Grade 9KC Fractions NAME:

January 2025



Lessons

1	Probability with Dice
2	Equivalent fractions with rectangles
3	Ordering fractions and decimals with a common denominator
4	Adding fractions that have the same denominator
5	Adding fractions that have different denominators
6	Multiplying two fractions: rectangle model
7	Dividing fractions
8	Review Percentages
9	Mixed and Improper Fractions, Whole numbers as fractions
10	Review
Project	Create a diagram to illustrate a calculation with fractions

Use this grid to play dice games described on the next page. You need a counter, two dice and an opponent.

END

91	92	93	94	95	96	97	98	99	100
90	89	88	87	86	85	84	83	82	81
71	72	73	74	75	76	77	78	79	80
70	69	68	67	66	65	64	63	62	61
51	52	53	54	55	56	57	58	59	60
50	49	48	47	46	45	44	43	42	41
31	32	33	34	35	36	37	38	39	40
30	29	28	27	26	25	24	23	22	21
11	12	13	14	15	16	17	18	19	20
10	9	8	7	6	5	4	3	2	1

START

Grade 9KC Fractions Lesson 1 Name:

Dice Game rules:

A. Race to 100, two dice

Put your counter at the start (on '0'). Roll two dice. Add the scores on your dice. Advance your counter the sum of the numbers on your dice.

Take turns, the first to land on or to pass 100 wins the game.

In this game, an 'outcome' is the score when you roll two dice and add the numbers.

List all the possible outcomes in this game:

Which of the outcomes above are more likely than other outcomes?

Which of the outcomes are least likely?

State a few outcomes that are impossible when rolling two dice:

What is the reason that some outcomes are more likely than other outcomes?

B. Race to 100, two dice: restart on double 6

Play the same game as before, only if you roll double 6 you must start again.

C. Race to 100, two dice: restart on ....

Play the same game however agree with your opponent on a new rule of when you must start again.

New Rule:

D. Race to 100, two dice: restart on ....

This time, create a 'start again' rule for each player. Create different 'start again' rules but make sure that they are equally likely so that the game is fair.

Rule 1:

Rule 2:

E. Race to 100, two dice: restart on ....

What is a rule that would make it pretty much but not entirely impossible to ever finish the game?

F. Race to 100, two dice: restart on ....

What is a rule that would *feel* possible but would take really long to finish the game?

Grade 9KC Fractions Lesson 2 NAME:

Probability Tables of Outcomes

Rolling one, fair dice:

	1	2	3	4	5	6
Probability						

Interpret the table:

(a) P(2) =

(b) P(1 or 2) =

(c) P(7)=

(d) P(less than or equal to 3)=

(e) P(even number)=

Rolling two, fair dice, sum the dice:

	1	2	3	4	5	6
1						
2						
3						
4						
5						
6						

Table of outcomes when summing two dice:

	2	3	4	5	6	7	8	9	10	11	12
Probability											

Table of outcomes when summing two dice:

	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$
Decimal (2 d.p.)											

Experiment!

As a class, we will roll the dice 360 times!

Expected outcome:

	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{\square}{360}$	$\frac{\square}{360}$	$\frac{\square}{360}$	$\frac{\square}{360}$	$\frac{\square}{360}$	$\frac{\square}{360}$	$\frac{\square}{360}$	$\frac{\square}{360}$	$\frac{\square}{360}$	$\frac{\square}{360}$	$\frac{\square}{360}$
Decimal (2 d.p.)											

Your actual results for ..... rolls:

Your organized results:

	2	3	4	5	6	7	8	9	10	11	12
Frequency											

The whole class organized results:

	2	3	4	5	6	7	8	9	10	11	12
Frequency											
Decimal:											

Reflection:

Lesson 3: Equivalent Fractions and Adding Fractions

Two fractions are equivalent when they represent the same quantity of a whole.

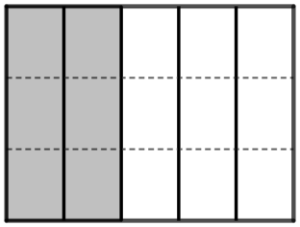
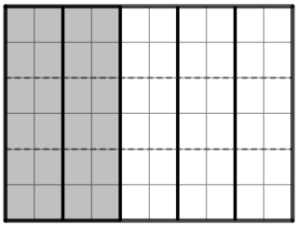
Some examples of fractions that are equivalent to $\frac{1}{2}$ are:

Circle all the fractions in the box that are equivalent to $\frac{1}{4}$:

$\frac{5}{7}$	$\frac{3}{12}$	$\frac{25}{100}$	$\frac{6}{20}$	$\frac{6}{24}$	$\frac{40}{50}$	$\frac{10}{40}$	$\frac{7}{28}$	$\frac{8}{36}$	$\frac{9}{36}$

We can use rectangles to illustrate equivalent fractions.

Use the number of cells the rectangle is divided into as the denominator for each fraction.

		
This rectangle is divided into 5.	This rectangle is divided into 15.	This rectangle is divided into 60.
Fraction shaded = $\frac{\square}{5}$	Fraction shaded = $\frac{\square}{15}$	Fraction shaded = $\frac{\square}{60}$

Conclusion:

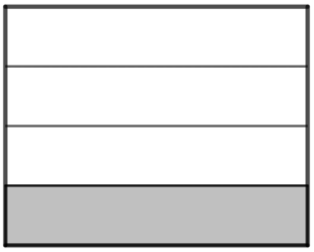
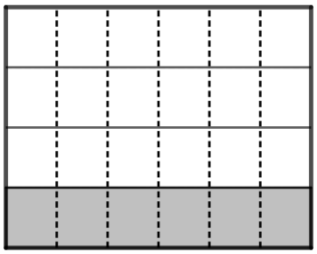
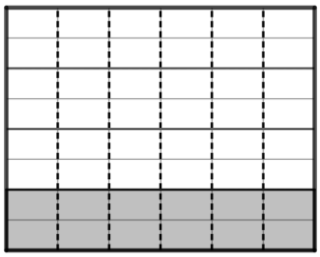
$$\frac{\square}{5} = \frac{\square}{15} = \frac{\square}{60}$$

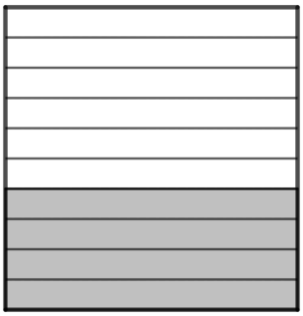
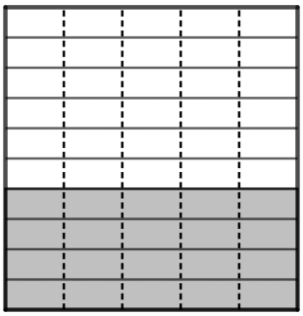
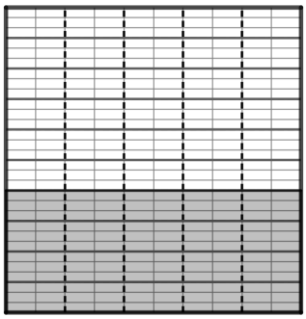
These three fractions are *equivalent* because they all refer to the same portion of the rectangle.

This diagram shows the same fraction of the rectangle shaded in.

Only the rectangle is cut into different numbers of pieces.

Think of the rectangle in as a chocolate bar. In the first image, the chocolate only cuts into four pieces like a kitkat.

Number of pieces = 4  .Fraction shaded =	Number of pieces = 24  Fraction shaded =	Number of pieces =  Fraction shaded =
Conclusion:		

Number of pieces:  Fraction shaded =	Number of pieces:  Fraction shaded =	Number of pieces: 300  Fraction shaded = $\frac{\square}{300}$
Conclusion:		

Simplify Fractions

To *simplify* a fraction is to write an equivalent fraction with the smaller whole numbers

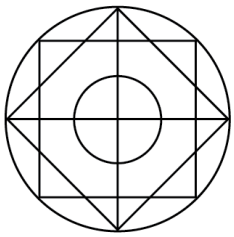
To simplify a fraction *fully* is to write an equivalent fraction with the *smallest possible* whole numbers

If the numerator and denominator share any common factors, a fraction can be simplified more.

If the numerator and denominator do not share any common factors, a fraction is fully simplified.

All of these fractions can be simplified by dividing by 2. Simplify by dividing by 2. Then decide if you think the fraction is fully simplified or not.

Fraction	$\frac{\div 2}{\div 2}$	Fully simplified or not?
$\frac{6}{8}$	$=$	Yes/no
$\frac{10}{20}$	$=$	Yes/no
$\frac{20}{24}$	$=$	Yes/no
$\frac{8}{16}$	$=$	Yes/no
$\frac{26}{30}$	$=$	Yes/no
$\frac{8}{10}$	$=$	Yes/no
$\frac{18}{20}$	$=$	Yes/no



Identify the highest common factor of the numerator and denominator in each fraction. Simplify by dividing numerator and denominator by the highest common factor.

Check your answer is fully simplified by using the fraction button on your calculator.

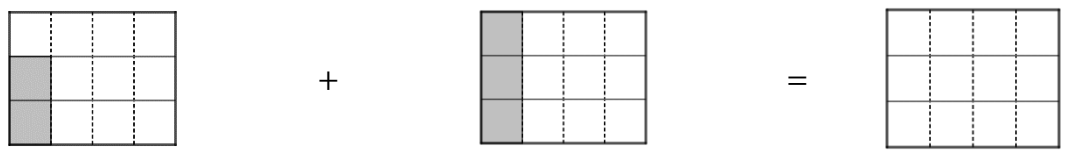
Fraction	HCF	Simplified
$\frac{15}{20}$		
$\frac{16}{36}$		
$\frac{30}{70}$		
$\frac{3}{12}$		
$\frac{8}{12}$		
$\frac{10}{25}$		
$\frac{16}{24}$		
$\frac{100}{300}$		
$\frac{9}{15}$		
$\frac{16}{20}$		
$\frac{4}{20}$		
$\frac{5}{20}$		
$\frac{2}{20}$		
$\frac{3}{21}$		

Fraction	HCF	Simplified
$\frac{8}{32}$		
$\frac{9}{45}$		
$\frac{7}{35}$		
$\frac{14}{35}$		
$\frac{7}{42}$		
$\frac{6}{30}$		
$\frac{6}{12}$		
$\frac{6}{24}$		
$\frac{12}{30}$		
$\frac{18}{30}$		
$\frac{18}{24}$		
$\frac{200}{500}$		
$\frac{9}{36}$		
$\frac{63}{72}$		

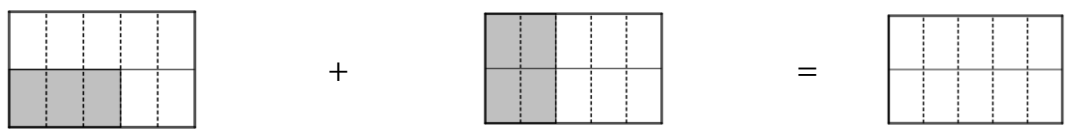
Lesson 4: Adding (or subtracting) Fractions

Add the parts shaded. Shade in the total parts on the third diagram. Complete the fraction sentence below each diagram.

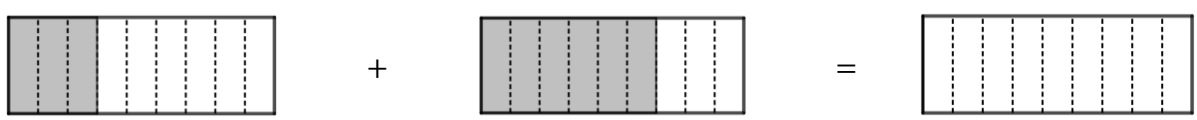
PART 1: When the fractions have the same denominator



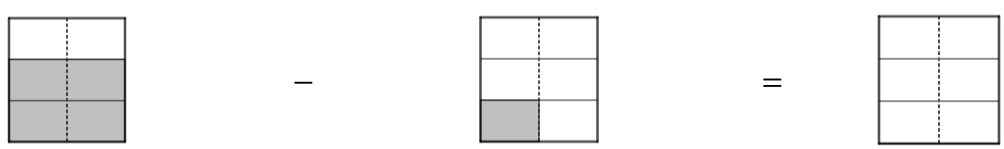
$\frac{\square}{\square} + \frac{\square}{\square} = \frac{\square}{\square}$



$\frac{\square}{\square} + \frac{\square}{\square} = \frac{\square}{\square}$



$\frac{\square}{\square} + \frac{\square}{\square} = \frac{\square}{\square} =$



$\frac{\square}{\square} - \frac{\square}{\square} = \frac{\square}{\square} = \frac{\square}{\square}$

Adding Probabilities



When throwing two dice there are 36 different outcomes. Eg, throwing a 4 and a 5 is one outcome.

When the two numbers are added together, some outcomes give the same answer. Eg 4 with 5 gives 9. So does 3 with 6. These combined outcomes are called events.

Copy the probability space table from page 5:

Sum of dice is:	2	3	4	5	6	7	8	9	10	11	12
Probability	$\frac{1}{36}$	$\frac{2}{36}$				$\frac{6}{36}$					$\frac{1}{36}$

To score 2 or 3 when rolling two dice:

$$P(2 \text{ or } 3) = P(2) + P(3) = \frac{1}{36} + \frac{2}{36} = \frac{3}{36}$$

If you can simplify your answer you should do that. The answers $\frac{3}{36}$ and $\frac{1}{12}$ are *equivalent* and so both are correct.

Calculate the following probabilities:

$P(2 \text{ or } 12) =$	$\frac{1}{36} + \frac{1}{36} = \frac{2}{36}$ $\left(= \frac{1}{18}\right)$
$P(5) =$	
$P(\text{not } 5) =$	
$P(\text{Multiple of } 3) =$	
$P(\text{not a multiple of } 3) =$	
$P(\text{Multiple of } 5) =$	
$P(\text{not a multiple of } 5) =$	
$P(\text{Multiple of } 6) =$	
$P(\text{not a multiple of } 6) =$	

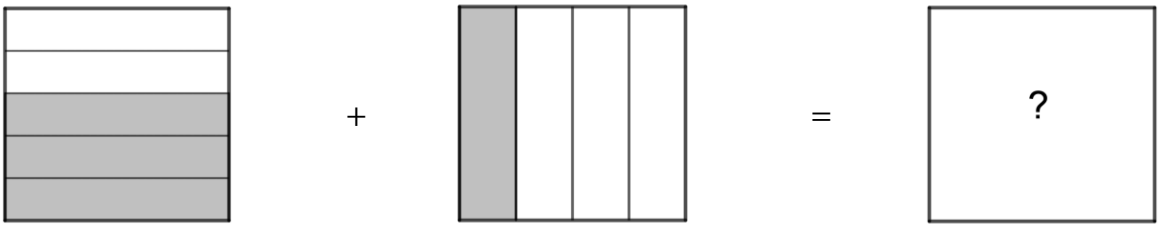
Reflect:
When adding fractions that have the same denominator, you:

For example:

PART 2: When the denominators are different.

Rectangle models help to understand how to add fractions with different denominators.

We choose a grid that works for both fractions.



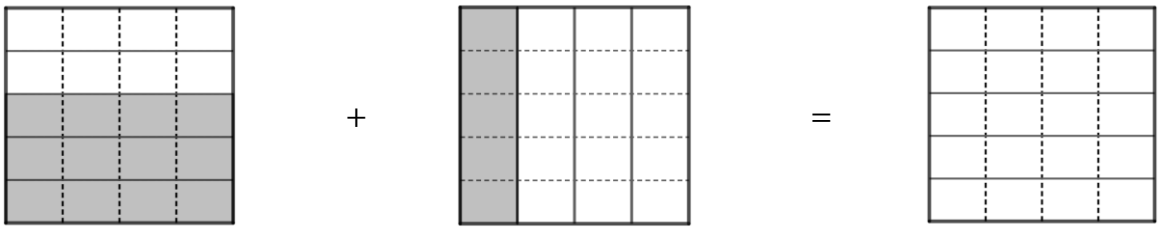
$\frac{3}{5}$ + $\frac{1}{4}$ = ?

Method: Use $rows\ and\ columns$, one with each denominator. The 5 by 4 grid has 20 equal cells.

$\frac{3}{5} = \frac{\square}{20}$ $\frac{1}{4} = \frac{\square}{20}$

Shade the right number of cells in the final rectangle.

$\frac{\square}{20} + \frac{\square}{20} = \frac{\square}{20}$

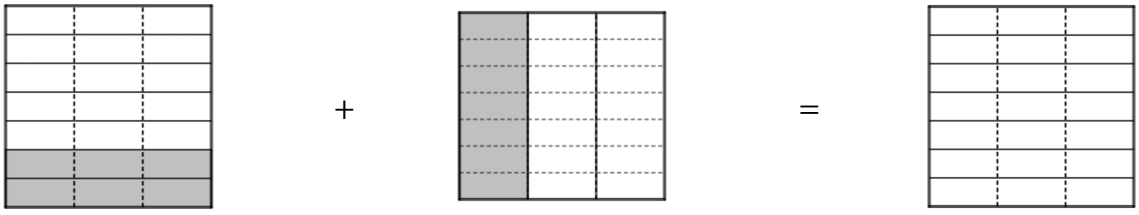


B.

$\frac{2}{7}$ + $\frac{1}{3}$ = ?

Use a grid that measures 7 by 3.

$\frac{2}{7} = \frac{\square}{21}$ $\frac{1}{3} = \frac{\square}{21}$ $\frac{\square}{21} + \frac{\square}{21} = \frac{\square}{21}$

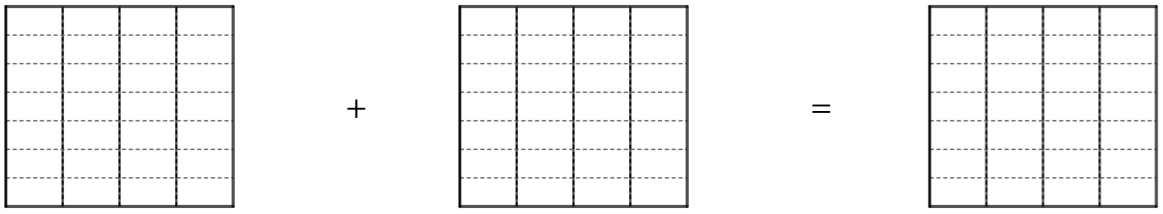


C.

$\frac{1}{7}$	+	$\frac{3}{4}$	=	?

Use a 7 by 4 grid. The 7 by 4 grid has 28 cells.

$\frac{1}{7} = \frac{\square}{28}$ $\frac{3}{4} = \frac{\square}{28}$ = $\frac{\square}{28} + \frac{\square}{28} = \frac{\square}{28}$

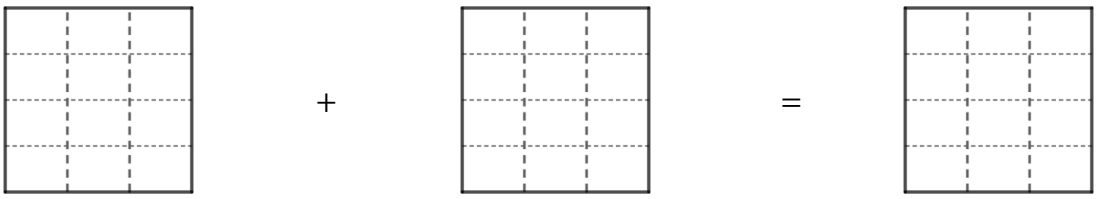


D.

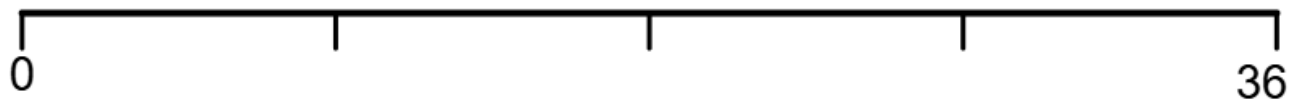
$\frac{2}{3}$	+	$\frac{1}{4}$	=	?

Use a 3 by 4 grid. The 3 by 4 grid has 12 cells.

$\frac{2}{3} = \frac{\square}{12}$ $\frac{1}{4} = \frac{\square}{12}$ $\frac{\square}{12} + \frac{\square}{12} = \frac{\square}{12}$



Complete the number line:



$\frac{1}{4}$ of 36 = $\frac{1}{2}$ of 36 = $\frac{3}{4}$ of 36 =

Lesson 5: Adding (or subtracting) Fractions Practice!

Example:

(a) $\frac{2}{5}+\frac{1}{2}$ (b) $\frac{2}{7}+\frac{1}{2}$ (c) $\frac{1}{3}+\frac{1}{2}$ (d) $\frac{4}{5}-\frac{2}{3}$

(e) $\frac{8}{9}-\frac{1}{3}$ (f) $\frac{2}{3}+\frac{1}{6}$ (g) $\frac{3}{10}+\frac{2}{5}$ (h) $\frac{3}{8}+\frac{1}{4}$

(i) $\frac{7}{15}-\frac{1}{5}$ (j) $\frac{3}{4}-\frac{2}{5}$ (k) $\frac{3}{10}+\frac{3}{8}$ (l) $\frac{2}{5}+\frac{4}{7}$

Question 2: Work out the following additions.
Give your answers as simplified fractions.
If necessary, give any answers as mixed numbers.

(a) $\frac{3}{4} + \frac{1}{2}$ (b) $\frac{5}{9} + \frac{2}{3}$ (c) $\frac{7}{10} + \frac{1}{3}$ (d) $\frac{4}{5} + \frac{3}{4}$

Question 1: In a car park, $\frac{2}{3}$ of the cars are red.

$\frac{1}{5}$ of the cars are blue.

What fraction of the cars are red or blue?

Question 2: This week Harry spent $\frac{1}{2}$ of his pocket money on a ticket for a football match.

He also spent $\frac{1}{8}$ of his pocket money on a scarf at the match.

(a) What fraction of his pocket money has Harry spent?

(b) What fraction of his pocket money does Harry have left?

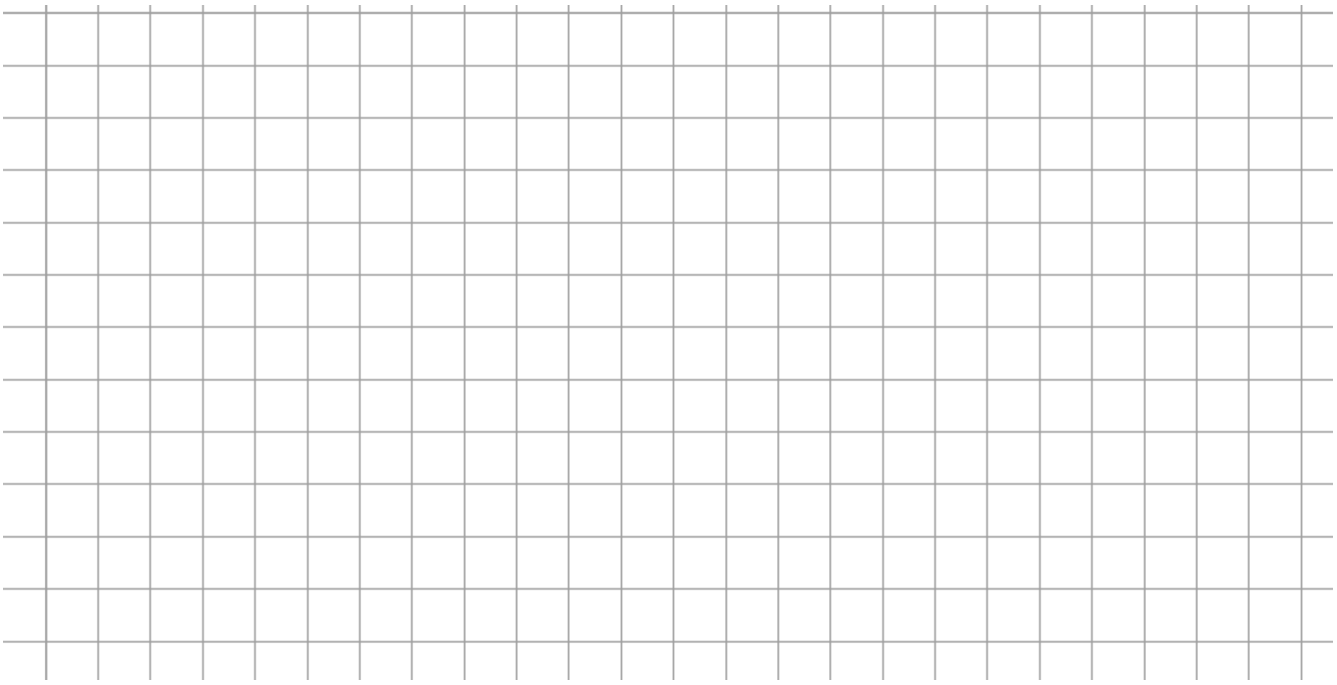
Question 3: On an airplane, the passengers may have chicken, vegetable or tomato soup.
Half of the passengers choose chicken soup
A third of the passengers choose tomato soup.

(a) What fraction of the passengers choose vegetable soup?

There are 240 passengers on the airplane.

(b) How many passengers choose vegetable soup?

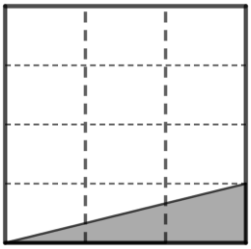
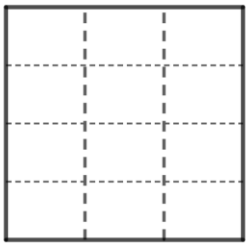
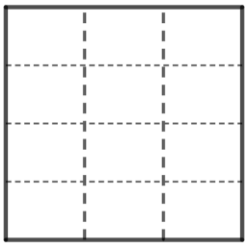
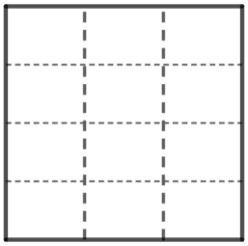
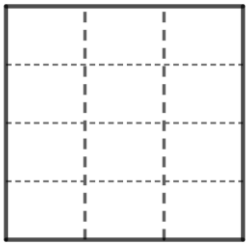
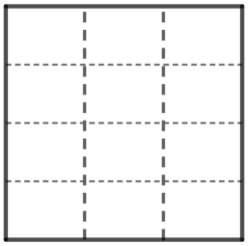
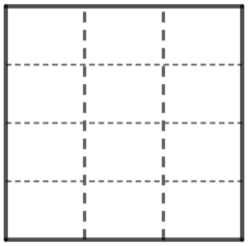
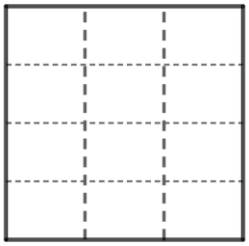
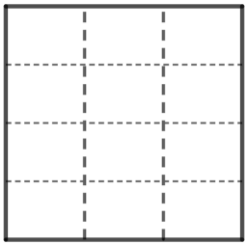
Draw a rectangle diagram to show that $\frac{3}{5} + \frac{2}{7} = \frac{31}{35}$



Draw a rectangle diagram to show that $\frac{3}{4} - \frac{3}{16} = \frac{9}{16}$



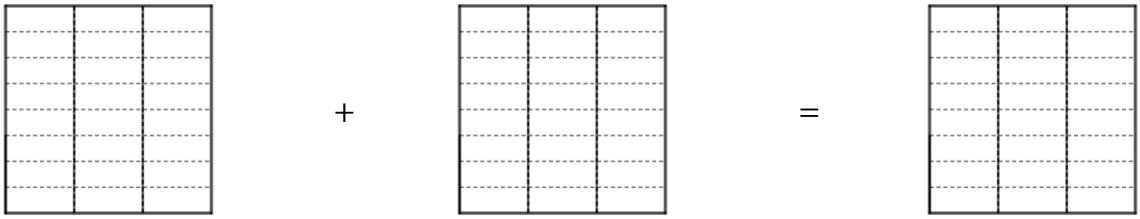
This rectangle has been divided into 12 equal parts. Draw one straight line and shade the fraction indicated.

 $\frac{1}{8}$	 $\frac{1}{2}$	 $\frac{1}{4}$
 $\frac{1}{3}$	 $\frac{1}{12}$	 $\frac{1}{24}$
 $\frac{1}{6}$	 $\frac{3}{8}$	 $\frac{7}{8}$

D. Shade the rectangles and complete the calculation.

$\frac{1}{8} + \frac{2}{3} = ?$

Use an 8 by 3 grid. The 8 by 3 grid has ..... cells.

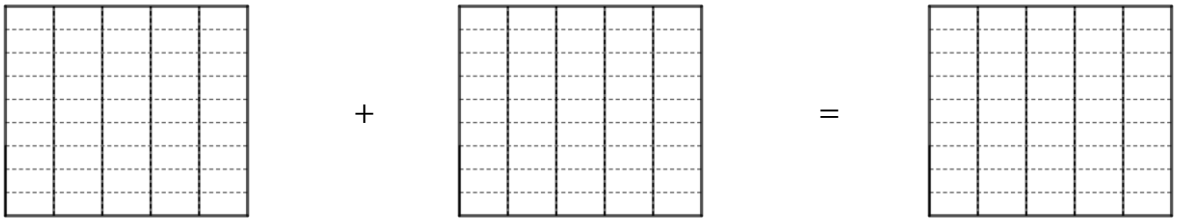


$\frac{\square}{24} + \frac{\square}{24} = \frac{\square}{24}$

E. Shade the rectangles and complete the calculation.

$\frac{7}{9} + \frac{1}{5} = ?$

Use a 9 by 5 grid. The 9 by 5 grid has ..... cells.



$\frac{\square}{45} + \frac{\square}{45} = \frac{\square}{45}$

What is the rule for choosing the new denominator?

F.

$\frac{3}{5} + \frac{2}{7} = ?$

Use a grid that measures ..... by ..... This grid has ..... cells.

$\frac{\square}{35} + \frac{\square}{35} = \frac{\square}{35}$

G.

$\frac{1}{2} + \frac{3}{10} = ?$

Use a grid that measures ..... by ..... This grid has ..... cells.

$\frac{\square}{\square} + \frac{\square}{\square} = \frac{\square}{\square}$

H.

$\frac{4}{11} + \frac{2}{5} = ?$

Use a grid that measures ..... by ..... This grid has ..... cells.

$\frac{\square}{\square} + \frac{\square}{\square} = \frac{\square}{\square}$

I.

$\frac{12}{23} + \frac{1}{2} = ?$

Use a grid that measures ..... by ..... This grid has ..... cells.

$\frac{\square}{\square} + \frac{\square}{\square} = \frac{\square}{\square}$

J.

$\frac{1}{5} + \frac{1}{11} = ?$

Use a grid that measures ..... by ..... This grid has ..... cells.

$\frac{\square}{\square} + \frac{\square}{\square} = \frac{\square}{\square}$

K.

$\frac{4}{5} + \frac{2}{3} = ?$

Use a grid that measures ..... by ..... This grid has ..... cells.

$\frac{\square}{\square} + \frac{\square}{\square} = \frac{\square}{\square}$

Lesson 4: Practice and Apply Equivalent Fractions and Adding Fractions

Workout

Question 1: Find the missing numbers

(a) $\frac{2}{3} = \frac{\quad}{6}$ (b) $\frac{1}{5} = \frac{\quad}{20}$ (c) $\frac{3}{4} = \frac{\quad}{12}$ (d) $\frac{5}{7} = \frac{10}{\quad}$

(i) $\frac{3}{4} = \frac{30}{\quad}$ (j) $\frac{\quad}{8} = \frac{55}{88}$ (k) $\frac{2}{9} = \frac{10}{\quad}$ (l) $\frac{2}{3} = \frac{\quad}{18}$

Question 2: Find the missing numbers

(a) $\frac{6}{7} = \frac{42}{\quad}$ (b) $\frac{9}{20} = \frac{63}{\quad}$ (c) $\frac{5}{12} = \frac{35}{\quad}$ (d) $\frac{7}{8} = \frac{\quad}{64}$

(i) $\frac{11}{16} = \frac{88}{\quad}$ (j) $\frac{2}{9} = \frac{\quad}{108}$ (k) $\frac{13}{25} = \frac{\quad}{375}$ (l) $\frac{9}{\quad} = \frac{81}{144}$

Apply

Question 1: Write down 3 different fractions that are equivalent to $\frac{1}{2}$

Question 2: Write down 3 different fractions that are equivalent to $\frac{3}{5}$

Question 3: Write down a fraction between $\frac{2}{3}$ and $\frac{4}{5}$

Question 4: Write down a fraction between $\frac{5}{8}$ and $\frac{2}{3}$

Question 1: Work out the following additions and subtractions.
Give your answers as simplified fractions.

(a) $\frac{2}{5} + \frac{1}{2}$

(c) $\frac{1}{3} + \frac{1}{2}$

(m) $\frac{11}{15} - \frac{1}{6}$

(o) $\frac{3}{14} + \frac{1}{3}$

Apply

Question 1: In a car park, $\frac{2}{3}$ of the cars are red.

$\frac{1}{5}$ of the cars are blue.

What fraction of the cars are red or blue?

Question 2: This week Harry spent $\frac{1}{2}$ of his pocket money on a ticket for a football match.

He also spent $\frac{1}{8}$ of his pocket money on a scarf at the match.

(a) What fraction of his pocket money has Harry spent?

(b) What fraction of his pocket money does Harry have left?

Question 3: On an airplane, the passengers may have chicken, vegetable or tomato soup.
Half of the passengers choose chicken soup
A third of the passengers choose tomato soup.

(a) What fraction of the passengers choose vegetable soup?

There are 240 passengers on the airplane.

(b) How many passengers choose vegetable soup?

Question 4: Patrick has a bag of sugar that contains $\frac{5}{6}$ kg

He uses $\frac{3}{5}$ kg of sugar to make a cake.

How much sugar does Patrick have left?

Question 5: Work out $\frac{1}{6} + \frac{1}{2} + \frac{2}{9}$

Colouring Grid

Here are 30 fractions.

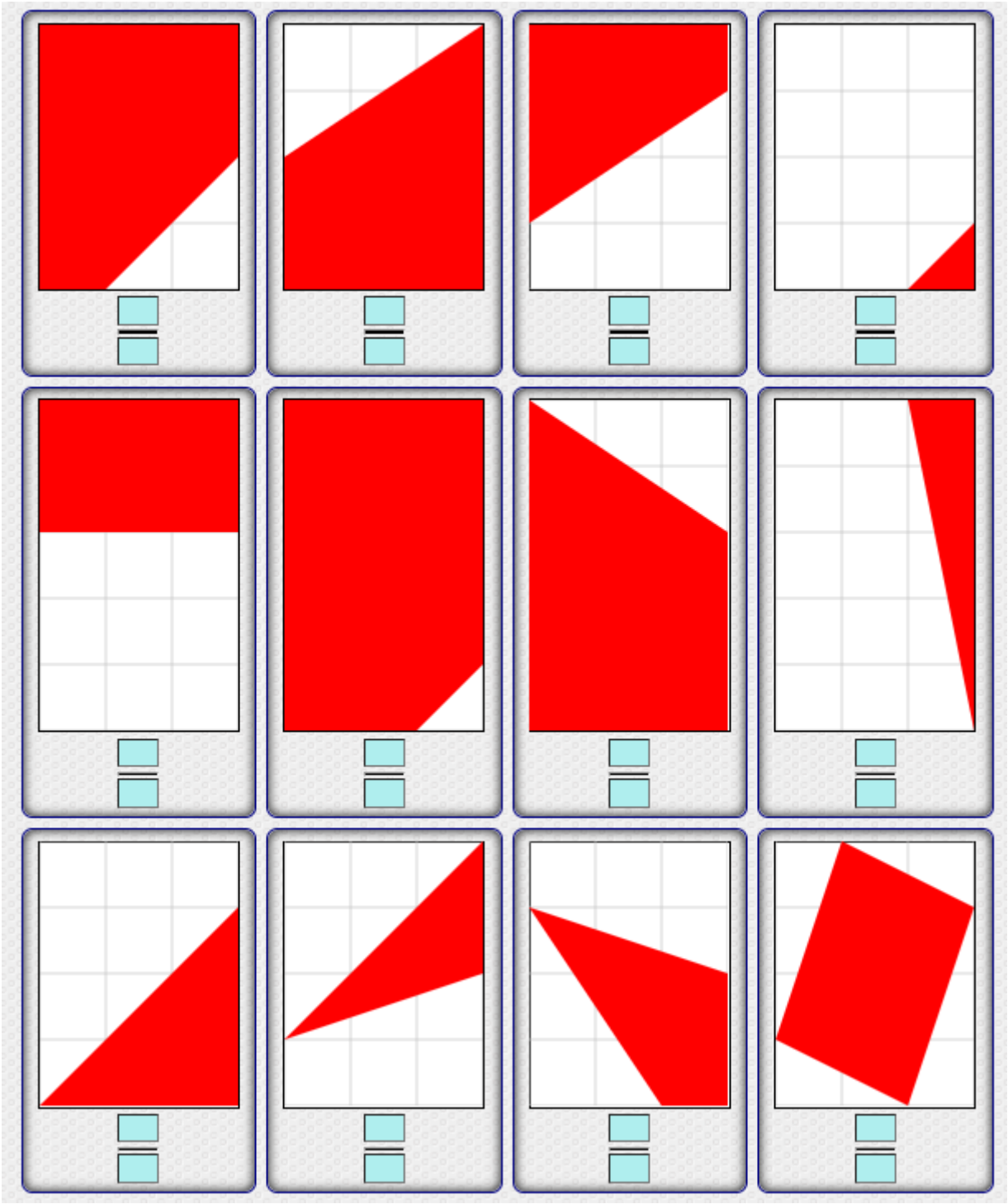
If the fraction is greater than ½ colour the square one colour (a light colour).

If the fraction is less than ½, colour the square a second colour (a dark colour).

$\frac{23}{40}$	$\frac{23}{25}$	$\frac{9}{12}$	$\frac{4}{7}$	$\frac{9}{16}$
$\frac{11}{20}$	$\frac{23}{100}$	$\frac{45}{80}$	$\frac{12}{25}$	$\frac{29}{54}$
$\frac{31}{60}$	$\frac{5}{8}$	$\frac{4}{12}$	$\frac{18}{35}$	$\frac{20}{36}$
$\frac{7}{18}$	$\frac{23}{40}$	$\frac{9}{14}$	$\frac{23}{36}$	$\frac{17}{40}$
$\frac{8}{9}$	$\frac{8}{18}$	$\frac{3}{8}$	$\frac{15}{36}$	$\frac{27}{50}$
$\frac{5}{6}$	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{63}{100}$	$\frac{13}{12}$

Puzzle Rectangles

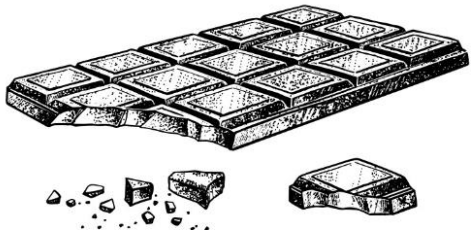
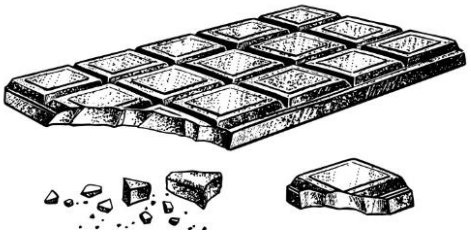
Write the fraction that has been shaded on each rectangle. Remember to simplify the fraction if possible.

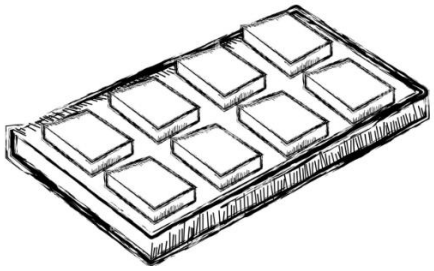
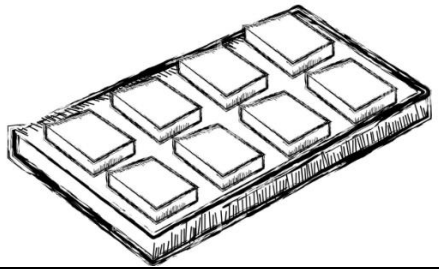


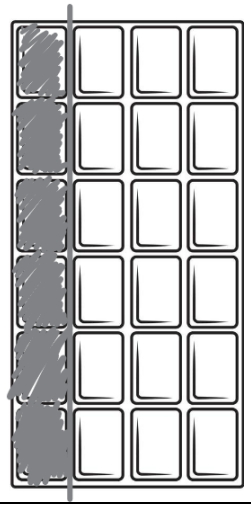
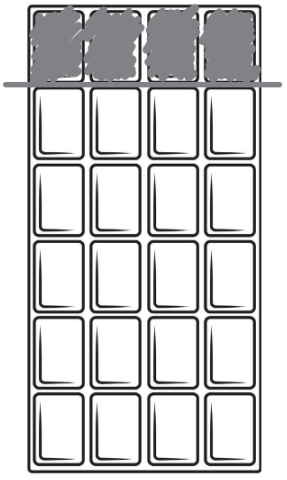
Grade 9KC Fractions NAME:

Lesson 6: Review adding Fractions & Using a Calculator

A 'bar of chocolate' grid can be used to draw fractions that have different denominators.

Draw on the picture to show how to split this bar into three equal parts (thirds). Colour in $\frac{1}{3}$. 	Draw on the picture to show how to split this bar into five equal parts (fifths). Colour in $\frac{1}{5}$. 	One square of chocolate is $\frac{1}{15}$ of the whole bar. $\frac{1}{3} = \frac{\square}{15}$ $\frac{1}{5} = \frac{\square}{15}$

Shade the fraction $\frac{5}{8}$ 	Draw on the picture to show how to split this bar into 4 equal parts. Shade the fraction $\frac{3}{4}$ 	One square of chocolate is $\frac{1}{8}$ of the whole bar. $\frac{3}{4} = \frac{\square}{8}$

What fraction is shaded? $\frac{1}{\square} = \frac{\square}{24}$ 	What fraction is shaded? $\frac{1}{\square} = \frac{\square}{24}$ 	How many sections does each person get if this bar is shared equally between: (a) 4 people? (b) 6 people? (c) 24 people? (d) 12 people? (e) 3 people? (f) 8 people?

Methods for Adding/Subtracting

SAME DENOMINATOR

When two fractions have the same denominator, add/subtract the numerators. Do not change the denominator.

$$\frac{3}{11}+\frac{5}{11}=\frac{8}{11}$$

If you can simplify the answer, you should do that:

$$\frac{7}{12}-\frac{1}{12}=\frac{6}{12}$$

$$\frac{6}{12}=\frac{1}{2}$$

When the denominators are different, they can't be so readily added. Read methods 1, 2 and 3. Circle the method that you prefer to use at the moment. Use your chosen method to complete page 15 if you haven't completed it already.

DIFFERENT DENOMINATORS METHOD 1

The nice thing about this method is it always works, even in algebraic fractions. It might not be the quickest method.

$$\frac{3}{11}+\frac{4}{7}=?$$

Make a common denominator by multiplying 11×7:

$$\frac{\square}{77}+\frac{\square}{77}=\frac{\square}{77}$$

Make equivalent fractions. That is, multiply the first numerator by 7, the second by 11

$$\frac{3\times 7}{77}+\frac{4\times 11}{77}=\frac{\square}{77}$$

Complete:

$$\frac{21}{77}+\frac{44}{77}=\frac{65}{77}$$

Simplify the answer if possible.

DIFFERENT DENOMINATORS METHOD 2

This is essentially the same as method 1, just written differently.

$$\frac{3}{11}+\frac{4}{7}=\ ?$$

Multiply the first fraction by $\frac{7}{7}$, the second by $\frac{11}{11}$:

$$\frac{3\times 7}{11\times 7}+\frac{4\times 11}{7\times 11}=\ ?$$

Now the denominators are the same:

$$\frac{21}{77}+\frac{44}{77}=\ ?$$

Complete:

$$\frac{21}{77}+\frac{44}{77}=\frac{65}{77}$$

Simplify the answer if possible.

DIFFERENT DENOMINATORS METHOD 3

This method uses the lowest numbers possible and is efficient.

$$\frac{7}{15}+\frac{9}{20}=\ ?$$

Use the lowest common multiple of 15 and 20. The $\mathrm{LCM}(15,20)=60$.

$$\frac{\square}{60}+\frac{\square}{60}=\frac{\square}{60}$$

Make equivalent fractions.

$$\frac{7}{15}=\frac{7\times 4}{15\times 4}=\frac{28}{60},\ \text{ also, }\ \frac{9}{20}=\frac{9\times 3}{20\times 3}=\frac{27}{60}$$

Complete:

$$\frac{28}{60}+\frac{27}{60}=\frac{55}{60}$$

Simplify the answer if possible.

$$\frac{55}{60}=\frac{11}{12}$$

Fractions on the Calculator

Use the calculator fraction button [a b/c] to perform all the operations on this page. Eg, to type in the fraction $\frac{3}{4}$ to your calculator, type 3 [a b/c] 4 . Try to *anticipate* and/or to *make sense* of each answer.

Simplify:

$\frac{60}{100} =$	$\frac{9}{12} =$	$\frac{45}{50} =$	$\frac{2}{8} =$

Add/Subtract:

$\frac{4}{9} + \frac{1}{9} =$	$\frac{3}{8} + \frac{1}{2} =$	$\frac{7}{11} + \frac{2}{5} =$	$\frac{5}{7} + \frac{7}{9} =$

Multiply (whole number, eg read '4 ninths twice' or '4 ninths of 2 wholes'):

$\frac{4}{9} \times 2 =$	$\frac{3}{8} \times 5 =$	$\frac{7}{11} \times 3 =$	$\frac{5}{7} \times 21 =$

Multiply (fraction, eg, read 'one half of three eighths'):

$\frac{1}{2} \times \frac{3}{8} =$	$\frac{1}{9} \times \frac{1}{9} =$	$\frac{2}{5} \times \frac{7}{11} =$	$\frac{5}{7} \times \frac{7}{9} =$

Divide (whole number. Eg, read 'four ninths divided into two groups')

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

Divide (fraction. Eg, read 'how many 1/9 in 4/9')

$\frac{4}{9} \div \frac{1}{9} =$	$\frac{3}{8} \times \frac{1}{2} =$	$\frac{7}{11} \times \frac{2}{5} =$	$\frac{5}{7} \times \frac{7}{9} =$

Transform Mixed to Improper. Read 'one whole and 4 ninths = how many ninths in total'

Type: 1 [a b/c] 4 [a b/c] 9 =

$1\frac{4}{9} = \frac{\square}{9}$	$3\frac{1}{2} = \frac{\square}{2}$	$7\frac{2}{5} = \frac{\square}{5}$	$3\frac{2}{9} = \frac{\square}{9}$

Transform Improper to mixed (Use the second function button with the fraction button)

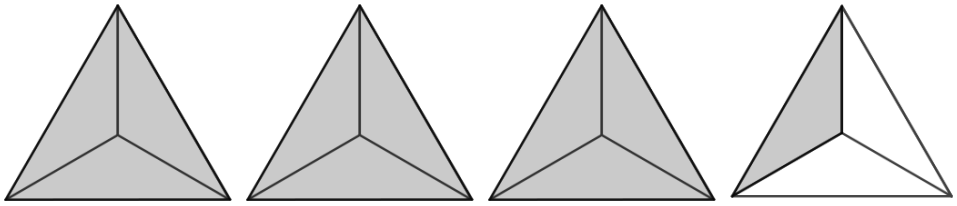
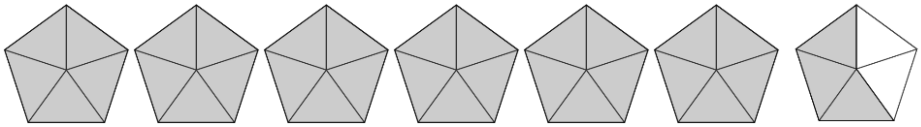
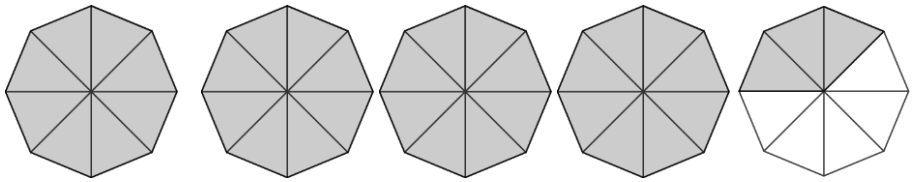
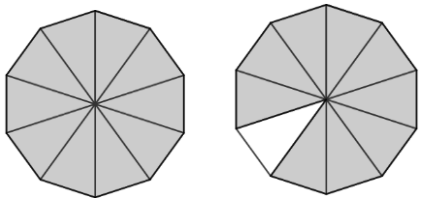
$\frac{11}{5} = 2\frac{1}{5}$	$\frac{33}{8} =$	$\frac{25}{11} =$	$\frac{87}{10} =$

Grade 9KC Fractions NAME:

Lesson 7: Improper and Mixed Fractions

	Jens is baking an apple pie. They cut 7 apples into quarters. Then they dip one quarter apple into maple syrup and eat it. How many quarters remain to be put into the pie? Mixed Number: Improper Fraction:

Express the fraction shaded in each image as both a mixed number and as an improper fraction.

	Mixed Number: Improper Fraction:
	Mixed Number: Improper Fraction:
	Mixed Number: Improper Fraction:
	Mixed Number: Improper Fraction:

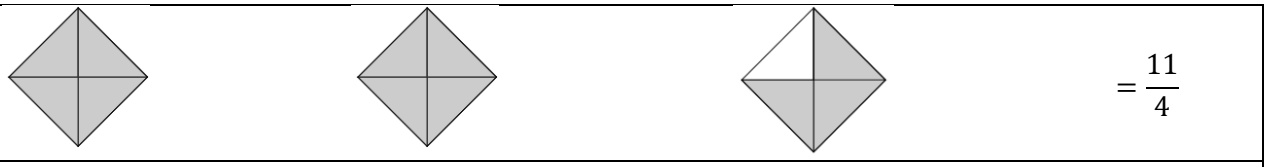
Convert from Improper to Mixed and vice versa by counting wholes:

In general, $\frac{a}{a} = 1.$

For example,

3 thirds is one whole: $\frac{3}{3} = 1$

7 sevenths is one whole: $\frac{7}{7} = 1$



$$\frac{4}{4} + \frac{4}{4} + \frac{3}{4} = \frac{11}{4} = 2\frac{3}{4}$$

The diagram above illustrates:

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

Complete the missing fractions in the table:

	Improper				Mixed
1.	$\frac{23}{7}$	$=$	$\frac{7}{7}+\frac{7}{7}+\frac{7}{7}+\frac{2}{7}$	$=$	$3\frac{2}{7}$
2.	$\frac{11}{5}$	$=$	$\frac{5}{5}+\frac{5}{5}+\frac{1}{5}$	$=$	
3.	$\frac{7}{2}$	$=$	$\frac{2}{2}+\frac{2}{2}+\frac{2}{2}+\frac{1}{2}$	$=$	
4.		$=$	$\frac{8}{8}+\frac{3}{8}$	$=$	$1\frac{3}{8}$
5.		$=$	$\frac{2}{2}+\frac{1}{2}$	$=$	$1\frac{1}{2}$
6.	$\frac{19}{6}$	$=$		$=$	$3\frac{1}{6}$
7.		$=$	$\frac{4}{4}+\frac{4}{4}+\frac{4}{4}+\frac{4}{4}+\frac{4}{4}+\frac{3}{4}$	$=$	
8.		$=$		$=$	$5\frac{3}{9}$

Convert by calculating: (Use your calculator fraction button to check your answers).

From improper to mixed:

$\frac{19}{6}$	$19 \div 6 = 3$ remainder 1	$\frac{19}{6} = 3\frac{1}{6}$

From mixed to improper:

$5\frac{2}{3}$	$5 \times 3 + 2 = 17$	$5\frac{2}{3} = \frac{17}{3}$



Question 1: Change these improper fractions into mixed numbers

(a) $\frac{7}{3}$ (c) $\frac{5}{2}$

(f) $\frac{10}{3}$ (h) $\frac{11}{4}$

(k) $\frac{13}{10}$ (m) $\frac{16}{7}$

(p) $\frac{29}{12}$ (r) $\frac{47}{15}$

(u) $\frac{12}{9}$ (w) $\frac{18}{4}$

Question 2: Change these mixed numbers into improper fractions

(a) $2\frac{1}{5}$ (c) $1\frac{3}{4}$

(f) $2\frac{4}{7}$ (h) $2\frac{3}{10}$

(k) $3\frac{9}{10}$ (m) $3\frac{5}{8}$

Corbett maths

Improper Fractions & Mixed Numbers

Videos 139 and 140 on www.corbettmaths.com

Apply

Question 1: Match up the improper fractions and mixed numbers.

$2\frac{1}{4}$	$2\frac{1}{3}$	$1\frac{3}{4}$	$3\frac{2}{3}$
$\frac{7}{4}$	$\frac{11}{3}$	$\frac{7}{3}$	$\frac{9}{4}$

Question 2: Arrange these improper fractions in order, starting with the smallest.

$$\frac{23}{4}, \frac{37}{7}, \frac{11}{2}$$

Question 3: Write down a mixed number between $3\frac{3}{11}$ and $3\frac{2}{5}$

Question 4: Gregory feeds his cat $\frac{2}{5}$ of a can of cat food each day.

Work out how many cans of cat food are eaten each fortnight.

Give your answer as a mixed number.



Question 5:

13	9	21	5	2

Using the cards, create an improper fraction that is:

(a) between 1 and 2
(b) between 2 and 3
(c) between 4 and 5
(d) between 5 and 10
(e) greater than 10

Answers



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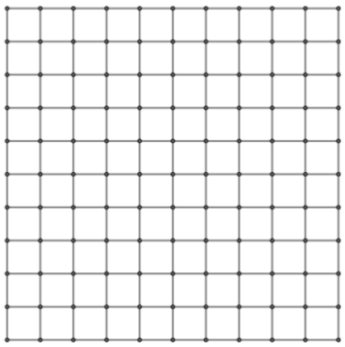
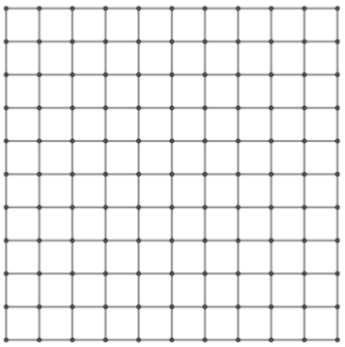
Grade 9KC Fractions NAME:

Lesson 8 Fractions and equivalent percentages

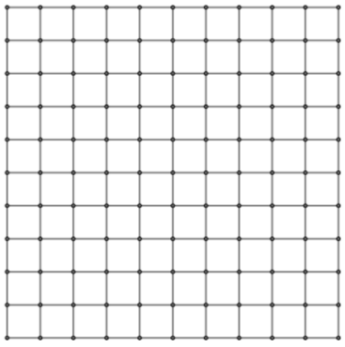
Shade in the fraction of 100 shown. Write the fraction in its simplest terms.



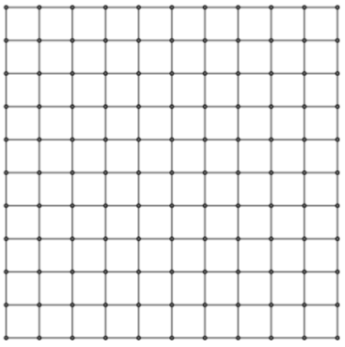
Shade in $\frac{50}{100} = 50\%$. Simplify: $\frac{50}{100} = \frac{\square}{\square}$.



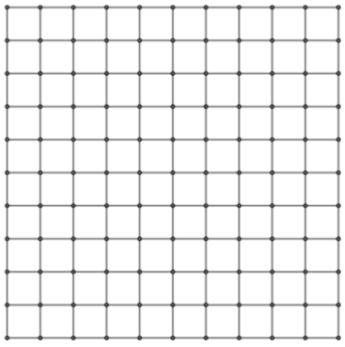
Shade in $\frac{25}{100} = 25\%$. Simplify: $\frac{25}{100} = \frac{\square}{\square}$.



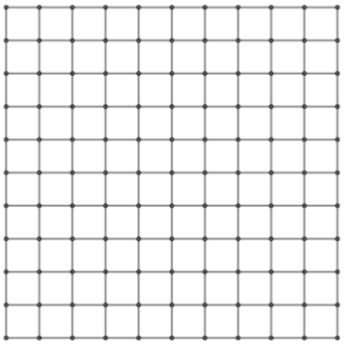
Shade in $\frac{20}{100} = 20\%$. Simplify: $\frac{20}{100} = \frac{\square}{\square}$.



Shade in $\frac{10}{100} = 10\%$. Simplify: $\frac{10}{100} = \frac{\square}{\square}$.

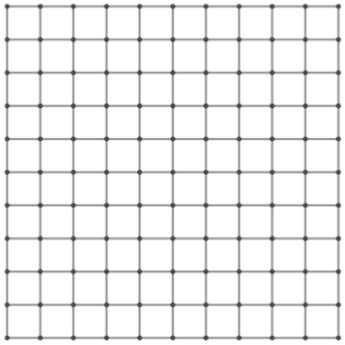


Shade in $\frac{70}{100} = 70\%$. Simplify: $\frac{70}{100} = \frac{\square}{\square}$.

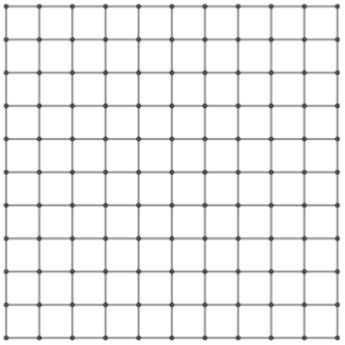


Shade in $\frac{15}{100} = 15\%$. Simplify: $\frac{15}{100} = \frac{\square}{\square}$.

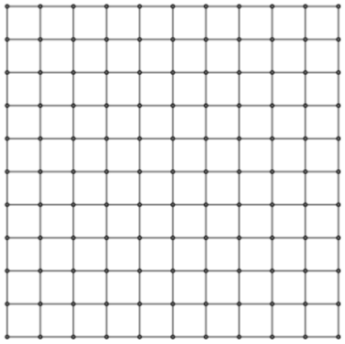
Use a coloured pen or pencil to divide each 100 square and to shade in the correct fraction.



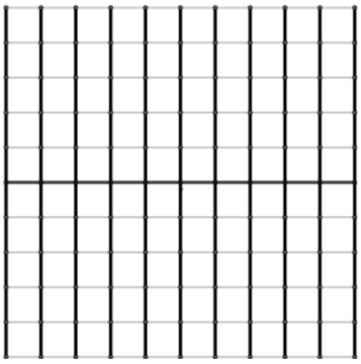
Divide into 4 equal sections.
How many squares in each section?
Shade in $\frac{3}{4}$ Complete: $\frac{3}{4} = \frac{\square}{100} =$ %



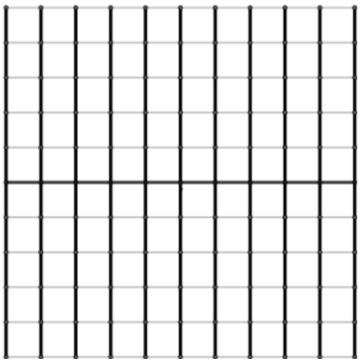
Divide into 5 equal sections.
How many squares in each section?
Shade in $\frac{3}{5}$. Complete: $\frac{3}{5} = \frac{\square}{100} =$ %



Divide into 10 equal sections.
How many squares in each section?
Shade in $\frac{3}{10}$. Complete: $\frac{3}{10} = \frac{\square}{100} =$ %

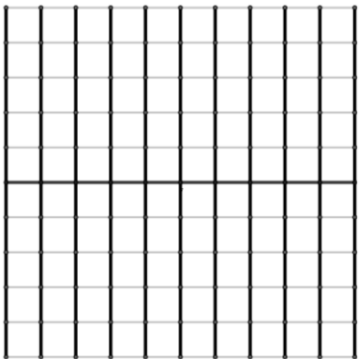


This 100 square is divided into 20 equal sections.
How many squares in each section?
Shade in $\frac{3}{20}$. Complete: $\frac{3}{20} = \frac{\square}{100} =$ %



This 100 square is divided into 20 equal sections.

Shade in $\frac{19}{20}$. Complete: $\frac{19}{20} = \frac{\square}{100} =$ %



This 100 square is divided into 20 equal sections.

Shade in $\frac{9}{20}$. Complete: $\frac{9}{20} = \frac{\square}{100} =$ %

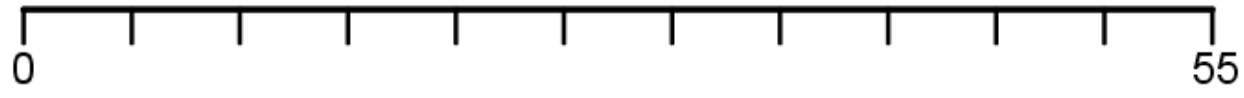
Lesson 9 Fractions of a number

(a) Complete the scale on each number line.

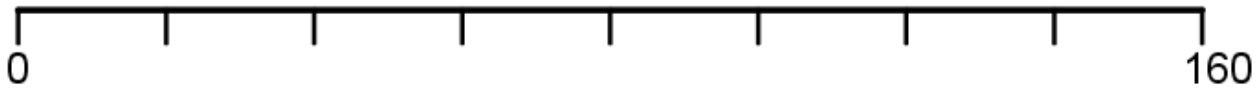
(b) Complete the fraction calculation.



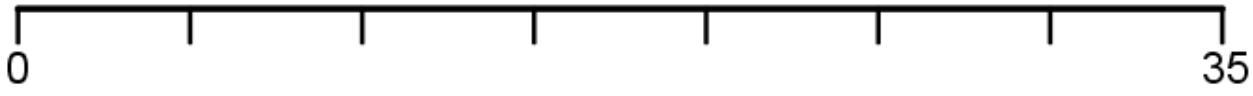
$\frac{3}{5}$ of $20 =$



$\frac{7}{11}$ of $55 =$



$\frac{5}{8}$ of $160 =$



$\frac{2}{7}$ of $35 =$

Unit fraction

A unit fraction is simply a fraction that has numerator = 1.

To calculate a unit fraction of a quantity, we divide the quantity by the denominator.

Eg. $\frac{1}{5} \times 40$ means "$\frac{1}{5}$ of 40" which is $40 \div 5 = 8$. In short,

$$\frac{1}{5} \times 40 = 8$$

Question 1: Work out each of the following

(a) $\frac{1}{2}$ of 10

(c) $\frac{1}{5}$ of 20

(e) $\frac{1}{9}$ of 27

(g) $\frac{1}{8}$ of 80

(i) $\frac{1}{2}$ of 9

(k) $\frac{1}{12}$ of 72

Any fraction

To calculate any fraction of a quantity, divide by the denominator then multiply by the numerator:

Eg. $\frac{3}{5} \times 40$ means "$\frac{3}{5}$ of 40" which is $40 \div 5 \times 3 = 24$

Question 2: Work out each of the following

(a) $\frac{2}{3}$ of 15

(c) $\frac{2}{5}$ of 30

(e) $\frac{3}{5}$ of 45

(g) $\frac{3}{8}$ of 88

(i) $\frac{5}{9}$ of 63

(k) $\frac{2}{7}$ of 91

Question 3: Work out each of the following.
Include suitable units.

(a) $\frac{1}{3}$ of £21

(c) $\frac{2}{3}$ of 27cm

(e) $\frac{2}{5}$ of 90 miles

(g) $\frac{5}{12}$ of 240ml

(i) $\frac{1}{8}$ of a day

(k) $\frac{3}{7}$ of 2 weeks

Question 5: Work out the largest of each of the following pairs.

(a) $\frac{1}{3}$ of 21 *or* $\frac{1}{2}$ of 12

(d) $\frac{1}{5}$ of 2m *or* $\frac{3}{4}$ of 60cm

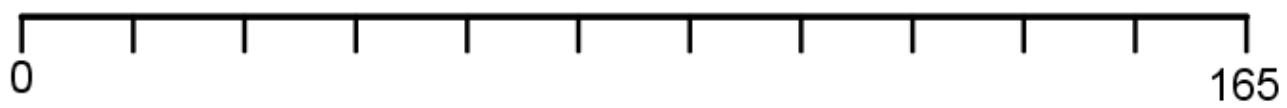
(f) $\frac{7}{15}$ of 480 *or* $\frac{2}{3}$ of 453

Question 10: The size of a jar of coffee is increased by one-fifth.
The new size is later reduced by one-fifth.
Is the new jar smaller, the same size or larger than the original?
Explain how you worked out your answer.

Colour 5 fractions that are greater than $\frac{1}{2}$ but smaller than $\frac{3}{4}$

$\frac{58}{66}$	$\frac{37}{42}$	$\frac{43}{64}$	$\frac{5}{98}$	$\frac{6}{27}$
$\frac{41}{97}$	$\frac{40}{61}$	$\frac{15}{72}$	$\frac{39}{87}$	$\frac{15}{19}$
$\frac{28}{30}$	$\frac{25}{75}$	$\frac{19}{22}$	$\frac{29}{76}$	$\frac{4}{39}$
$\frac{48}{91}$	$\frac{24}{86}$	$\frac{5}{35}$	$\frac{46}{71}$	$\frac{19}{33}$

Calculate the number that goes in the box:



$$\frac{11}{8} \times \square = 165$$

Lesson 10 Multiplying Fraction × Fraction and Short Review

Multiplying fraction by fraction is as follows:

$$\frac{3}{5}\times\frac{4}{7}=\frac{3\times4}{5\times7}=\frac{12}{35}$$

$\frac{3}{8}\times\frac{2}{5}=$	$\frac{5}{4}\times\frac{1}{2}=$	$\frac{9}{11}\times\frac{2}{5}=$

Here are some additional things to consider:

1. Remember to simplify your answer if you can:

$$\frac{3}{8}\times\frac{2}{5}=\frac{6}{40}$$

$$\frac{6}{40}=\frac{3}{20}$$

2. Turn a mixed number into an improper fraction first:

$$1\frac{2}{7}\times\frac{3}{5}$$

$$=\frac{9}{7}\times\frac{3}{5}=\frac{27}{35}$$

3. Negative number rules apply:

$$-\frac{3}{5}\times\frac{4}{7}=-\frac{12}{35}$$

$$\frac{3}{5}\times-\frac{4}{7}=-\frac{12}{35}$$

$$-\frac{3}{5}\times-\frac{4}{7}=\frac{12}{35}$$

Explanation with Geometry:

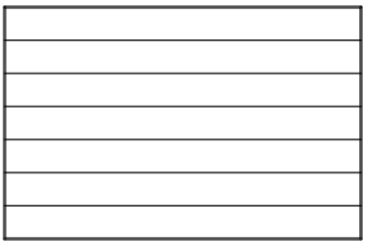
$\frac{2}{3}$ of $\frac{4}{7}$ (of 1 whole)

Start with 1 whole

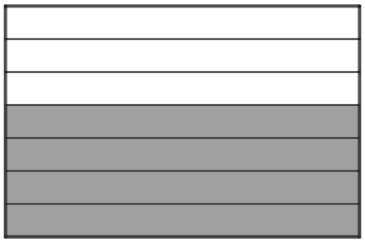


Divide into 7 rows.

Each row is $\frac{1}{7}$.



Shade in $\frac{4}{7}$.



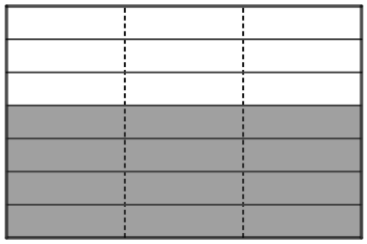
Now take $\frac{2}{3}$ of the shaded portion:

Divide the rows into three equal parts.

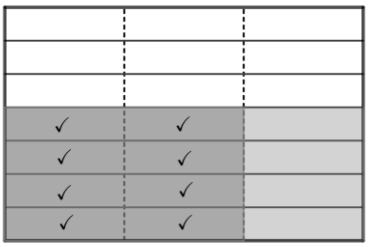
There are now three columns.

Each column is $\frac{1}{3}$.

Each cell is $\frac{1}{21}$.



Select $\frac{2}{3}$ of the shaded cells.



$$\frac{2}{3} \text{ of } \frac{4}{7} = \frac{8}{21}$$

Fraction Processes Check In:

A. Equivalent Fractions: Complete the blank

$\frac{3}{8}=\frac{\square}{32}$	$\frac{5}{\square}=\frac{15}{33}$	$\frac{5}{7}=\frac{15}{\square}$

B. Simplify: Write each fraction in simplest terms

$\frac{16}{20}=\frac{\square}{\square}$	$\frac{45}{50}=\frac{\square}{\square}$	$\frac{12}{14}=\frac{\square}{\square}$

C. Convert a percentage to a simplified fraction:

$90\%=\frac{90}{100}=\frac{\square}{\square}$	$25\%=\frac{\square}{100}=\frac{\square}{\square}$	$8\%=\frac{\square}{100}=\frac{\square}{\square}$

D. Convert a fraction to a percentage:

$\frac{4}{5}=\frac{\square}{100}=$ %	$\frac{21}{25}=\frac{\square}{100}=$ %	$\frac{32}{50}=\frac{\square}{100}=$ %

E. Convert mixed fraction to improper fraction:

$1\frac{5}{7}=\frac{\square}{7}$	$2\frac{1}{9}=\frac{\square}{9}$	$7\frac{1}{2}=\frac{\square}{2}$

F. Convert Improper to Mixed:

$\frac{9}{4}=\square\frac{\square}{4}$	$\frac{83}{10}=\square\frac{\square}{10}$	$\frac{16}{3}=\square\frac{\square}{3}$

G. Add/subtract with the same denominator:

$\frac{3}{11}+\frac{5}{11}=\frac{\square}{11}$	$\frac{8}{9}-\frac{2}{9}=\frac{\square}{\square}$	$1\frac{8}{9}+3\frac{2}{9}=\frac{\square}{\square}$

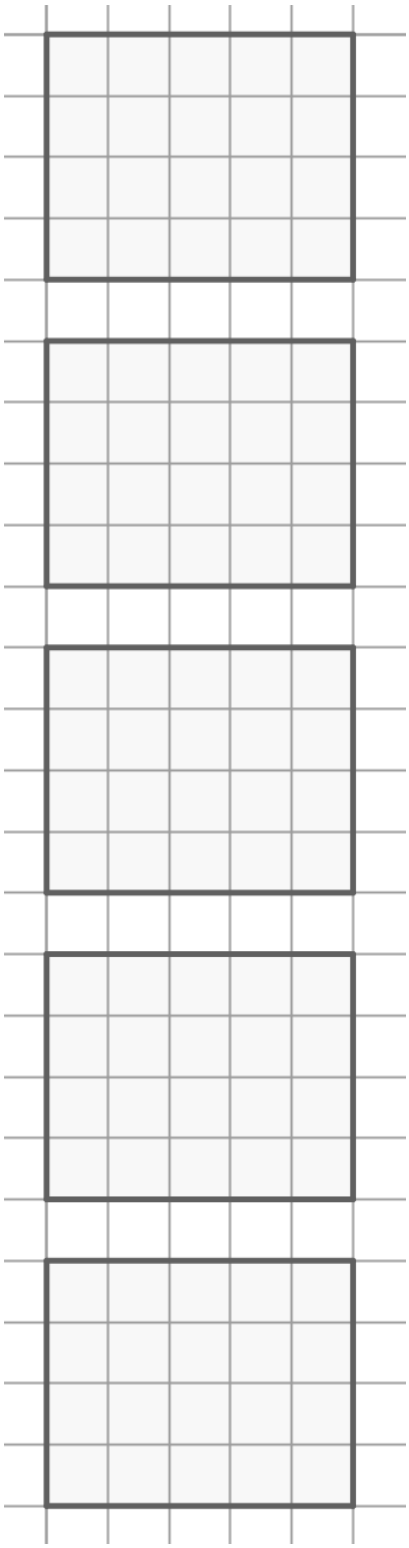
H. Add/subtract with different denominators:

$\frac{4}{7}+\frac{1}{3}$ $=\frac{\square}{21}+\frac{\square}{21}=\frac{\square}{21}$	$\frac{7}{11}-\frac{1}{2}$ $=\frac{\square}{\square}+\frac{\square}{\square}=\frac{\square}{\square}$	$\frac{5}{6}+\frac{1}{3}$ $=\frac{\square}{\square}+\frac{\square}{\square}=\frac{\square}{\square}$

I. Multiply two fractions:

$\frac{3}{5}\times\frac{4}{7}=$	$\frac{3}{10}\times\frac{4}{10}=$	$1\frac{3}{7}\times 2\frac{4}{5}=\frac{\square}{\square}\times\frac{\square}{\square}=$

Draw rectangle flow chart to explain why $\frac{3}{5} \times \frac{3}{4} = \frac{9}{20}$ (read: $\frac{3}{5}$ of $\frac{3}{4}$ of 1 whole). (Refer to page 33)



"A fraction of a fraction is a smaller fraction"

Explain this statement and give an example.

Is the statement ever not true?

All positive numbers can be put into three categories:

Category 1: All numbers between 0 and 1.

Category 2: The number 1 exactly.

Category 3: All numbers bigger than 1.

Operating on numbers changes them as follows: smaller, no change, or bigger.

What happens when you multiply any positive number (eg 50) by a number from category 1?

Describe, explain and give an example.

What happens when you multiply any positive number (eg 50) by the category 2 number?

Describe, explain and give an example.

What happens when you multiply any positive number (eg 50) by a number from category 3?

Describe, explain and give an example.

Grade 9KC Fractions NAME:

Lesson 11 Dividing: Fraction ÷ Fraction

Dividing is the inverse operation of multiplying. For every multiplication fact, we can deduce two related dividing facts. For example:

One multiplication fact:	Two division facts:
$3 \times 5 = 15$	$15 \div 5 = 3$ $15 \div 3 = 5$

The same is true for fractions:

One multiplication fact:	Two division facts:
$\frac{3}{7} \times \frac{4}{5} = \frac{12}{35}$	$\frac{12}{35} \div \frac{3}{7} = \frac{4}{5}$ $\frac{12}{35} \div \frac{4}{5} = \frac{3}{7}$

Only there's a really giant problem in the realm of whole numbers.



Usually, $\text{integer} \div \text{integer}$ does not give a whole number.

The first three of these four divisions can be calculated easily. The last division is a problem.

$\frac{30}{49} \div \frac{10}{7} =$	$\frac{15}{24} \div \frac{5}{6} =$	$\frac{18}{25} \div \frac{6}{5} =$	$\frac{4}{5} \div \frac{3}{7} =$

Here is one method that is used to get around the problem. It is explained on page 37 & 38:

Flip the second fraction, replace ÷ with ×

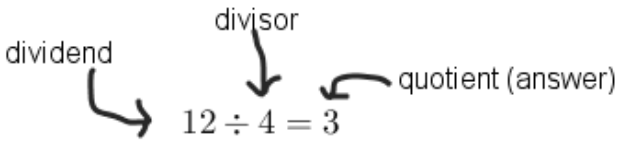
$$\frac{4}{5} \div \frac{3}{7}$$

$$= \frac{4}{5} \times \frac{7}{3}$$

$$= \frac{28}{15}$$

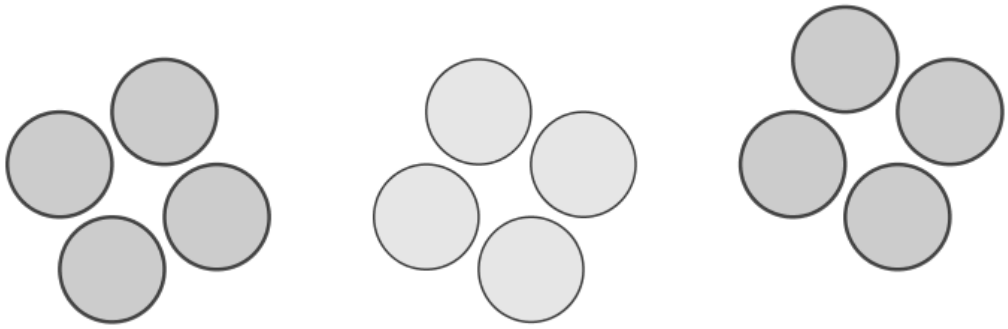
Why does 'flip the second fraction and multiply' work?

Some language:



This calculation means *12 wholes divided into sets of four*.

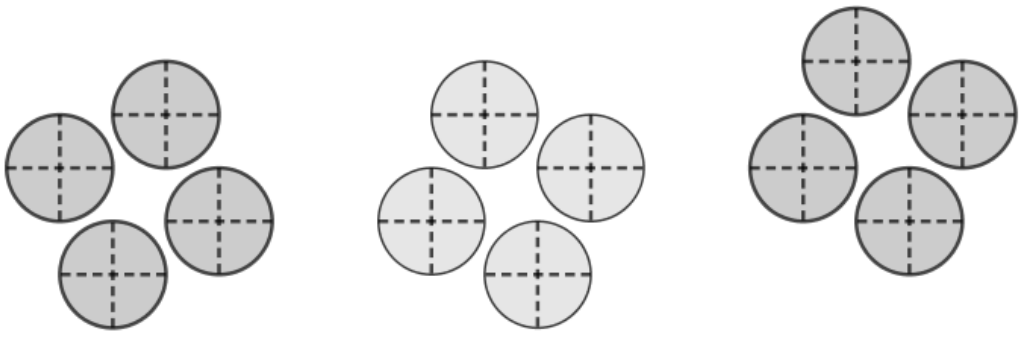
This diagram shows sets of four. Three sets of 4 make 12. Therefore $12 \div 4 = 3$.



When the *divisor* is a fraction

$$12 \div \frac{1}{4} = ??$$

This calculation means 12 wholes divided into quarters. How many quarters?



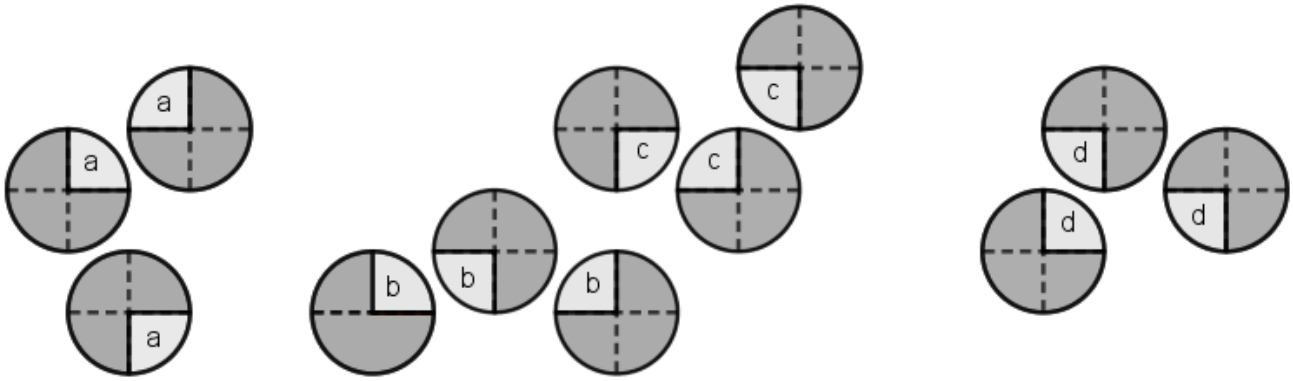
The number of quarter circles is $12 \times 4 = 48$. Notice that $12 \div \frac{1}{4} = 12 \times 4 = 48$.

So far, we have $12 \div \frac{1}{4} = 12 \times 4$

What about:

$$12 \div \frac{3}{4} = ??$$

This calculation means 12 wholes divided into three quarters. How many $\frac{3}{4}$ are there in 12 wholes?



First let's find out how many quarters there are. $12 \div \frac{1}{4} = 12 \times 4 = 48$.

There are 48 quarters.

Now count how many sets of 3 quarters there are.

That is, $48 \div 3 = 16$. There are 16 sets of three quarters.

In pizza terms, if there are 12 whole pizza's and one portion is $\frac{3}{4}$ pizza, how many portions are there?

$$12 \div \frac{3}{4} = 16.$$

To calculate $12 \div \frac{3}{4}$ we performed the operations $12 \times 4 \div 3$. This is the same as $12 \times \frac{4}{3}$

To generalize,

$$\text{dividend} \div \frac{a}{b}$$

$$= \text{dividend} \times \frac{b}{a}$$

Practice Fraction ÷ Fraction

$\frac{4}{5} \div \frac{3}{7}$ $= \frac{4}{5} \times \frac{7}{3} = \frac{28}{15}$	$\frac{2}{7} \div \frac{3}{8}$ $= \frac{2}{7} \times \frac{8}{3} = \frac{16}{\square}$	$\frac{1}{2} \div \frac{1}{4}$ $= \frac{1}{2} \times \frac{4}{1} = \frac{\square}{\square} =$	$\frac{6}{11} \div \frac{5}{7}$ $= \frac{6}{11} \times \frac{\square}{\square} = \frac{\square}{\square}$

$\frac{3}{4} \div \frac{1}{9}$ $= \frac{\square}{\square} \times \frac{\square}{\square} = \frac{\square}{\square}$	$\frac{9}{10} \div \frac{3}{5}$ $= \frac{\square}{\square} \times \frac{\square}{\square} = \frac{\square}{\square}$	$\frac{3}{10} \div \frac{3}{7}$ $=$	$\frac{6}{5} \div \frac{3}{10}$ $=$

Whole numbers. It is sometimes easier to convert a whole number into a fraction like this:

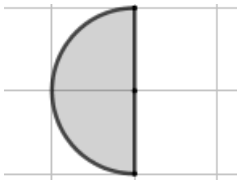
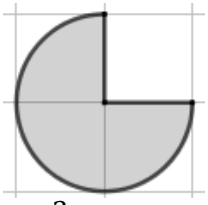
$$3 = \frac{3}{1}$$

For example, $3 \times \frac{2}{11} = \frac{3}{1} \times \frac{2}{11} = \frac{6}{11}$

$\frac{4}{5} \div 3$ $= \frac{4}{5} \div \frac{3}{1}$ $= \frac{4}{5} \times \frac{1}{3} =$	$\frac{2}{3} \div 7$ $= \frac{2}{3} \div \frac{7}{1}$ $= \frac{\square}{\square} \times \frac{\square}{\square} =$	$\frac{9}{11} \div 5$ $= \frac{9}{11} \div \frac{5}{1}$ $= \frac{\square}{\square} \times \frac{\square}{\square} =$	$\frac{12}{7} \div 5$ $= \frac{\square}{\square} \div \frac{\square}{\square}$ $= \frac{\square}{\square} \times \frac{\square}{\square} =$

$3 \div \frac{4}{5}$ $= \frac{3}{1} \div \frac{4}{5}$ $= \frac{\square}{\square} \times \frac{\square}{\square} =$	$8 \div \frac{1}{4}$ $= \frac{\square}{\square} \div \frac{\square}{\square}$ $= \frac{\square}{\square} \times \frac{\square}{\square} =$	$4 \div \frac{1}{5}$ $= \frac{\square}{\square} \div \frac{\square}{\square}$ $= \frac{\square}{\square} \times \frac{\square}{\square} =$	$12 \div \frac{2}{3}$ $= \frac{\square}{\square} \div \frac{\square}{\square}$ $= \frac{\square}{\square} \times \frac{\square}{\square} =$

Divide a cake

$\frac{1}{2}$ a cake is shared between 6 people. Draw the portions. What fraction does each person get to eat?  $\frac{1}{2} \div 6 =$	$\frac{3}{4}$ of a cake is shared between 6 people. Draw the portions. What fraction does each person get to eat?  $\frac{3}{4} \div 6 =$