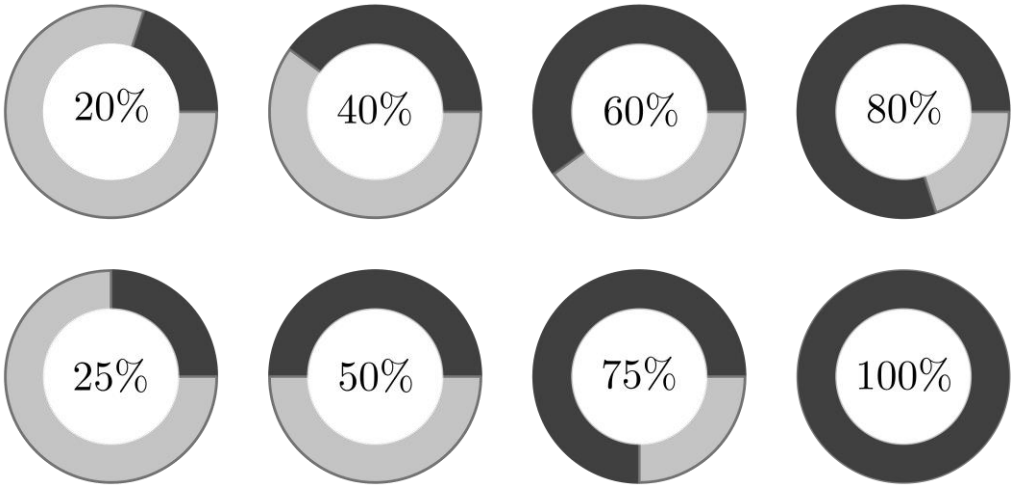
Grade 9 Key Concepts

Unit 1: Percentages

RBSS September 2024

NAME:

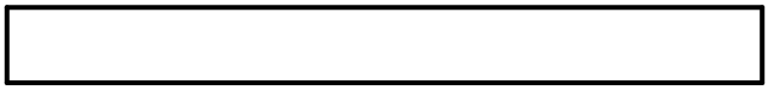


	Pages	Assessment	Feedback
Estimating			
Equivalent fractions			
Percentages of quantities			
Finance and percentages			
Unit test			
Creative task math			
Creative task design & communication			

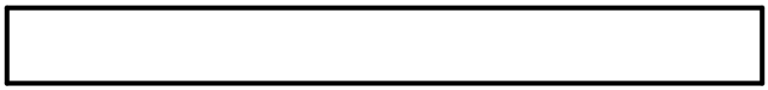
Percentages NAME:

Lesson 1: Estimating Percentages

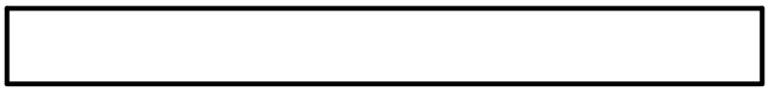
1.a) Shade in the stated percentage on each bar. Use visual estimation.



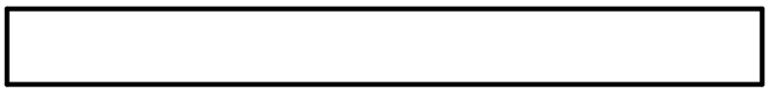
10%



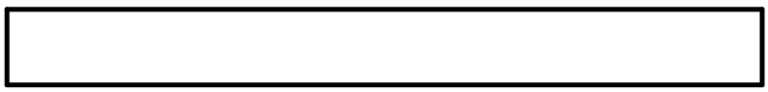
96%



30%



75%



25%

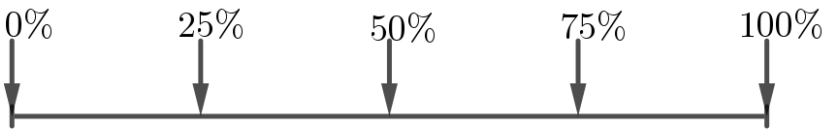
b) Now use a ruler. Each bar measures 10 cm that is, 100 mm.

Put an arrow on the bar showing where the correct percentage is.

Draw an emoji next to each bar for your estimation!



2. On each line, draw an arrow to show 0, 25%, 50%, 75% and 100% as for the example. Use visual estimation.













b) Use a ruler to measure each line.

Write on the line how many mm long the line is.

Calculate one quarter, one half and three quarters.

Measure the correct lengths to see how close your estimate is. Use a different colour to mark measurement. Draw an emoji next to each bar for your estimation!



More or less than 50%?

Colour the grid using two colours as follows:

If the fraction is equivalent to less than $\frac{50}{100}$ (50%), colour the box black.

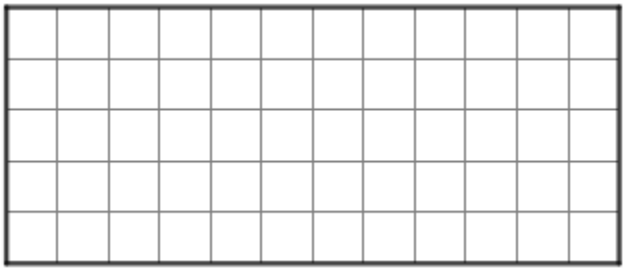
If the fraction is equivalent to more than $\frac{50}{100}$ (50%), colour the box yellow. (or use your own two colours).

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

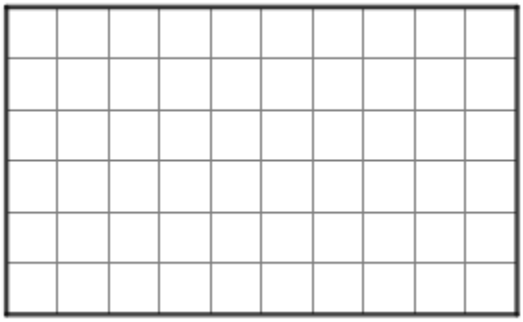
Lesson 2: Percentage of a Rectangle

1. The rectangle below measures 5 boxes high by 12 boxes wide. Total boxes = _____

   Use 4 different colours: Colour 50% of the rectangle in one colour; 25% in another colour; 10% in a third colour and 5% in a fourth colour without any overlapping areas. What percentage of the rectangle remains?

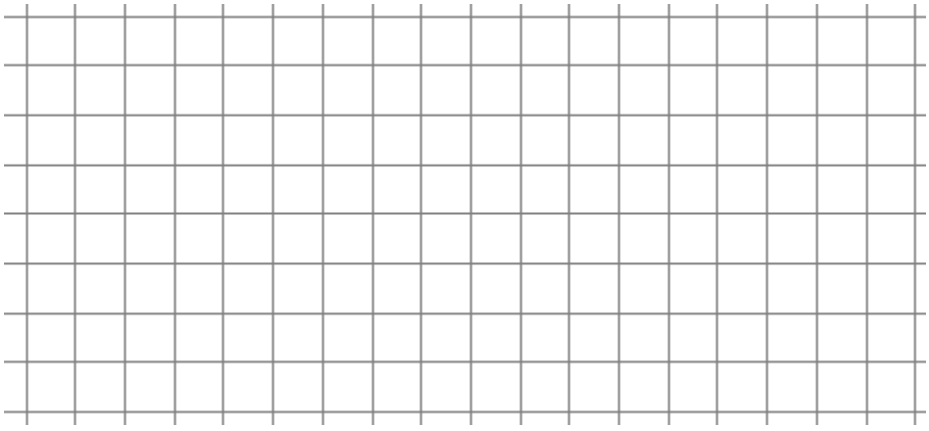


2. This rectangle measures 6 boxes by 10 boxes. Again, use four different colours to shade 50%; 25%; 10% and 5% as for the previous rectangle.



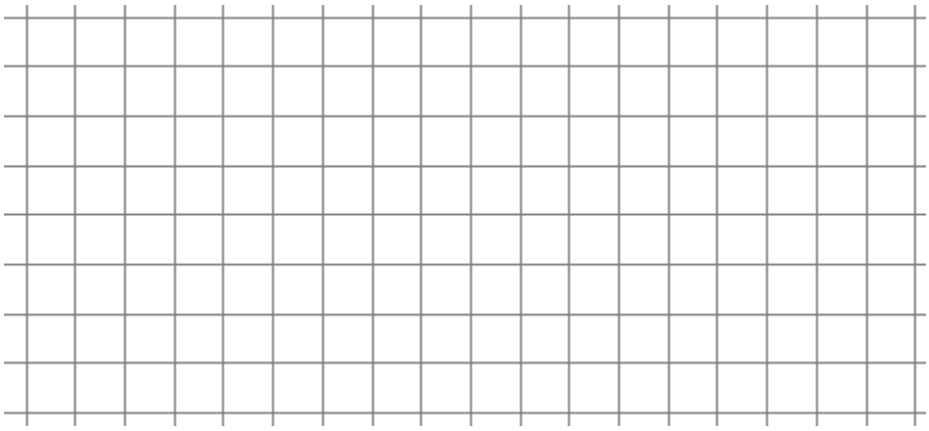
3. List the factor pairs of 70:

   On the grid below, draw a rectangle that covers 70 squares. Use four different colours to shade 50%; 25%; 10% and 5% respectively. You will need to colour half squares.



4. List the factor pairs of 48:

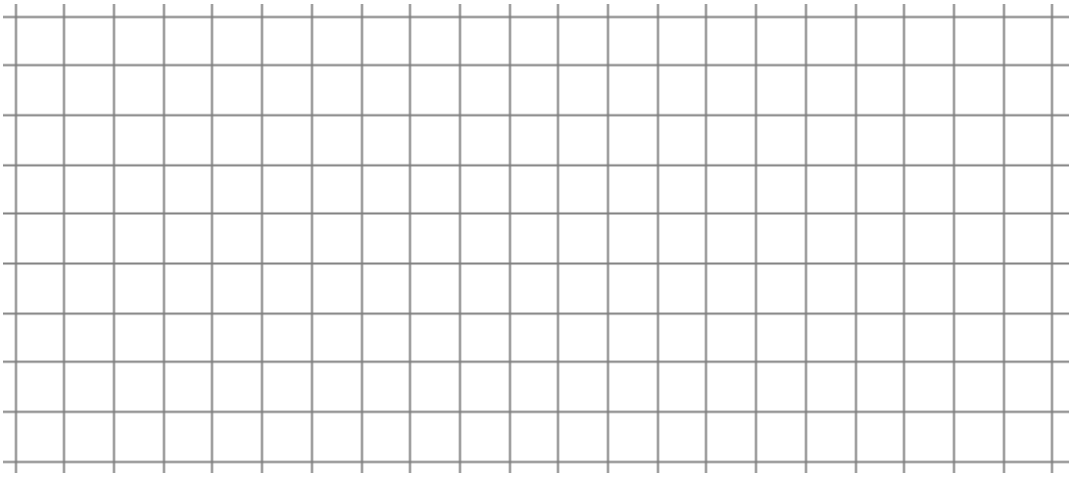
On the grid below, draw a rectangle that covers 48 squares. Use four different colours to shade 50%; 25%; 10% and 5% respectively.



5. Choose a number between 65 and 95. **Number chosen:**

List the factor pairs of your number:

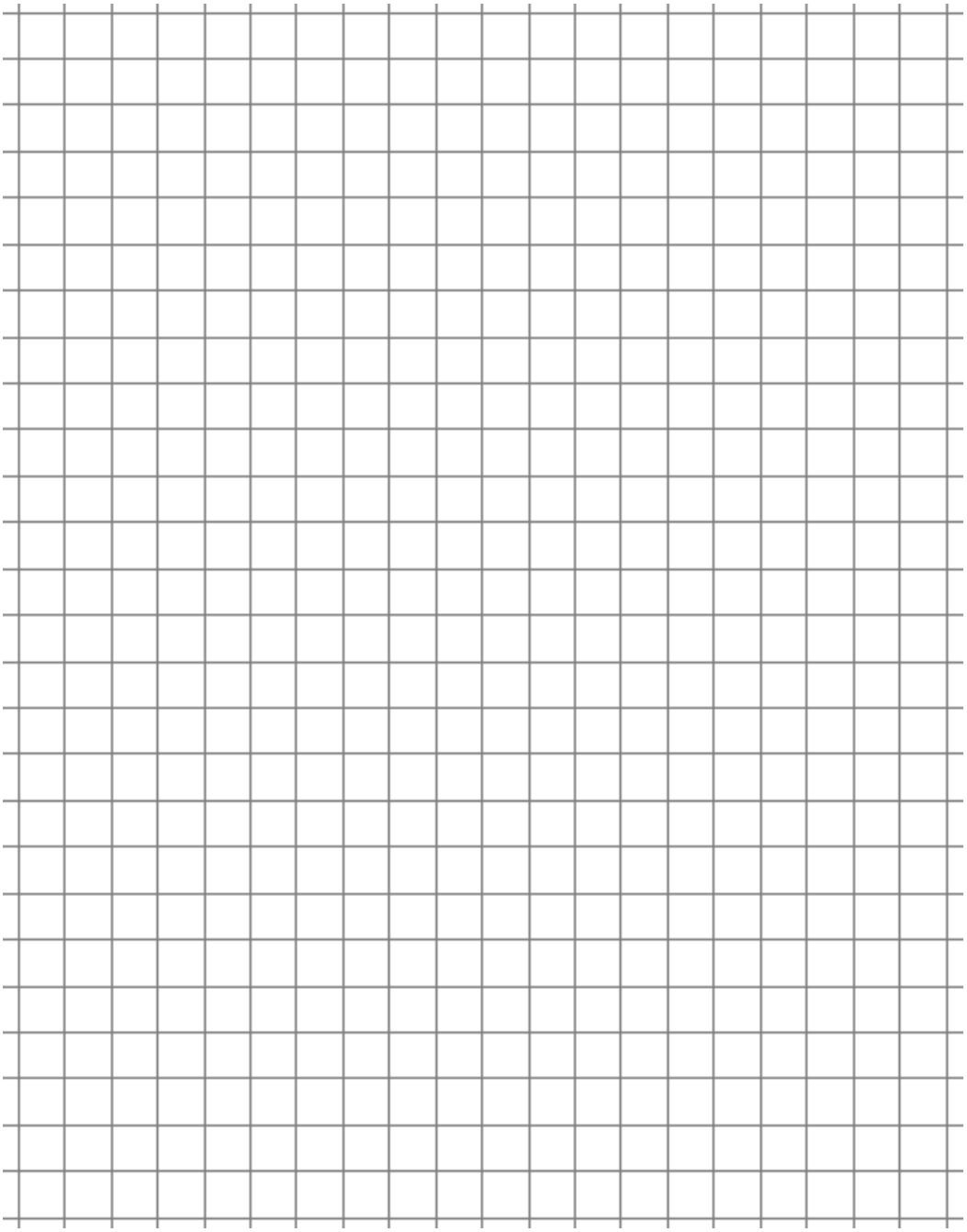
Draw a rectangle that has the same area as the number you chose. Use four different colours to shade 50%; 25%; 10% and 5% respectively.



Please explain why you chose your number:

6. On the grid below, create a figure so that 20% of the figure is the head; 15% is the torso; 40% is the legs/feet and the remainder of the shape is the arms/hands.

Please give your figure a name and show your calculations!



Puzzle Page

The four numbers in the boxes follow an adding pattern (add 2) *and* they add up to 100:

$$\boxed{22} + \boxed{24} + \boxed{26} + \boxed{28} = 100$$

Figure out the adding pattern to these puzzles. Make sure the numbers add to 100:

$$\boxed{16} + \boxed{22} + \boxed{} + \boxed{} = 100$$

$$\boxed{} + \boxed{} + \boxed{20} + \boxed{} + \boxed{26} = 100$$

$$\boxed{} + \boxed{13} + \boxed{} + \boxed{27} + \boxed{} = 100$$

$$\boxed{} + \boxed{0} + \boxed{} + \boxed{} + \boxed{} + \boxed{} + \boxed{} + \boxed{} = 100$$

Percentages NAME:

Fraction:	Equivalent fraction with denominator $= 100$	Percent:
$\frac{1}{2}$	$\frac{50}{100}$	50%
$\frac{1}{4}$	$\frac{\quad}{100}$	
$\frac{3}{4}$	$\frac{\quad}{100}$	
$\frac{1}{10}$	$\frac{\quad}{100}$	

Lesson 3: Using Number Lines

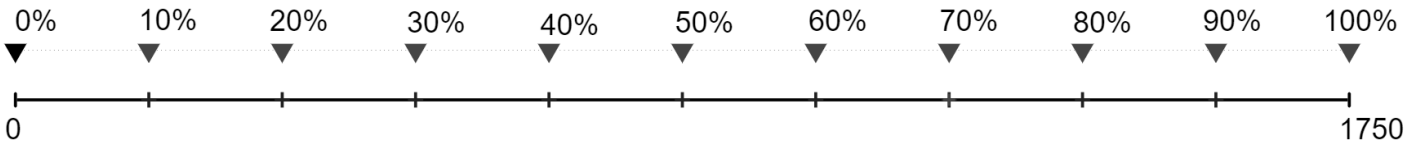
10 is $\frac{1}{10}$ of 100. To calculate 10% of a quantity, we calculate $\frac{1}{10}$. We divide the quantity by 10.

Divide these numbers by 10:

$80 \div 10 =$	$770 \div 10 =$
$500 \div 10 =$	$9 \div 10 =$
$4000 \div 10 =$	$0.03 \div 10 =$
$9{,}000{,}000 \div 10 =$	$3.4 \div 10 =$
$3450 \div 10 =$	$23.45 \div 10 =$

We can use a number line to help us think about percentages.

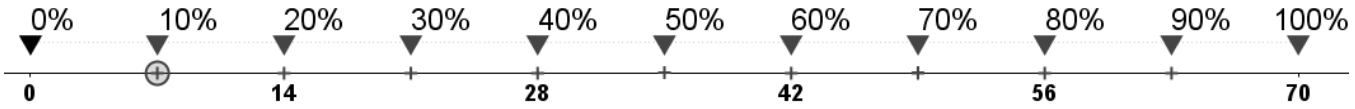
This number line helps to calculate percentages of the number 1750 - the number of students at RBSS this year.



On each number line:

- write the missing numbers on the scale.
- answer the questions.

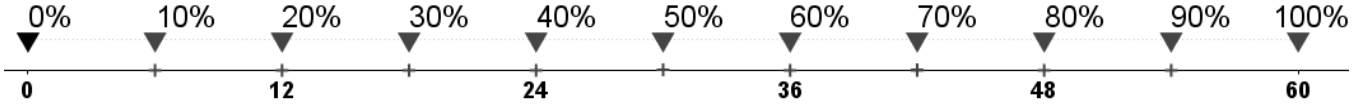
a) Percentages of 70



Complete:

(i) 10% of 70 = (ii) 30% of 70 = (iii) 90% of 70 =

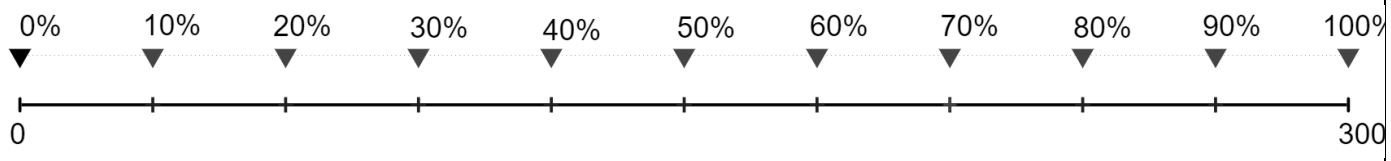
b) Percentages of 60



Complete:

(i) 10% of 60 = (ii) 40% of 60 = (iii) 90% of 60 =

c) Percentages of 300

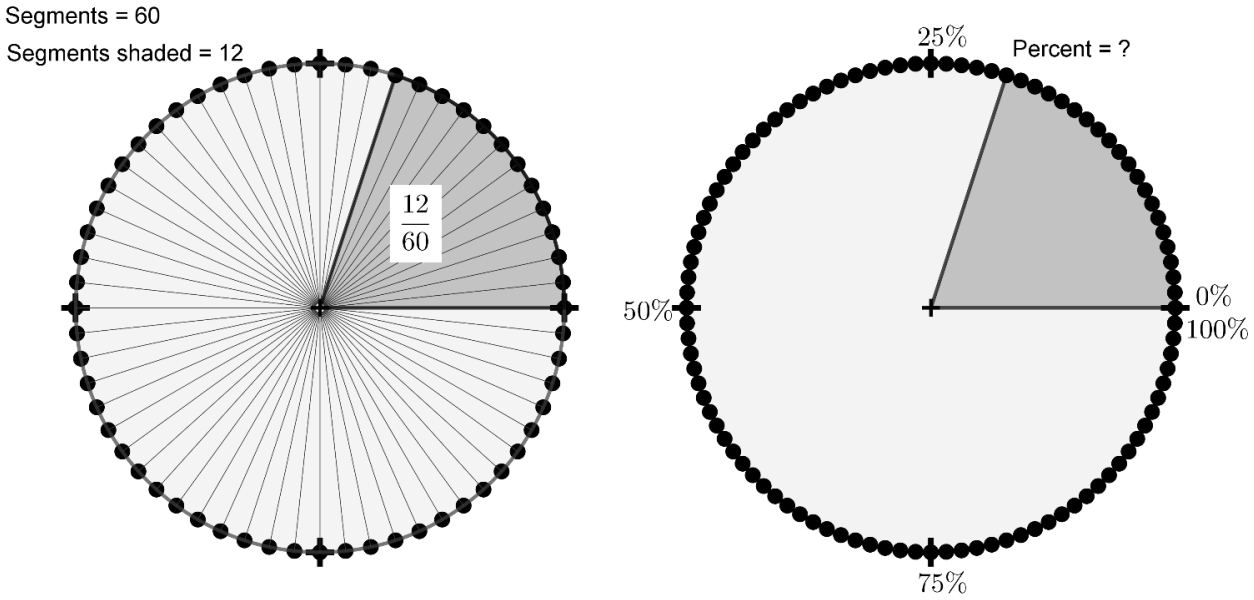


Complete:

(ii) 10% of 300 = (ii) 50% of 300 = (iii) 90% of 300 =

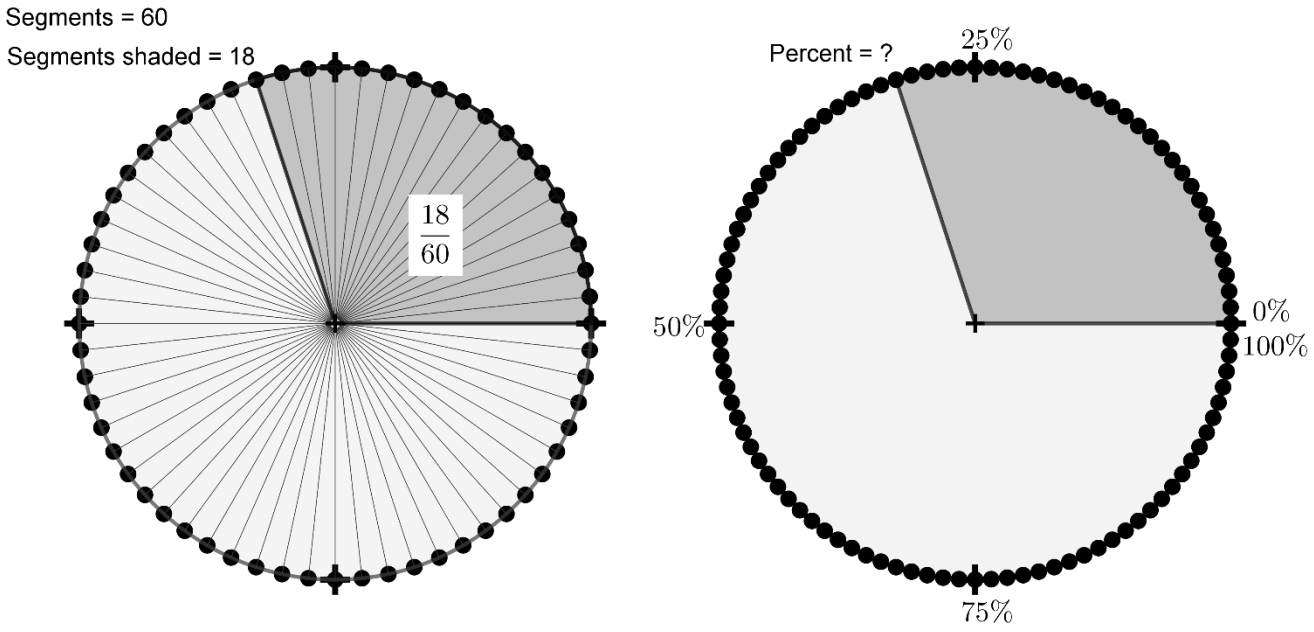
Lesson 4: Using Circle Diagrams to turn fraction into a percentage

These circle diagrams help to visualize a percentage for other fractions. Compare the two circles:



Compare each pair of circles. Write down the fraction shaded on the left circle. Use the right circle to estimate the equivalent percentage. Finally, use a calculator to calculate the percentage. Round to 1 d.p. when required.

A



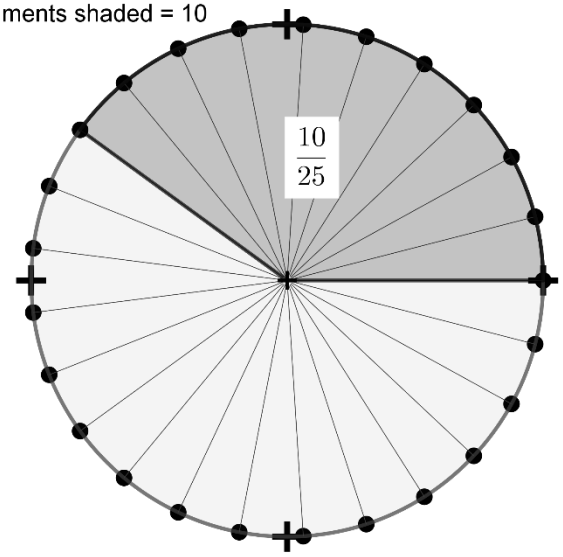
$\frac{18}{60} \approx$ %

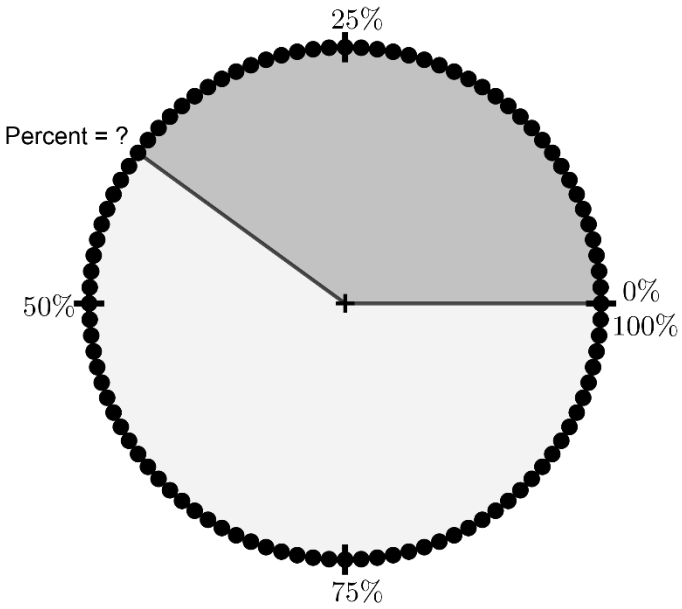
Calculation:

B

Segments = 25

Segments shaded = 10





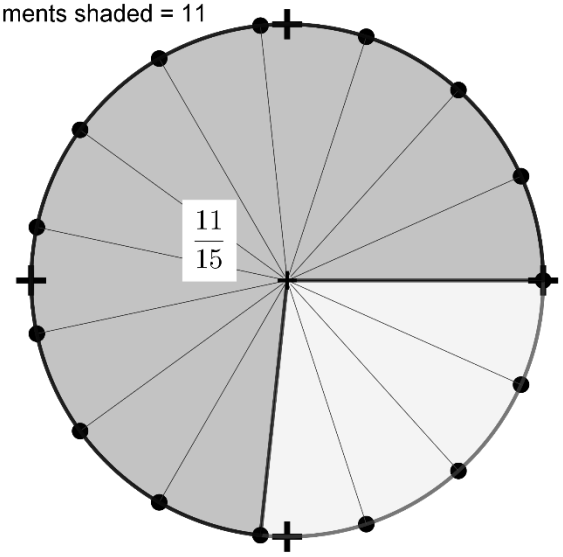
$\frac{10}{25} \approx$ %

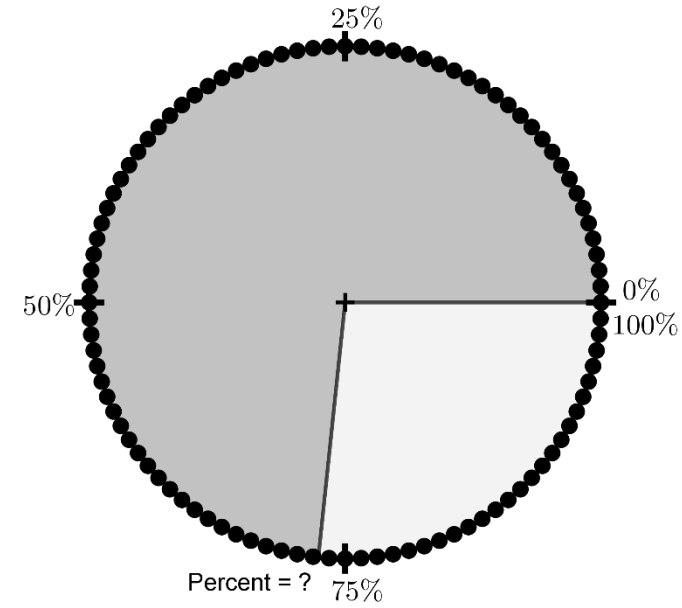
Calculation:

C

Segments = 15

Segments shaded = 11



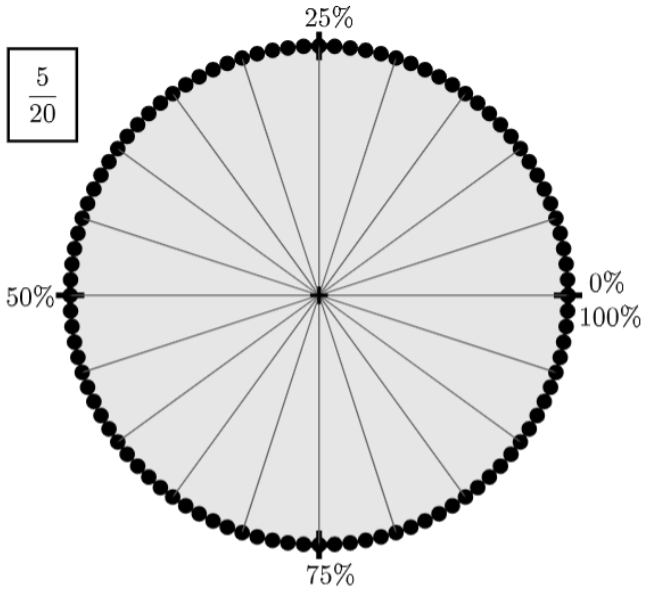


$\frac{11}{15} \approx$ %

Calculation:

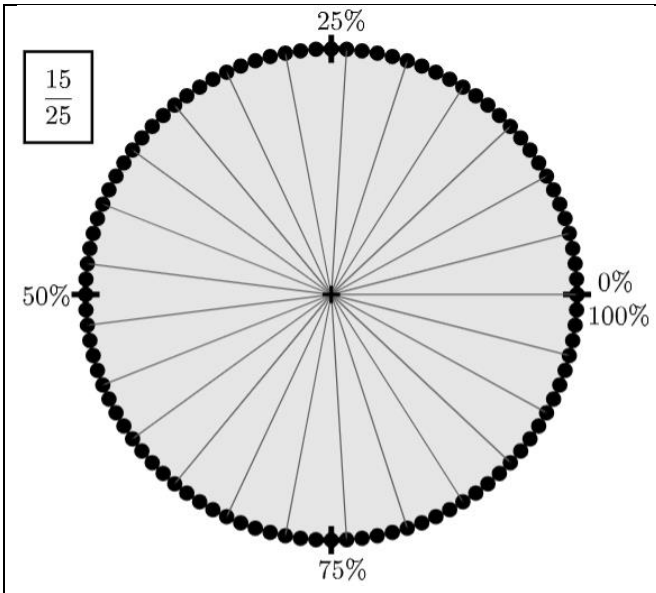
On these circles,

- Colour the correct number of segments. Start at the zero line.
- Use the dots on the circumference to estimate the percentage.
- After estimating, use the calculator. Round your answer to one decimal place.



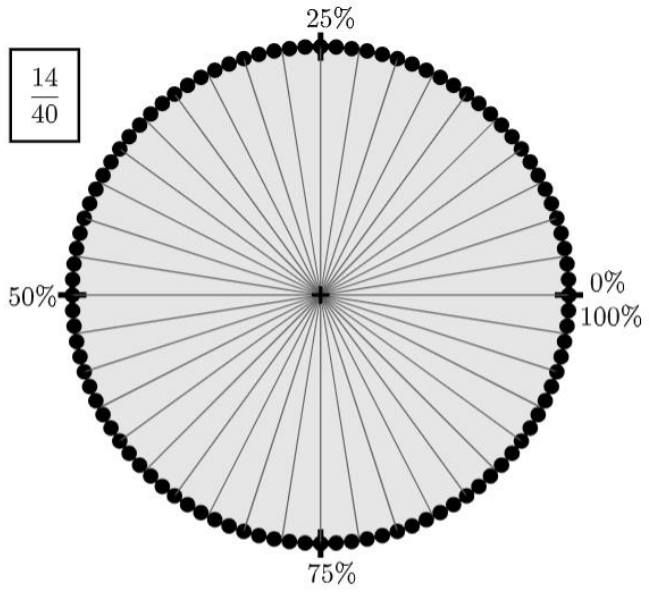
Estimate percentage:

Calculate percentage: $\frac{5}{20} = 5 \div 20 \times 100 =$



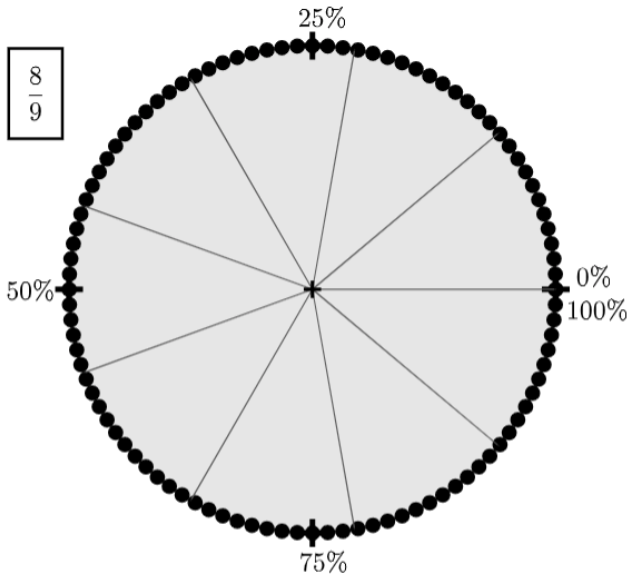
Estimate percentage:

Calculate percentage:



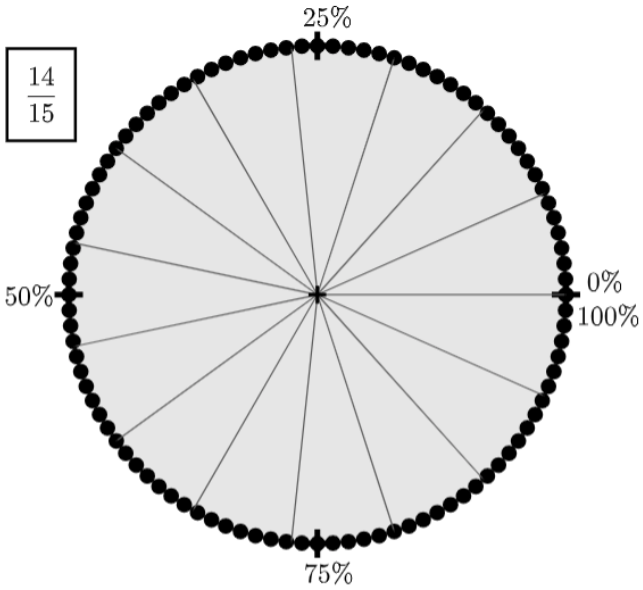
Estimate percentage:

Calculate percentage:



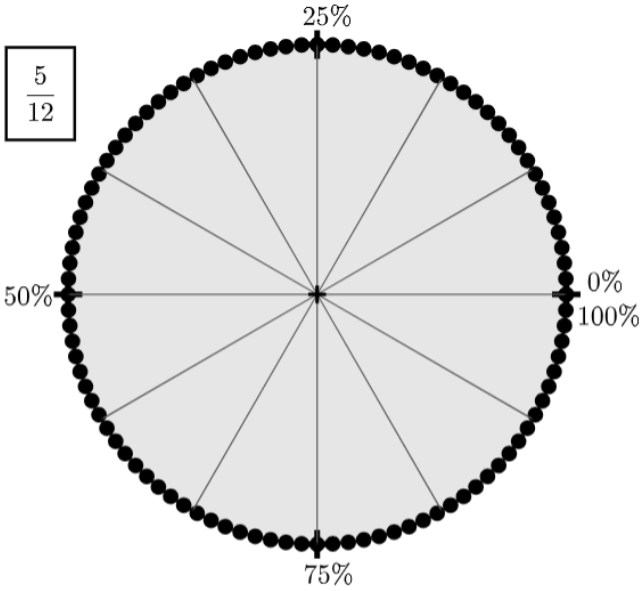
Estimate percentage:

Calculate percentage:



Estimate percentage:

Calculate percentage:



Estimate percentage:

Calculate percentage:

Finally: Here is a new grid!

- five fractions are equivalent to 25%;
- five are equivalent to 50%;
- five are equivalent to 75%
- five are random.

You can use equivalent fractions or you can use the calculator technique from today help with colouring.

Use three colours. One for the 25% fractions, one for the 50% fractions and another for the 75% fractions.

$\frac{10}{40}$	$\frac{23}{92}$	$\frac{18}{36}$	$\frac{19}{76}$	$\frac{30}{60}$
$\frac{24}{76}$	$\frac{10}{20}$	$\frac{10}{96}$	$\frac{27}{36}$	$\frac{66}{88}$
$\frac{11}{44}$	$\frac{20}{80}$	$\frac{21}{28}$	$\frac{42}{56}$	$\frac{10}{100}$
$\frac{57}{76}$	$\frac{12}{40}$	$\frac{44}{88}$	$\frac{43}{48}$	$\frac{48}{96}$

Lesson 5: Equivalent Fractions and Percentages

Definition: Fractions that are *equivalent* are the same *quantity* even though they look different.

A. Draw lines to cut the first cake into 4 equal pieces. Shade half the pieces.

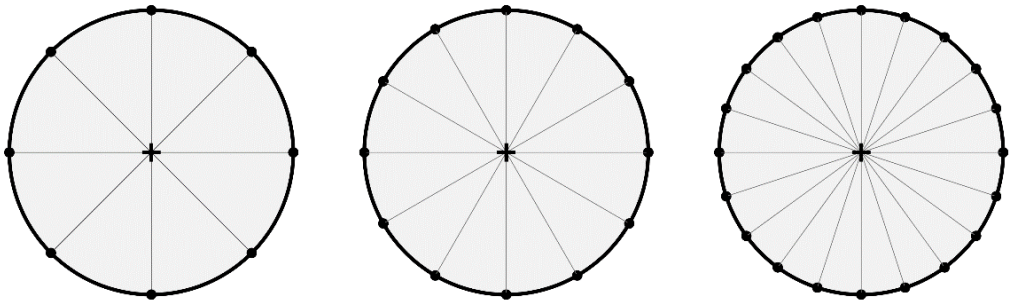
Draw lines to cut the second cake into 8 equal pieces. Shade half the pieces.

Draw lines to cut the third cake into 12 equal pieces. Shade half the pieces.

Note that $\frac{2}{4}$ is the same amount of cake as $\frac{4}{8}$, which is the same amount of cake as $\frac{6}{12}$. All amount to half.

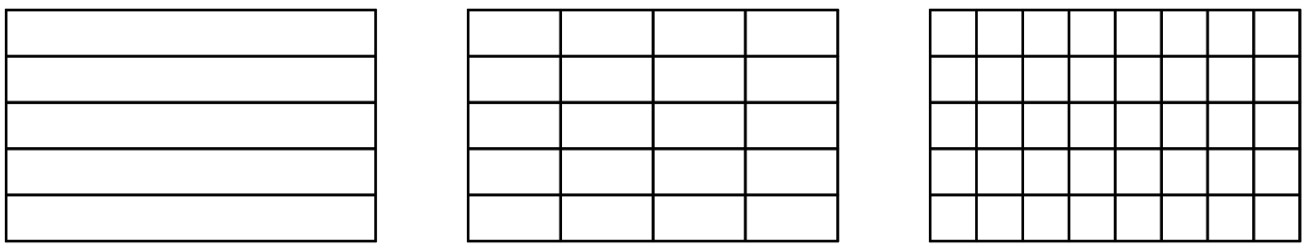


B. Diagrams help us to see some equivalent fractions. Shade $\frac{3}{4}$ of each of these three circles:



$\frac{3}{4} = \frac{\quad}{8}$ $\frac{3}{4} = \frac{\quad}{12}$ $\frac{3}{4} = \frac{\quad}{20}$

Shade $\frac{1}{5}$ of each of these rectangles:



$\frac{1}{5}$ $\frac{1}{5} = \frac{\quad}{20}$ $\frac{1}{5} = \frac{\quad}{40}$

C. We can find equivalent fractions without using a diagram.

To calculate equivalent fractions, we use multiplying.

We examine either denominators (bottom) or numerators (top) to find the multiplier.

State the multiplier in each of these equivalent fractions:

Equivalent Fractions	Multiplier
$\frac{3}{4}=\frac{9}{12}$	$\frac{3\times 3}{4\times 3}=\frac{9}{12}$
$\frac{5}{6}=\frac{10}{12}$	$\frac{5\times}{6\times}=\frac{10}{12}$
$\frac{15}{17}=\frac{150}{170}$	$\frac{15\times}{17\times}=\frac{150}{170}$
$\frac{7}{8}=\frac{21}{24}$	$\frac{7\times}{8\times}=\frac{21}{24}$
$\frac{9}{11}=\frac{45}{55}$	$\frac{9\times}{11\times}=\frac{45}{55}$
$\frac{4}{7}=\frac{48}{84}$	$\frac{4\times}{7\times}=\frac{48}{84}$
$\frac{4}{5}=\frac{52}{65}$	$\frac{4\times}{5\times}=\frac{52}{65}$

D. Calculate the multiplier for each equivalent fraction below, then fill in the blank:

Equivalent Fractions	Multiplier
$\frac{3}{5}=\frac{}{10}$	$\frac{\times 2}{\times 2}$
$\frac{2}{7}=\frac{}{21}$	$\frac{\times 3}{\times 3}$
$\frac{9}{10}=\frac{}{40}$	$\frac{\times}{\times}$
$\frac{3}{8}=\frac{}{40}$	$\frac{\times}{\times}$
$\frac{1}{4}=\frac{}{24}$	$\frac{\times}{\times}$

Equivalent Fractions	Multiplier
$\frac{3}{8}=\frac{12}{}$	$\frac{\times}{\times}$
$\frac{1}{7}=\frac{}{21}$	$\frac{\times}{\times}$
$\frac{3}{10}=\frac{}{50}$	$\frac{\times}{\times}$
$\frac{}{6}=\frac{25}{30}$	$\frac{\times}{\times}$
$\frac{7}{}=\frac{14}{22}$	$\frac{\times}{\times}$

E. ‘Percent’ is simply a fraction that has 100 as the denominator. Some fractions turn into percentages easily:

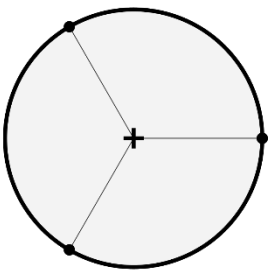
	Multiply by:	Fill the blank	Percent Equivalent
$\frac{1}{2}$	$\frac{\times 50}{\times 50}$	$\frac{1}{2}=\frac{}{100}$	$\frac{1}{2}=$
$\frac{3}{4}$	$\frac{\times}{\times}$	$\frac{3}{4}=\frac{}{100}$	$\frac{3}{4}=$
$\frac{7}{10}$	$\frac{\times}{\times}$	$\frac{7}{10}=\frac{}{100}$	$\frac{7}{10}=$
$\frac{3}{5}$	$\frac{\times}{\times}$	$\frac{3}{5}=\frac{}{100}$	$\frac{3}{5}=$
$\frac{3}{20}$	$\frac{\times 5}{\times 5}$	$\frac{3}{20}=\frac{15}{100}$	$\frac{3}{20}=15\%$
$\frac{11}{25}$	$\frac{\times}{\times}$	$\frac{11}{25}=\frac{}{100}$	$\frac{11}{25}=$

F. Convert the following fractions into percentages as in the example:

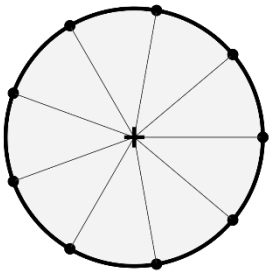
	Multiplier	Equivalent fraction	Percent
$\frac{21}{25}$	$\frac{\times 4}{\times 4}$	$\frac{21}{25}=\frac{}{100}$	84%
$\frac{18}{20}$	$\frac{\times}{\times}$	$\frac{18}{20}=\frac{}{100}$	
$\frac{44}{50}$	$\frac{\times}{\times}$	$\frac{44}{50}=\frac{}{100}$	
$\frac{15}{20}$	$\frac{\times}{\times}$	$\frac{15}{20}=\frac{}{100}$	
$\frac{3}{10}$		$\frac{3}{10}=\frac{}{100}$	

	Multiplier	Equivalent Fraction	Percent
$\frac{2}{5}$	$\frac{\times}{\times}$	$\frac{2}{5}=\frac{}{100}$	
$\frac{3}{50}$	$\frac{\times}{\times}$	$\frac{3}{50}=\frac{}{100}$	
$\frac{9}{10}$	$\frac{\times}{\times}$	$\frac{9}{10}=\frac{}{100}$	
$\frac{1}{4}$	$\frac{\times 25}{\times 25}$	$\frac{1}{4}=\frac{}{100}$	
$\frac{5}{4}$		$\frac{5}{4}=\frac{}{100}$	

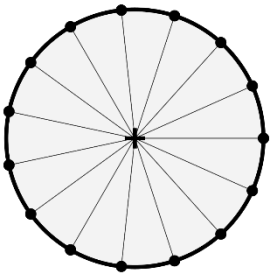
G. Colour these fractions:



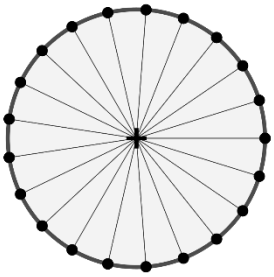
One Third



One Third



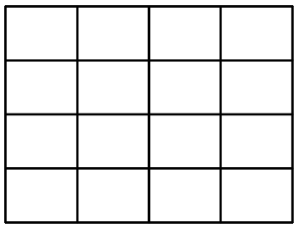
Two Thirds



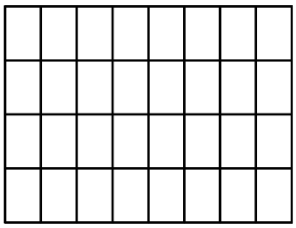
Two Thirds



One Quarter



One Eighth



Three Eighths

I. It's possible to convert some other fractions to percentages using *two* steps. Here's a method for $\frac{42}{60}$:

$$\frac{42}{60} = \frac{7}{10} = \frac{70}{100} = 70\%$$

What are the two steps required?

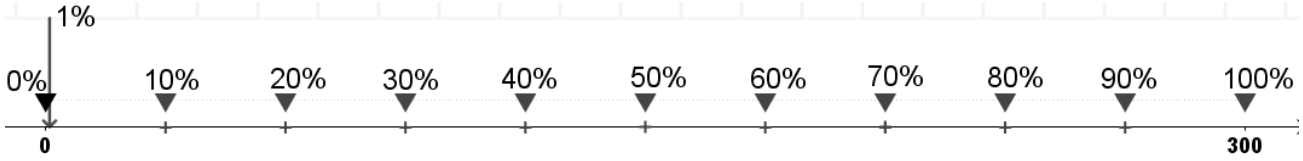
Convert to a percent using two steps:

(a) $\frac{18}{45}$ (b) $\frac{63}{75}$ (c) $\frac{99}{110}$

Percentages NAME:

Lesson 6: Calculator Method for any Percent

Complete the scale on the axes, starting with '30' for '10%'.



To calculate 1% of any quantity, divide the quantity by 100.

To calculate any other percentage, we multiply the 1% value by the required percent.

For example:

a) 4% of 300 = (1% of 300) × 4 = $(300 \div 100) \times 4 = 12$ (NOTE: $4 \div 100 \times 300$ is the same).

b) 71% of 300 = (1% of 300) × 71 = $(300 \div 100) \times 71 =$

c) 105% of 300 =

d) 0.9% of 300 =

A. Divide the quantity given by 100 to find 1%; then multiply to find the percent required:

(a) 15% of 90kg	(a)
(b) 6% of 200ml	(b)
(c) 37% of 500 minutes	(c)
(d) 82% of 730km	(d)
(e) 12% of $480	(e)
(f) 4% of 30g	(f)

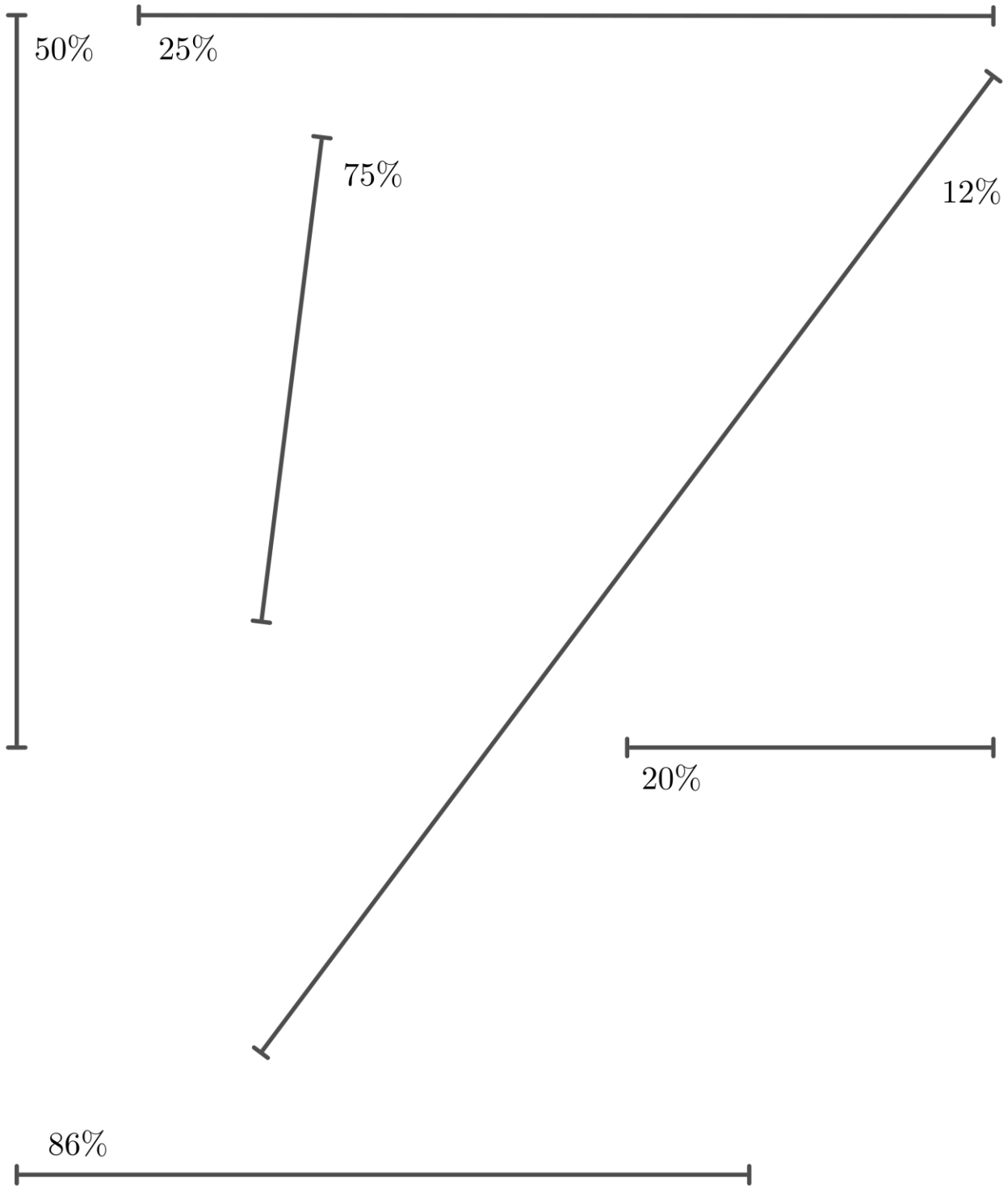
B. Jerem loves to play chess. They're ok with losing but they like to win at least 55% of their games. In the last year they played 145 games: they drew 15 games, lost 47 games, and won the rest. Did they win more or less than 55%? Show your calculations.



C. Here are six line-segments. Each line-segment has a percentage indicated.

First, use visual estimation to colour the percentage indicated of each line segment.

Second, use a ruler to measure the length of each line. Calculate the percentage indicated. Measure your calculation.



Percentages NAME:

Completing Rectangles

Complete the factor pairs of 100:

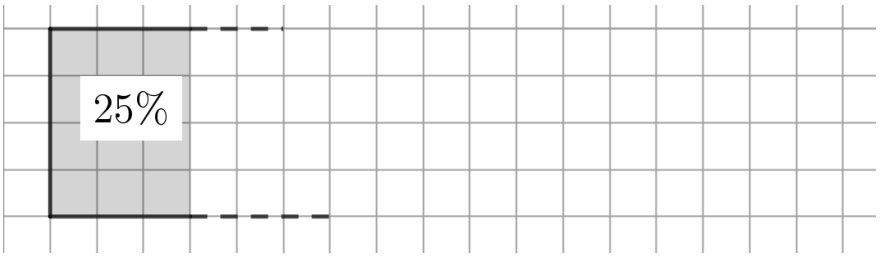
$1 \times$	$= 100$
$2 \times$	$= 100$
$4 \times$	$= 100$
$5 \times$	$= 100$
$10 \times$	$= 100$
$20 \times$	$= 100$
$25 \times$	$= 100$
$50 \times$	$= 100$

Only 25% of this rectangle is drawn.

What is the area of 25% of the rectangle?

What is the area of 100% of the rectangle?

Complete the rectangle.

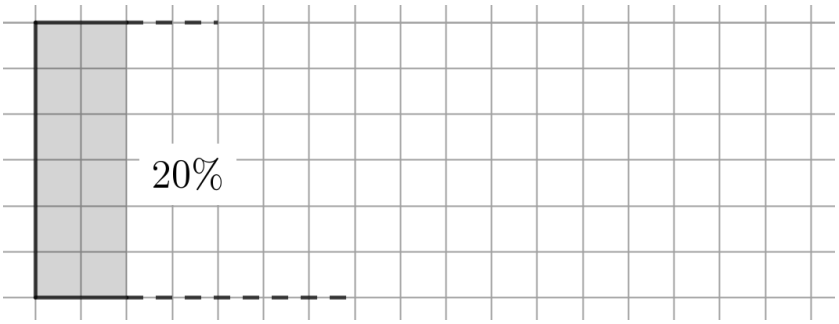


Only 20% of this rectangle is drawn.

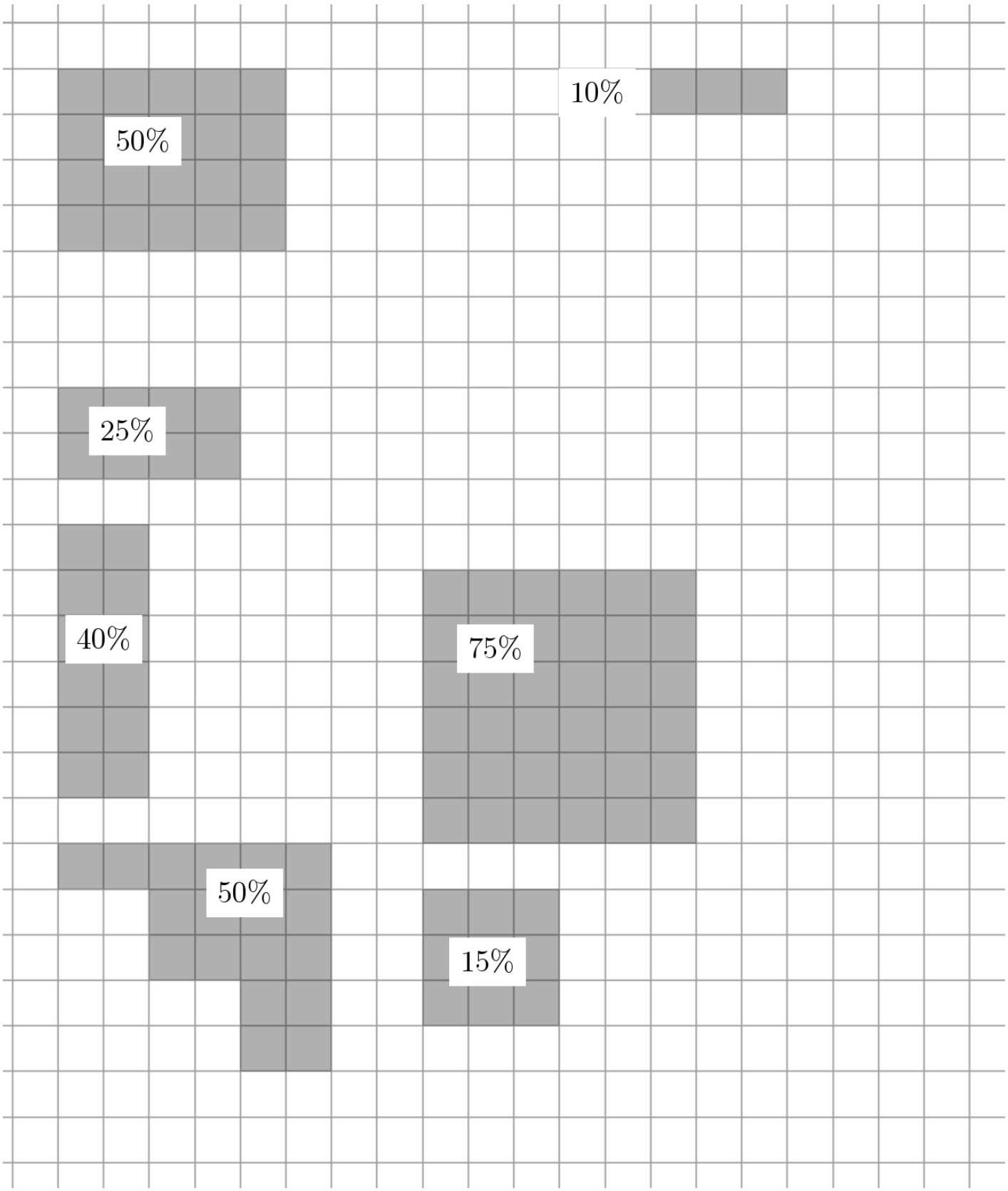
What is the area of 20% of the rectangle?

What is the area of 100% of the rectangle?

Complete the rectangle:



A percentage of each rectangle is drawn. Complete each rectangle. There is more than one way to complete each rectangle. It is possible to complete each rectangle without any overlaps.



Unit Review NAME:

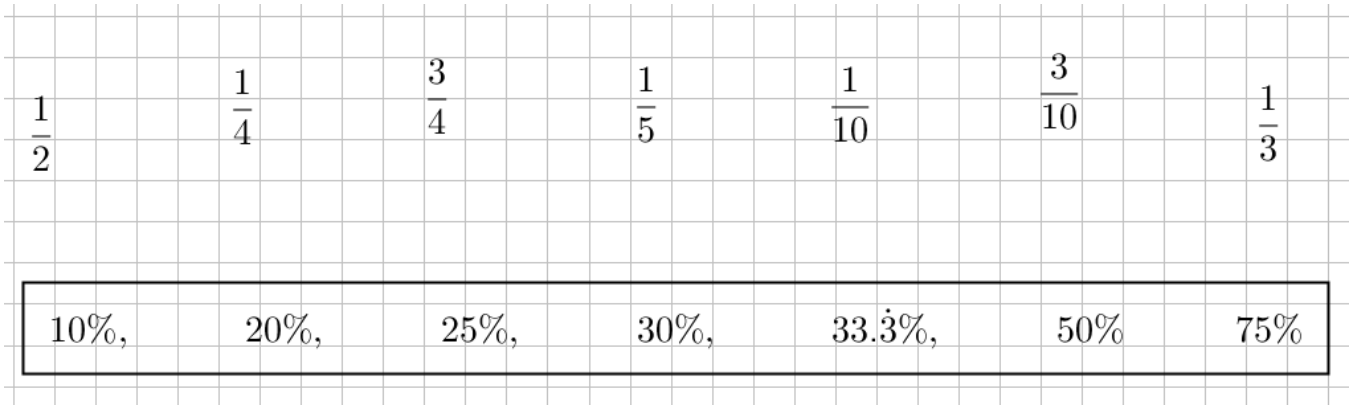
Percentages: Review of Learning

A. Number Knowledge: Divide by 2, 4, 5, 10, 100

$20 \div 2 =$	$44 \div 2 =$	$90 \div 10 =$	$35 \div 5 =$	$300 \div 100 =$
$20 \div 4 =$	$80 \div 2 =$	$40 \div 10 =$	$15 \div 5 =$	$700 \div 100 =$
$20 \div 5 =$	$28 \div 2 =$	$36 \div 10 =$	$40 \div 5 =$	$750 \div 100 =$
$20 \div 10 =$	$90 \div 2 =$	$27 \div 10 =$	$60 \div 5 =$	$1200 \div 100 =$
$20 \div 100 =$	$100 \div 2 =$	$100 \div 10 =$	$100 \div 5 =$	$30 \div 100 =$

B. Recall percentages as equivalent fractions

Draw a line between each fraction and its equivalent percentage in the box.



C. Calculate percentages using equivalent fractions

Complete each equivalent fraction. Write the fraction as a percentage:

$\frac{42}{50} = \frac{\quad}{100}$	$\frac{42}{50} =$	%
$\frac{20}{25} = \frac{\quad}{100}$	$\frac{20}{25} =$	%
$\frac{7}{10} = \frac{\quad}{100}$	$\frac{7}{10} =$	%
$\frac{3}{20} = \frac{\quad}{100}$	$\frac{3}{20} =$	%

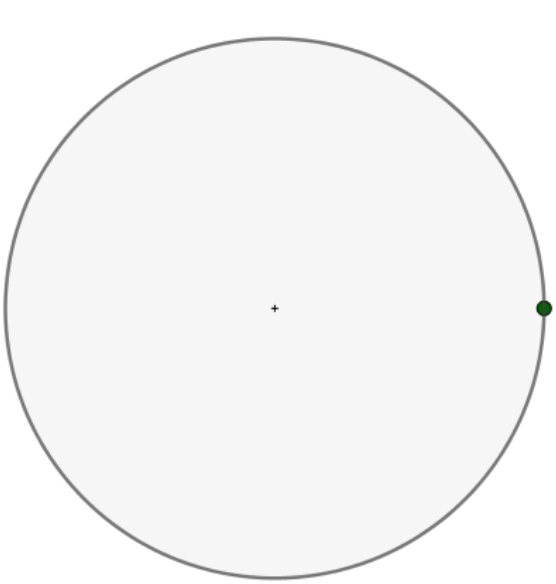
$\frac{3}{10} = \frac{\quad}{100}$	$\frac{3}{10} =$	%
$\frac{7}{20} = \frac{\quad}{100}$	$\frac{7}{20} =$	%
$\frac{4}{5} = \frac{\quad}{100}$	$\frac{4}{5} =$	%
$\frac{3}{4} = \frac{\quad}{100}$	$\frac{3}{4} =$	%

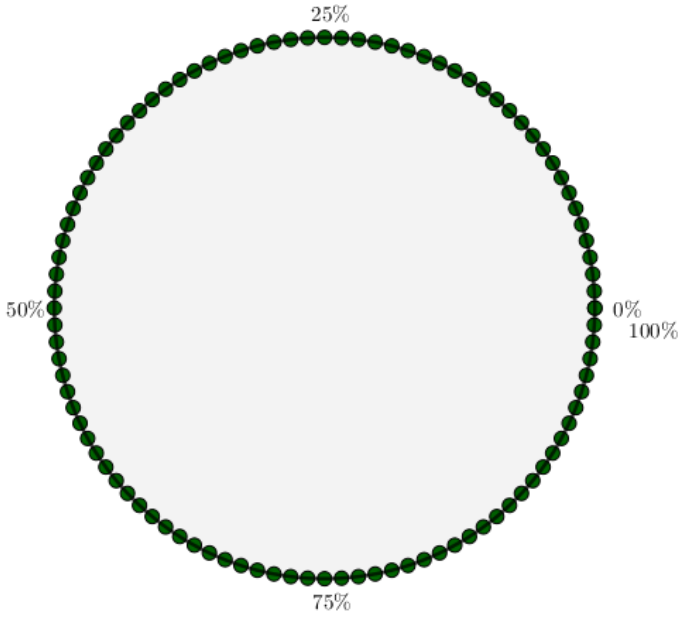
D. Visual Estimation

Shade in 40% of this rectangle by visual estimation:



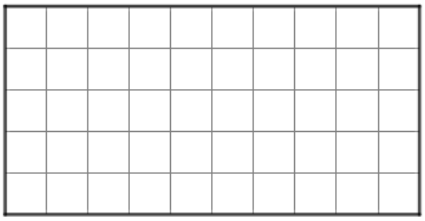
Divide the circle on the left into 8 equal sized sectors (using visual estimation). Shade in 3. Approximately what percentage is $\frac{3}{8}$ equivalent to?



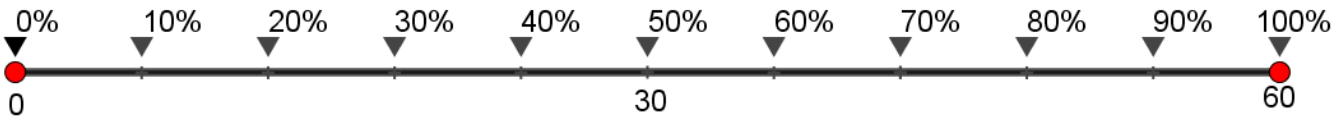


E. Calculate percentages of area and of length

Shade in 50% of this rectangle in one colour. Shade in 10% of the rectangle in a different colour.



Fill in 10% of 60, 20% of 60 etc on the number line below



Mark the value of 85% of 60 on the number line above.

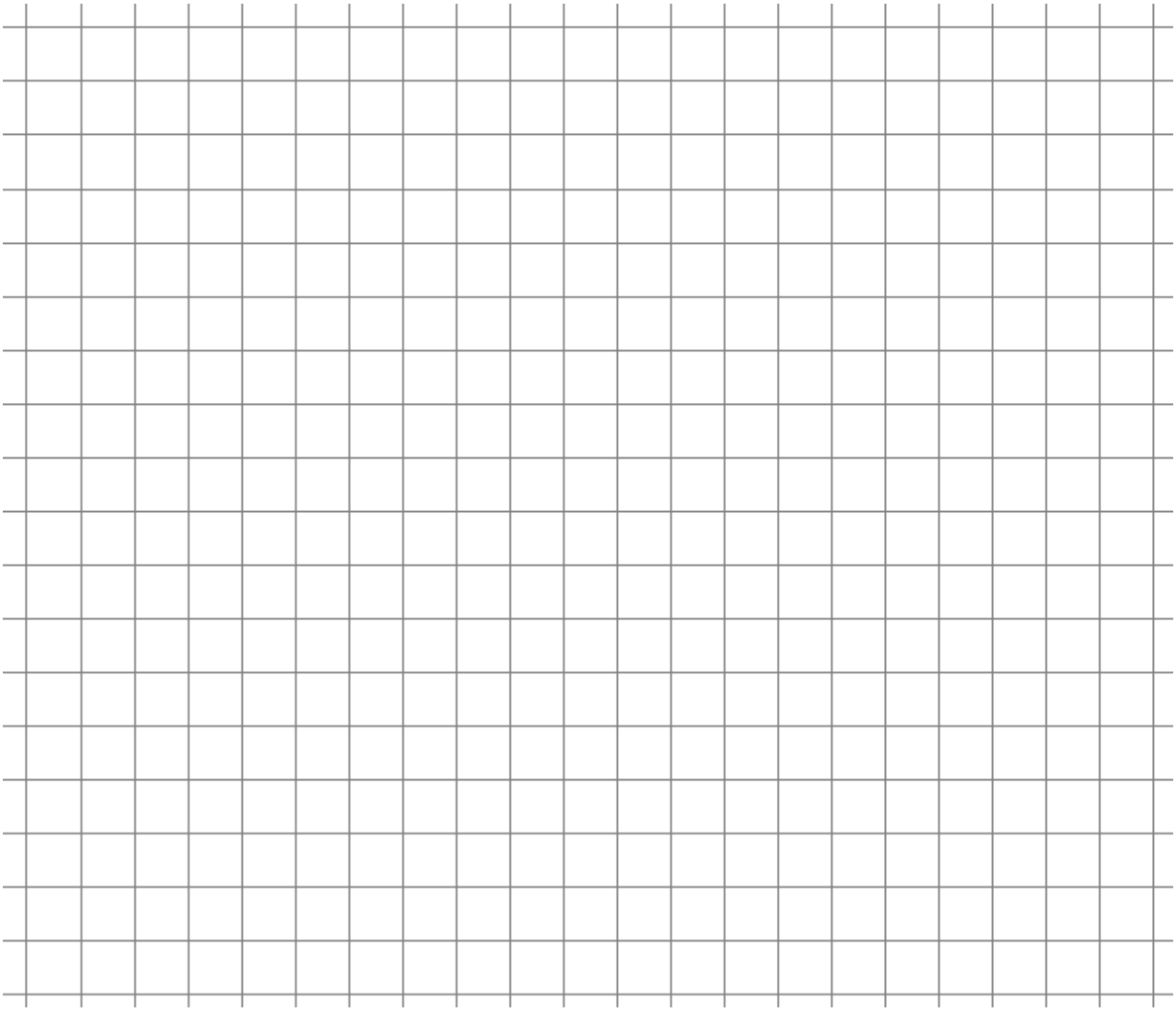
F. Draw your own rectangle with a given area

On the grid below draw three different rectangles.

Your first rectangle should have area = 30 boxes.

Your second rectangle should also have area= 30 boxes but it should be different from your first rectangle.

Your third rectangle should have dimensions 5 x 8



On each rectangle, shade in 50% in one colour, 25% in a second colour and 10% in a third colour.

G. Calculator: Calculate a percentage by first calculating 1%

Calculate 90% of 400km.

Method: 1 % of 400 = $400 \div 100 = 4$. That means 90% of 400 = $90 \times 4 = 360$km.

Calculate 30% of 200kg
Calculate 11% of 1500ml
Calculate 7% of 500km
Calculate 13% of 45g
Calculate 19% of 70cm

H. Calculator method to convert a fraction to a percentage:

$\frac{7}{28} = 7 \div 28 \times 100 = 25\%$	$\frac{14}{15} =$
$\frac{15}{25} =$	$\frac{22}{30} =$
$\frac{40}{64} =$	$\frac{80}{90} =$

Percentage Scavenger Hunt

Random groups of 3. If you ask someone for information, please remember to thank them!

$$\text{percentage} = \frac{\text{part}}{\text{whole}} \times 100\ \%$$

1. A kangaroo can jump 25 feet (300 inches). Use a measuring tape to measure your jump and record the length in inches. What percentage is your jump of the kangaroos jump?

2. Go to the school office. Ask them how many students are in the school total. Ask how many students are grade 9 students. Calculate the percentage of students in the school who are grade 9.

3. Calculate what percentage of grade 9 students are in this class.

4. Find an adult who is not teaching and ask them if they are willing to tell you their age. Calculate your age as a percentage of their age.

5. Look at the phone hotel list. What percentage of this class of students have names that begin with a vowel?

6. A sea otter can hold their breath for 5 minutes (300 seconds). Time how long you can hold your breath. Calculate your time as a percentage of the sea otter's time.

7. The bell goes at 8:55 in the morning and again at 3:20 in the afternoon. How many minutes is the time between the bells? Given that there are 1440 minutes in a day, what percentage of the day is the school day?

Percentages Creative task

You are to create a poster to explain how percentages work. Please take one piece of letter paper and stick to one piece of construction paper.

Please look at the unit review.

Choose to explain **one** of the following:

Sections B and C: How to turn fractions into percentages using recall and equivalent fractions

Number line: How to use the number line to calculate 10, 20, 30… etc percent of a quantity. You may use this applet to create two diagrams: https://www.geogebra.org/m/sqjdvar6

Circle Diagram: How to compare any number of segments to 100 segments and to estimate a percentage. You may use this applet to create two diagrams: https://www.geogebra.org/m/ayzd6rst

Section G: How to calculate a percentage of a quantity. A mental arithmetic technique and a calculator technique

Section H: How to converting a fraction to a percent. A mental arithmetic technique and a calculator technique.

Each poster should have at least two examples. Aim for between 2 and 4 examples. A simple example is good for communication, followed by a more complex example to demonstrate your understanding.

You will be given a grade for your work as follows:

	Emerging	Developing	Proficient
Final Design	You hand in a final design. It shows some attention to page layout.		Your poster is easy to read. The examples are well displayed using colours or another technique.
Final Math Accuracy	You hand in a final design. It shows some correct work on percentages.		Your examples are complete and correct. Although you might have got help with this task, your examples are your own original and independent work.
Final Math Communication	You hand in a final design. It shows some correct notation and vocabulary.		You have used the correct writing for math. Your explanation is clear because you used colours/diagrams or some other technique for explaining.