, how many friends were in the group?
7. Eight girls shared 4 metres of ribbon equally. What fraction did each girl get?
8. Mother had 3 packs of juice. She poured equal amounts of juice into 5 glasses for her children to drink. Which number sentence can be used to find the fraction of a bottle of juice that each child received?

   a) $3 \times 5 = \square$

   b) $3 \div 5 = \square$

   c) $5 \times 3 = \square$

   d) $5 \div 3 = \square$

Divide A Whole Number by a Fraction

Teaching Point 1:

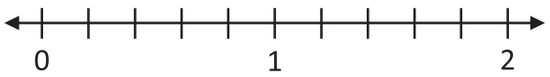
*How do you divide a whole number by a **unit** fraction?*

Maria has a ribbon that is 2 metres long. She cuts the ribbon in $\frac{1}{5}$ metre pieces. How many pieces of ribbon will she get?

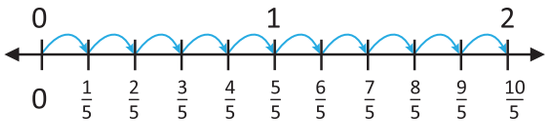
Find $2 \div \frac{1}{5}$.

Method 1: Use **a model**.

1. **Draw** a fraction strip to represent the ribbon. **Divide** each metre into **fifths**.



2. **Skip-count** by fifths from 0 to 2 to find $2 \div \frac{1}{5}$.



Number of fifths in 1 whole = 5

Number of fifths in 2 wholes = 2 × 5

So, $2 \div \frac{1}{5} = 2 \times 5$ ← Write as a multiplication expression.

$= 10$

So, Maria gets 10 pieces of ribbon.

---

reciprocals

$2 \div \frac{1}{5} = 10$ and $2 \times 5 = 10$

same result

Dividing by $\frac{1}{5}$ and multiplying by 5 gives the same result. Two numbers whose **product** is **1** are called **reciprocals**. The reciprocal of 5 is $\frac{1}{5}$.

$$2 \div \frac{1}{5} = \frac{2}{1} \times \frac{5}{1} = 10$$

Use multiplication to check.

$$2 \div \frac{1}{5} = 10 \text{ because}$$

$$10 \times \frac{1}{5} = \frac{10 \div 5}{1} \times \frac{1}{5 \div 5} = 2$$

Activity 1:

1. Draw four circles and cut them out. Divide each circle in half by cutting it.

   a) How many halves are there?

   b) Write the division number sentence to show what you have done.

2. Draw, divide and cut circles to complete the table below.

Number of Circles	Fraction	Number of Pieces	Number Sentence
2	$\frac{1}{2}$	____	$2 \div \frac{1}{2} = \square$
3	$\frac{1}{4}$	____	____
5	$\frac{1}{3}$	____	____
6	$\frac{1}{5}$	____	____

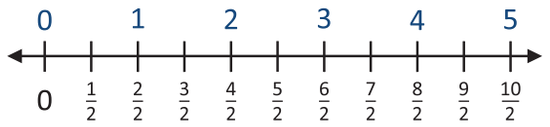
3. What pattern do you observe between the number of circles and the number of pieces?

4. What happens when you divide a whole number by a fraction?

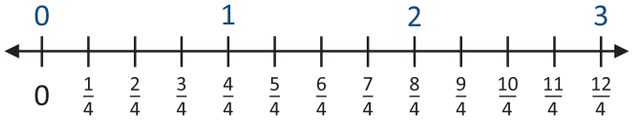
5. How are dividing a whole number by $\frac{1}{3}$ and multiplying by 3 related? Explain.

6. Find each quotient. Use a model. Check using multiplication.

   a) $5 \div \frac{1}{2} = \square$ **Check** $\square \times \frac{1}{2} = \square$



b) $3 \div \frac{1}{4} =$ ☐ **Check** ☐ $\times \frac{1}{4} =$ ☐



c) $3 \div \frac{1}{3} =$ ☐ **Check** ☐ $\times \frac{1}{3} =$ ☐

7. Divide 4 by $\frac{1}{5}$.

8. How many $\frac{1}{4}$ of a kilogram of flour are there in 4 kilograms of flour?

9. Mother makes 3 sandwiches. Each sandwich is cut into halves. How many children can she serve if she gives each child $\frac{1}{2}$ of a sandwich?

10. Alex spends 4 hours washing cars. If he washes each car in $\frac{1}{4}$ of an hour. How many cars can he wash during that time?

11. Melissa uses $\frac{1}{5}$ can of dog food to feed her pet dog each day. How many servings will she get from the 5 cans of dog food?

12. Draw a picture and explain how dividing by $\frac{1}{4}$ and dividing by the number 4 is different.

13. A cake recipe calls for $\frac{1}{4}$ litre of milk. You have 4 litres of milk. How many cakes can you make with the milk that you have?

Teaching Point 2:

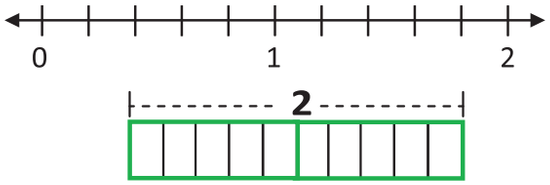
How do you divide a whole number by a ***non-unit*** *fraction?*

A baker cuts 2 cakes into pieces. Each piece represents $\frac{2}{5}$ of a cake. How many pieces of cake would he get?

Find $2 \div \frac{2}{5}$.

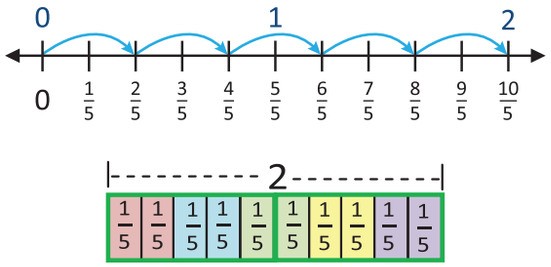
Use **a model** to represent $\mathbf{2 \div \frac{2}{5}}$.

1. Use a **model** to represent 2 wholes divided into fifths.



There are **10** parts in 2.

2. **Count** the groups of $\frac{2}{5}$s which take up the 10 parts.



There are **5** groups of $\frac{2}{5}$**s** in the 10 parts.

The baker will get 5 pieces of cake.

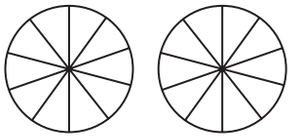
Division and **multiplication** are inverse operations. So check division problems using multiplication.

$2 \div \frac{2}{5} = 5$ because $5 \times \frac{2}{5} = \frac{\cancel{5}^{1} \times 2}{\cancel{5}_{1}} = \mathbf{2}$

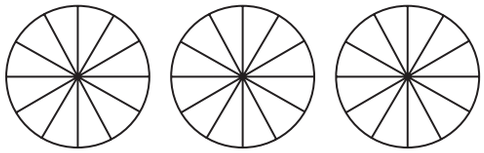
Activity 2:

Find each quotient. Use a model. Check using multiplication.

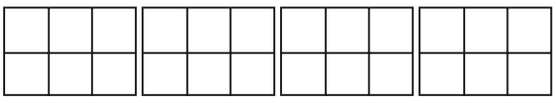
1. $2 \div \frac{2}{10} = \square$ **Check** $\square \times \frac{2}{10} = \square$



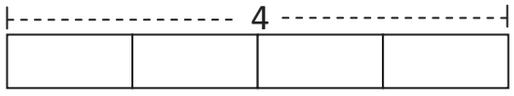
2. $3 \div \frac{9}{12} = \square$ **Check** $\square \times \frac{9}{12} = \square$



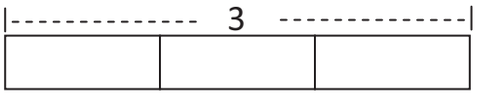
3. $4 \div \frac{3}{6} = \square$ **Check** $\square \times \frac{3}{6} = \square$



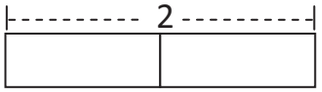
4. $4 \div \frac{2}{3} = \square$ **Check** $\square \times \frac{2}{3} = \square$



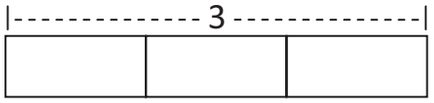
5. $3 \div \frac{3}{5} = \square$ **Check** $\square \times \frac{3}{5} = \square$



6. $2 \div \frac{2}{4} = \square$ **Check** $\square \times \frac{2}{4} = \square$



7. $3 \div \frac{2}{6} = \square$ **Check** $\square \times \frac{2}{6} = \square$



Teaching Point 3:

*How do you divide a whole number by a **non-unit** fraction?*

Find $6 \div \frac{2}{10}$.

Method 1:

Since, **division** and **multiplication** are **inverse operations**:

$6 \div \frac{2}{10}$ is asking $\frac{2}{10} \times \square = 6$

1. First, we **divide** by the **numerator** to get a **unit fraction**.

$\frac{1}{10} \times \square = 6 \div 2$

↓

$\frac{1}{10} \times \square = 3$

2. Then **multiply** by the **denominator** to get the **whole**.

$\frac{10}{10} \times \square = 3 \times 10$

$\downarrow$

$= 30$

This dividing by the numerator and multiplying by the denominator is called "**multiplying by the reciprocal**".

Method 2:

$6 \div \frac{2}{10} = \frac{6}{1} \div \frac{2}{10} =$ Write 6 as $\frac{6}{1}$

$= \frac{6}{1} \times \frac{10}{2}$ Change $\frac{2}{10}$ to its reciprocal $\frac{10}{2}$ and multiply.

$= \frac{60}{2}$ Simplify

$= 30$

Dividing by a number is the same as multiplying by the **reciprocal** of the number.

Activity 3:

Write the reciprocal of each number.

1. $\frac{5}{8} =$	**2.** $\frac{2}{3} =$	**3.** $\frac{1}{2} =$
4. $\frac{3}{4} =$	**5.** $\frac{4}{9} =$	**6.** $\frac{7}{12} =$

Find each quotient. You can use a model to solve.

7. $12 \div \frac{2}{3} =$	**8.** $6 \div \frac{4}{8} =$	**9.** $8 \div \frac{2}{7} =$
10. $15 \div \frac{5}{9} =$	**11.** $9 \div \frac{3}{6} =$	**12.** $24 \div \frac{8}{10} =$
13. $16 \div \frac{3}{8} =$	**14.** $18 \div \frac{9}{12} =$	**15.** $14 \div \frac{7}{10} =$

16. How many $\frac{3}{4}$ of a metre are in 15 metres? Draw a diagram that models the problem.

17. Mrs. Chin has a 6 metres length of ribbon that she wants to cut to make bows. Each bow will take $\frac{2}{6}$ of a metre of ribbon. How many bows will she be able to make?

18. Daddy buys a board that is 8 metres long. He wants to cut it into pieces that are $\frac{4}{8}$ metre each. How many pieces will daddy have after he cuts the board?

19. How many $\frac{3}{5}$ are in 4? What is left over?

20. Lee said that the answer to 8 divided by $\frac{2}{3}$ is a whole number. Is Lee correct? Explain your answer.

Divide Fractions by Whole Numbers

Teaching Point 1:

How do you divide a fraction by a whole number?

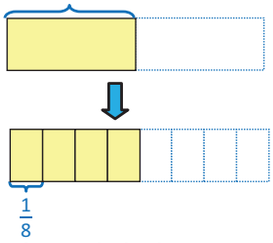
$\frac{1}{2}$ of a chocolate is shared equally among four persons. What fraction of the chocolate did each person get?

Find $\frac{1}{2} \div 4$.

Method 1: Use a Model.

Model the chocolate that is shared by the friends. **Divide** each half into 4 equal parts.

$\frac{1}{2}$ of a chocolate bar



Each fraction is $\frac{1}{8}$ of the chocolate bar.

Method 2: Find a fraction of the fraction.

Each part is $\frac{1}{4}$ *of* $\frac{1}{2}$

$\frac{1}{2} \div 4 = \frac{1}{4}$ of $\frac{1}{2}$

$= \frac{1}{4} \times \frac{1}{2}$

$= \frac{1}{8}$

Each fraction is $\frac{1}{8}$ of the chocolate bar.

Method 3: Multiply by the reciprocal.

$\frac{1}{4}$ is the **reciprocal** of $\frac{4}{1}$ or 4.

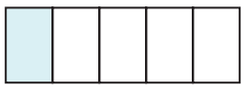
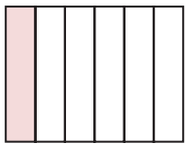
$\frac{1}{2} \div \frac{4}{1} = \frac{1}{2} \times \frac{1}{4}$ ← Multiply by the reciprocal.

$= \frac{1}{8}$

Each fraction is $\frac{1}{8}$ of the chocolate bar.

Activity 1:

Use a model to divide.

1. $\frac{1}{5} \div 2 =$ 	**2.** $\frac{1}{4} \div 3 =$ 
3. $\frac{1}{6} \div 2 =$ 	**4.** $\frac{1}{2} \div 4 =$ 
5. $\frac{1}{3} \div 5 =$	**6.** $\frac{1}{8} \div 3 =$
7. $\frac{1}{10} \div 3 =$	**8.** $\frac{1}{4} \div 4 =$
9. $\frac{2}{3} \div 6 =$	**10.** $\frac{2}{4} \div 2 =$
11. $\frac{2}{5} \div 4 =$	**12.** $\frac{6}{8} \div 3 =$
13. $\frac{2}{3} \div 8 =$	**14.** $\frac{2}{4} \div 12 =$
15. $\frac{8}{9} \div 4 =$	**16.** $\frac{6}{7} \div 3 =$

Activity 2:

Solve. Write the answer in its simplest form.

1. Analise cuts $\frac{4}{6}$ metre of wood into 8 equal parts. What is the length of each part?

2. Mother has $\frac{1}{2}$ litre of juice to share equally among her 3 children. How much juice did each child get?

3. Myron shares $\frac{1}{3}$ of a pizza equally among his 4 friends. What fraction of the pizza did each friend get?

4. Three friends share $\frac{1}{4}$ of a pineapple equally. What fraction of a whole pineapple does each friend get?

5. Miss Thomas has $\frac{1}{2}$ a kilogram of nuts. She divides the nuts equally into 5 bags. What fraction of a kilogram of nuts is in each bag?

6. Mother bought $\frac{3}{4}$ kilogram of minced beef. She divided it equally into 6 smaller bags.
   a) What is the weight of each bag?
   b) If she used 2 bags to make burgers, how much minced beef was left over?

7. You want to cut a $\frac{3}{4}$ metre of fabric into 9 equal pieces. What will be the length of each piece?

8. $\frac{6}{8}$ of a pizza is shared equally among 3 boys. What fraction of the whole pizza did each boy get?

Divide a Fraction by a Fraction

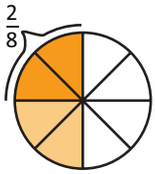
Teaching Point 1:

How can you divide a fraction by a fraction?

You have $\frac{1}{2}$ of a cake left over. You cut it into pieces, each of which is $\frac{2}{8}$ of the whole cake. How many pieces did you cut?

Number of pieces $\frac{1}{2} \div \frac{2}{8}$.

Use a model.



There are 2 two-eighths in $\frac{1}{2}$.

So, $\frac{1}{2} \div \frac{2}{8} = 2$

You can solve this problem another way:

$\frac{1}{2} \div \frac{2}{8} = \frac{1}{2} \times \frac{8}{2}$ ← Multiply by the **reciprocal**.

$= \frac{8}{4}$ ← Simplify.

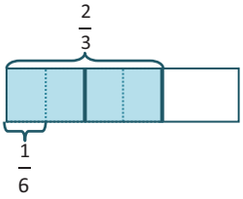
$= 2$

So, you cut 2 pieces.

Share $\frac{2}{3}$ litre of juice into $\frac{1}{6}$ litre paper cups. How many paper cups can you fill?

How many $\frac{1}{6}$s are there in $\frac{2}{3}$ or $\frac{2}{3} \div \frac{1}{6}$.

Use **a model**.



There are 4 sixths in $\frac{2}{3}$.

$\frac{2}{3} \div \frac{1}{6} = \frac{2}{3} \times \frac{6}{1}$ ← Multiply by the **reciprocal**.

$= \frac{12}{3}$ ← Simplify.

$= 4$

So, I can fill 4 paper cups.

Activity 1:

Divide. Express the quotient in simplest form.

1. $\frac{2}{3} \div \frac{1}{9} =$	2. $\frac{3}{5} \div \frac{2}{10} =$
3. $\frac{3}{4} \div \frac{2}{8} =$	4. $\frac{4}{6} \div \frac{3}{12} =$
5. $\frac{4}{5} \div \frac{2}{15} =$	6. $\frac{1}{3} \div \frac{2}{9} =$
7. $\frac{2}{3} \div \frac{1}{9} =$	8. $\frac{2}{3} \div \frac{3}{9} =$
9. $\frac{1}{6} \div \frac{2}{3} =$	10. $\frac{3}{4} \div \frac{1}{2} =$

Solve the problems below.

11. How many $\frac{1}{8}$ metre pieces of ribbon can be cut from a $\frac{1}{2}$ metre ribbon.

12. Maya has $\frac{3}{4}$ of a cake to share with her friends. If she gave each friend $\frac{3}{12}$ of the cake, how many friends will get a piece of cake?

13. Anton had $\frac{5}{8}$ of a pizza. He cut it into pieces that were $\frac{1}{16}$ of the whole pizza. How many pieces did he get?

14. A bottle contains $\frac{4}{5}$ litre of soft drink. If mummy fills two $\frac{4}{10}$ litre cups with soft drink from the bottle, what fraction of a litre of soft drink is left in the bottle?

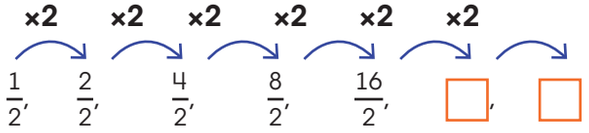
Number Patterns with Fractions

Teaching Point 1:

How can you describe and use patterns?

This is an **increasing** pattern.

Find the **pattern rule**.



The **rule** is × **2**.

Use the rule to complete the pattern.

So, the missing elements are $\frac{32}{2}$ and $\frac{64}{2}$.

Activity 1:

Complete each pattern. Write the rule.

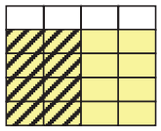
1. $\frac{1}{3}, \frac{2}{6}, \square, \frac{8}{24}, \frac{16}{48}, \square$
2. $\frac{96}{144}, \frac{48}{72}, \square, \frac{12}{18}, \square$
3. $\frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \square, \square, \frac{1}{128}$
4. $\frac{1}{9}, \square, 1, 3, 9, \square$
5. $\frac{1}{2}, \frac{1}{4}, \square, \frac{1}{16}, \frac{1}{32}, \square$
6. $\frac{1}{4}, \frac{1}{12}, \square, \frac{1}{108}, \square$
7. $\frac{3}{4}, \frac{6}{12}, \frac{12}{36}, \square, \frac{48}{324}$
8. $\frac{3}{8}, \frac{3}{2}, \square, 24, 96$

Chapter Review

Express the quotient in simplest form. Use models to help you.

1. $\frac{3}{8}$ of 24
2. $1\frac{1}{4} \times 3\frac{5}{8}$
3. $\frac{2}{5} \div 16$
4. Complete the number pattern:

   $\frac{1}{3}, \square, 3, 9, 27, 81$
5. Write the multiplication number sentence that the model on the right represents?



6. Asha is $\frac{3}{8}$ of her father's age. If her father is 32 years old, how old is Asha?
7. Share 3 chocolates among 5 children. How much chocolate would each child get?

8. A vendor has a watermelon that weighs 5 kilogram. He wants to cut it into $\frac{1}{5}$ kilogram pieces for sale. How many pieces will he get?
9. Jian spent 6 hours on Sunday playing games, watching television and studying. He spent $\frac{1}{6}$ of the time watching television and $\frac{1}{3}$ of the time studying. What fraction of the time did he spend playing games?

10. Every day you drink $\frac{1}{4}$ litre of milk.

    Your baby brother drinks 5 times as much. How much milk does your baby brother drink?
11. Alex spends 2 hours a day studying. His sister, Amanda spends $\frac{6}{8}$ as much time studying. What is the exact amount of time that his sister spends studying?

12. The banner for the bazaar is 3 metres long. If Mala sews a red strip on each $\frac{1}{6}$ metre section, how many strips will she sew?

13. A jug holds 4 litres of fruit punch. Each paper cup holds $\frac{1}{4}$ litre. How many paper cups can be filled?

14. Maria used a vehicle to travel to school on $\frac{3}{4}$ of the days last month. On $\frac{1}{2}$ of those days she took the bus.

    a) What fraction of those days last month did Maria take the bus?

    b) If Maria went to school for 16 days last month, how many days did she take the bus?

15. Mr. Khan has 48 plants in his vegetable garden. $\frac{2}{3}$ of the plants are tomatoes and $\frac{1}{4}$ are cucumbers. The rest of the plants are pumpkin. How many pumpkin plants are in the garden?

16. Mother has a 2 kilogram package of flour. She uses $\frac{1}{2}$ of the flour to make bread. She then uses $\frac{1}{4}$ of the remaining flour to make a cake. What fraction of the flour is left?

17. Jonathan spends $\frac{1}{2}$ of his vacation at summer camp. He spends $\frac{2}{3}$ of the remaining time at his granny's house. The remaining 8 days of his vacation he spent at the beach with his parents. How many days of vacation did Jonathan have?

18. Alisha had $60. She spent $\frac{2}{5}$ of it on a toy, and $\frac{1}{2}$ of it on a book and saved the remainder.

    a) What fraction did she spend on the toy and the book?

    b) How much money did she save?

19. While unpacking 50 bundles of dasheen bush at the market, a vendor found that $\frac{1}{10}$ of them were damaged.

    a) How many bundles of dasheen bush were damaged?

    b) Of the bundles that were not damaged the vendor sold $\frac{3}{4}$ of them in the morning. How many bundles remained?

20. In a class $\frac{3}{5}$ of the students are girls. $\frac{1}{6}$ of these girls wear glasses. If $\frac{3}{4}$ of the boys wear glasses, what fraction of the students wear glasses?

21. In a bag of fruits $\frac{5}{9}$ of them are mangoes and the rest are oranges. $\frac{3}{10}$ of the mangoes are green. There are 15 green mangoes. How many fruits are in the basket?

22. $\frac{3}{5}$ of the children at a party were boys. There were 15 boys at the party. How many children were at the party?