Helmshore Primary School: Preparing for the Maths Reasoning Paper

We hope you find the following questions, taken from previous Maths SAT papers useful. Work through them with care to help you to become familiar with their layout and format and to allow you to improve your confidence and accuracy in completing Reasoning style questions.

Parents: you will hopefully find this document useful when helping your child revise for the forthcoming SATs. It lists the topics covered in Key Stage 2 and gives examples of related questions from past years' SATs papers.

CONTENTS

CHANCE and PROBABILITY

Probability is all about how likely it is for something to happen. Probability is the likelihood or chance of an event happening.

Probability can be described using words, such as, perhaps, maybe, might, fair, unfair, likely, unlikely, equally likely, chance, certain, uncertain, probable, possible, impossible, good chance, poor chance, no chance, equal chance, even chance, evens, fifty-fifty chance, likelihood, low probability, high probability and possibility.

In mathematical terms, we can define probability as fractions, decimals and percentages.

Take a coin. Spin it in the air. Let it land. There are only two possible outcomes. Either it will be heads up or it will be tails up. So the probability of it being head or tails is one in two or 1 in 2 or $\frac{1}{2}$ or 0.5 or **50%**.

Take 4 marbles – 1 red, 1 blue, 1 green, 1 yellow. Put them in a bag. Reach in and take one marble out. What is the probability of taking out a red marble? It is:
$\frac{1}{4}$ as a fraction, 1 ÷ 4 = 0.25 as a decimal and 0.25 x 100 = 25% as a percentage.

Take a die. Roll it. What are the chances (probability) of getting an even number?
There are 6 numbers. Three are even: 2, 4, 6. Three are odd: 1, 3, 5.
So you have 3 chances out of 6 of getting an even (or an odd number).
As a fraction that's 3/6 or simplified $\frac{1}{2}$... as a a decimal 1 ÷ 2 = 0.5 ... 50%

Take a pack of playing cards. Shuffle them. Pick a card at random.
What is the probability if picking a Heart.
There are 52 cards in the pack (no Jokers). There are 13 Hearts.
So you have 13 chances out of 52 of picking a Heart.
As a fraction that's 13/52 or $\frac{1}{4}$ or 0.25 or 25%

1. **Here are some events.**

Write the **probability** of the following events happening as a **fraction.**

1. A snooker table has 4 red balls and 6 other colours on it. One ball is hit without looking at its colour. What is the probability that it is red ball?

2. A bag has 20 raffle tickets in it, numbered from 1 to 20.
What is the probability of picking out an even number?

3. A spinner has the numbers 1 to 20 on it.
If it is spun what is the probability of getting a prime number?

4. A milkcrate has ten semi-skimmed and 4 skimmed bottles of milk.
A robin lands on one of the milk bottles.
What is the probability that it lands on a bottle of skimmed milk?

5. Twenty playing cards are pinned on a board. Four are hearts. Six are spades. Ten are diamonds. A boy throws a dart at the board and lands on one of the cards.
What is the probability that he lands on a spade?

6. A football team is made up of six boys and five girls. One of the team scores a goal.
What is the probability of the goal scorer being a boy?

7. There are 16 tickets left in the tombola. Three are winning tickets.
What is the probability of picking a winning ticket?

8. In the last 100 days it has rained on only 12 of them.
If one day was picked at random what is the probability of it being a rainy day?

Now write your answers again, but as **decimal fractions**
You might need a calculator for some.

The answers are on the next page. No peeking!

Answers

As fractions:

1. 4/10 or 2/5 2. 10/20 or 1/2 3. 8/20 or 2/5 (1 is not a prime number) 4. 4/14 or 2/7

5. 6/20 or 3/10 6. 6/11 7. 3/16 8. 12/100 or 6/50 or 3/25

As decimals (to 2 decimal places):

1. 0.40 2. 0.50 3. 0.40 4. 0.29

5. 0.30 6. 0.55 7. 0.19 8. 0.12

2 Now try these

On a single die what are the chances of rolling…

a 6?
an evennumber?
An odd number

Extension *(think very carefully about these):*
On a **pair of dice** what are the chances of scoring the following?
(Hint: write out all of the possible combinations first.)

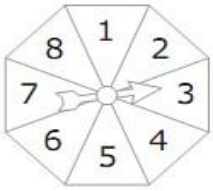
1 =
6 =
12 =
13 =

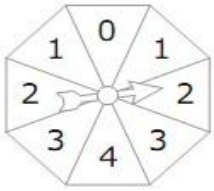
3 SUCCESS

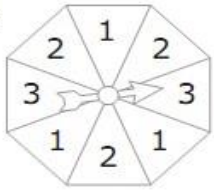
If you pop all the letters of the word **success** in a bag, what are the chances, expressed as a fraction, that you can pull out the letter **S** without looking?

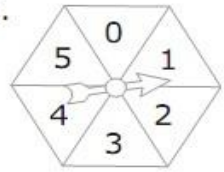
4 Now try these

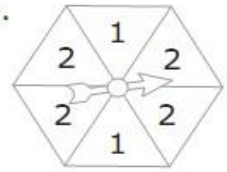
For each spinner, work out the probability of the arrow landing on a 2.

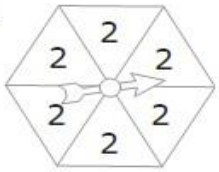
a. 

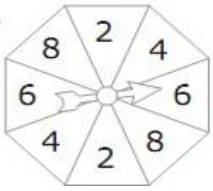
b. 

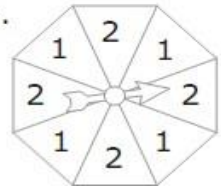
c. 

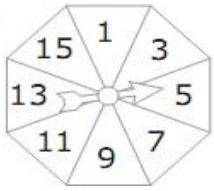
d. 

e. 

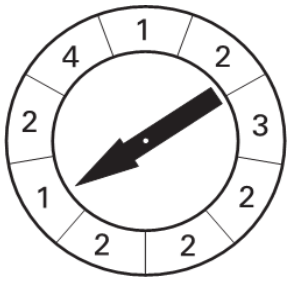
f. 

g. 

h. 

i. 

5 This spinner is divided into nine equal sections.



What are your chances, expressed as a **fraction**, of getting a

- **a. 1**
- **b. 2**
- **c. 3**
- **d. 4**
- **e.** a number higher than **2**?

6 **How likely? How probable?**

Dan has a bag of seven counters numbered **1 to 7**
Zoe has a bag of twenty counters numbered **1 to 20**
Each chooses a counter from their own bag without looking.

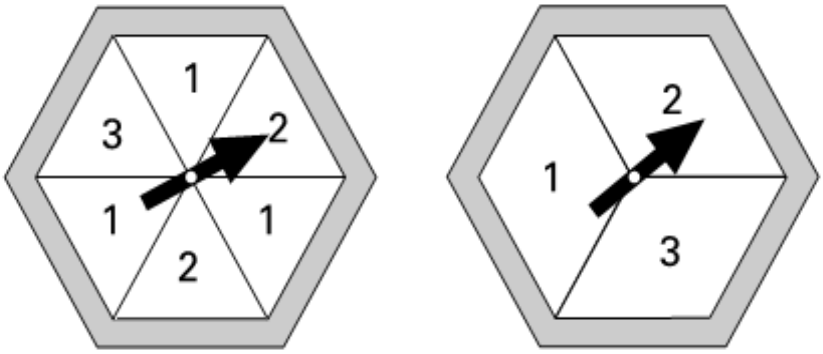
For each statement, put a tick (✓) if it is **true**.
Put a cross (✗) if it is **not true**.

Dan is **more likely** than Zoe to choose a '**5**'.
They are both **equally likely** to choose a number less than **3**.
Dan is **more likely** than Zoe to choose **an odd number**.
Zoe is **less likely** than Dan to choose a '**10**'

7 **How likely? How probable?**

Here are two spinners, A and B.

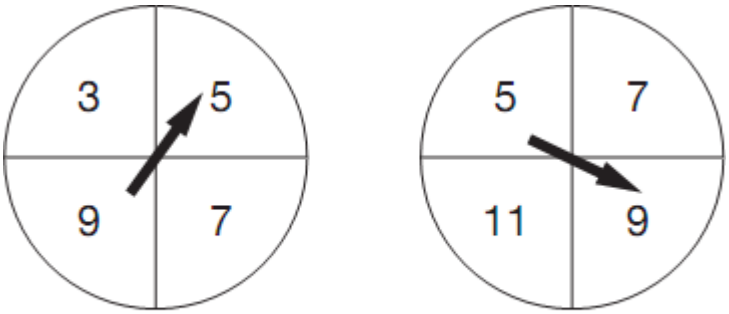
Each one is a regular hexagon.



For each statement, put a **tick** (✓) if it is **true**.
Put a **cross** (✗) if it is **not true**.

Scoring '1' is **more likely** on A than on B.
Scoring '2' is **more likely** on A than on B.
Scoring '3' is as **equally likely** on A as on B.

8 Here are two spinners, A and B.



A B

Hassan spins the pointer on each spinner.
He adds his **two scores together**.

For each statement put a tick (✓) to show if it is **certain**, **possible** or **impossible**.

The total will be **more than 15**
The total will be an **even number**.
The total will be **less than 6**
The score on **A will be less** than the score on **B**.

9 Fair or Unfair?

Max makes up a new card game using seven cards **1** to **7**.
The cards are placed face down.

He tells Louis: if you pick up an **odd** number, I get a point,
but if you pick up an **even** number, you get a point!
The cards are shuffled and placed face down again after every point.
If you were Louis, would you play Max's game or not?
Explain your decision.

10 A Practical Investigation

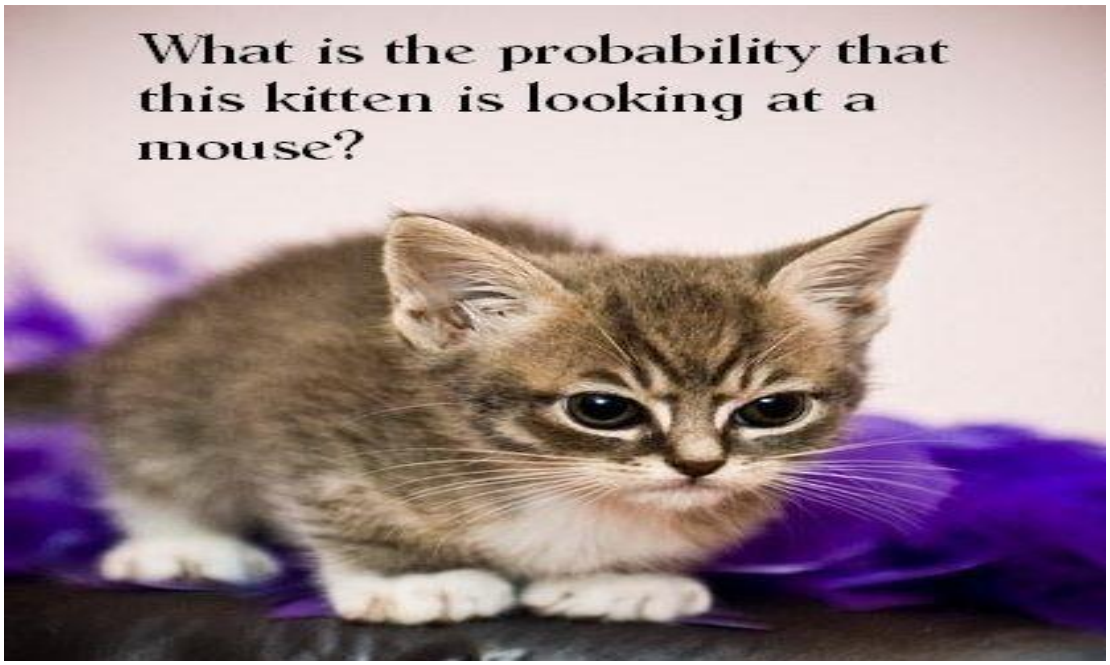
Four children tossed a coin several times and wrote their results in this table.
Write the answer to each question in the appropriate part of the table.

Outcome	Alan	Becky	Carol	David	**Totals** *frequency*	**Ratio** *relative frequency* fraction	decimal	percentage
Head	24	30	27	20				
Tail	25	28	31	15				
				Total tosses				

a) How many tosses were there altogether?

b) How many: i) *Heads* ii) *Tails* were tossed altogether?

c) What is the ratio of each outcome to the total number of tosses:
i) as a fraction ii) as a decimal iii) as a percentage?



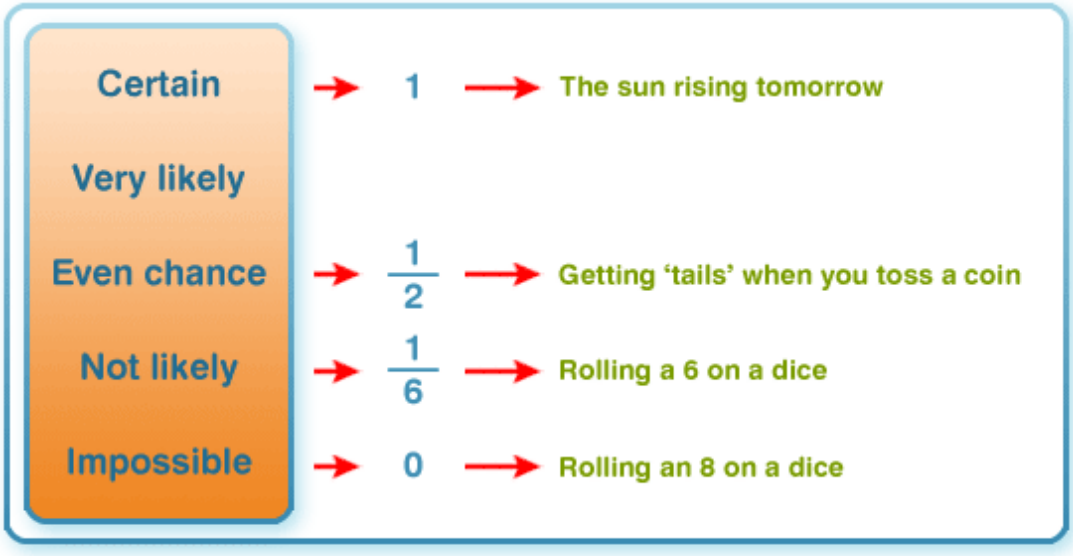
PROBABILITY

Probability means how likely something is to happen. In everyday speech we often call probability 'chance'. Let's say you have £10 to bet in a horse race. There are two horses, Freddy and Funky. You look at the odds: it's 2 to 1 against Freddy, and 30 to 1 against Funky winning the race. So you have a far greater chance of winning if you put your money on Freddy. In Maths we say there's a greater **probability** that Freddy will win the race.

Probability can be expressed as **fractions**, **decimals** or **percentages**, or on a probability scale. There are two main methods of expressing probability. **Most commonly** they are shown as **fractions**. The probability of getting 'tails' when you toss a coin is a 1 in 2 chance, or **1/2.** The probability of getting a 3 when you roll a dice is a 1 in 6 chance or **1/6**.

Probabilities can also be shown as **decimals** or **percentages**. A probability of $^1/_2$ can also be shown as **0.5** or **50%**. A probability of $^3/_4$ can also be shown as **0.75** or **75%.**

Probabilities can be shown on a **probability scale**
between **0** (**impossible**) and **1** (**certain**).



1. Use the **probability scale** to estimate the probability of the following statements.

C = Certain **VL** = Very likely **EC** = Even chance
NL = Not likely **IM** = Impossible

(a) Manchester United will win the Premiership this year.
(b) If you throw a dice, you will roll an even number.
(c) You will win the X Factor.
(d) You will be given Free Time in the IT Studio.
(e) If you toss a 20p coin, it will land heads up.
(f) England will win the World Cup in Brazil.
(g) Micro-organisms cause food to rot.
(h) You can draw a triangle with 4 equal sides.

2. There are 52 regular cards in a pack of cards.
What is the probability of picking.....?
Give each answer as a fraction. Simplify it as far as you can.

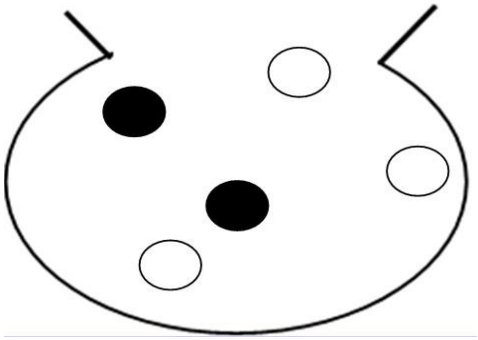
(a) the King of Diamonds
(b) any of the four Kings
(c) a red card
(d) a black card
(e) a picture card (not including Aces)
(f) an Ace

3. There are 26 letters in the alphabet.
What is the probability of picking.....?

(a) A, or B, or C
(b) a consonant
(c) a vowel
(d) a letter from your own first name.

4. Predict the probability

You have a bag of marbles – three are white and two are black.
Using what you know about probability, complete the chart below.



Event	Fraction	Decimal	Percentage	Scale
Picking a white marble				
Picking a black marble				
Picking a marble				

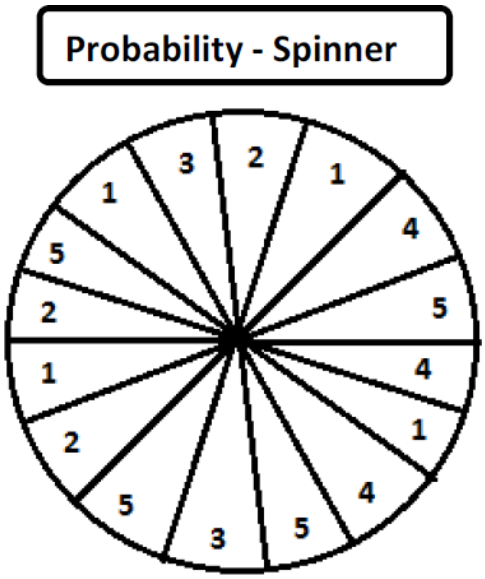
5. Predict the probability - What are your chances?

You have a dice. (Actually the singular of 'dice' is die.)
What are your chances of getting..... ?

Probability of getting a/an	Fraction	Percentage
even number		
odd		
3		
a multiple of 2		
a multiple of 3		
3 or more than 3		
5 or less than 5		

6. Probability spinner

There are **16 sections** in this probability spinner.
Use the spinner to complete the chart below.



Probability of getting a/an	How many	Fraction	Decimal
a 1	4	4/16 = 1/4	0.25
a 3			
a 4			
an even number			
an odd number			
a 2 or 3			
any number except 5			

7. The language of probability/chance

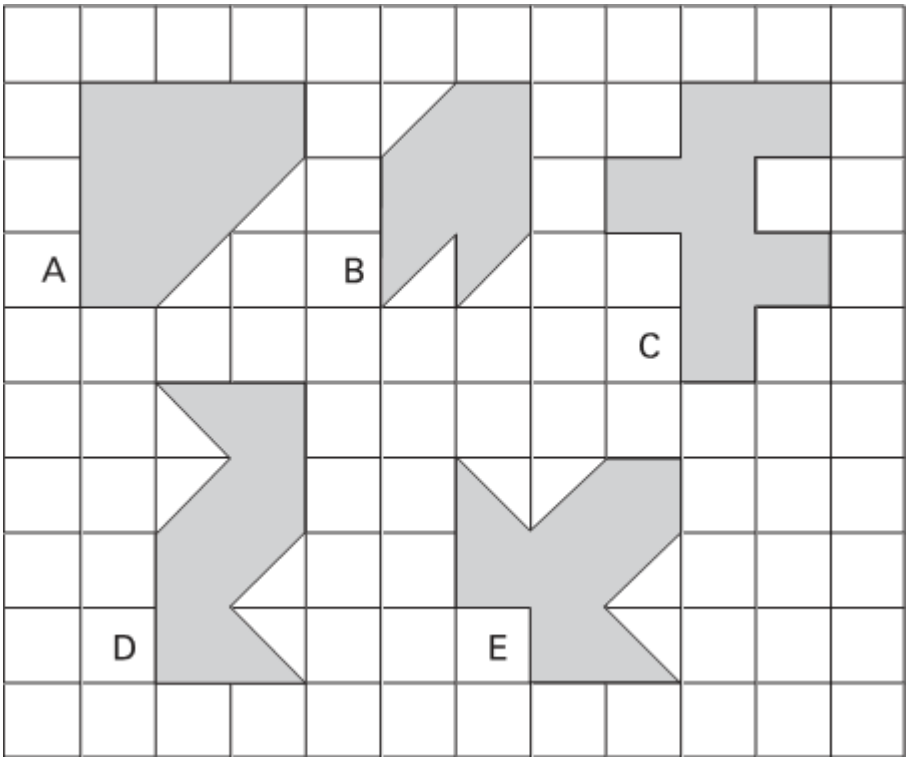
On the scale of **1** (impossible) to **5** (certain),
What number would **you** give these words:

likely - unlikely - no chance - fifty fifty - possibly
maybe - who knows? - equally - uncertain - improbable

SYMMETRY

If a shape can be folded in half so that one half fits exactly on top of the other, then we say that the shape has got **line symmetry**. The fold is called **a line of symmetry**.

1. Here are five shapes on a square grid.



Which **two** shapes have a line of symmetry?

2. Here are the letters of the alphabet. Which letters have a line of symmetry?

A B C D E F G

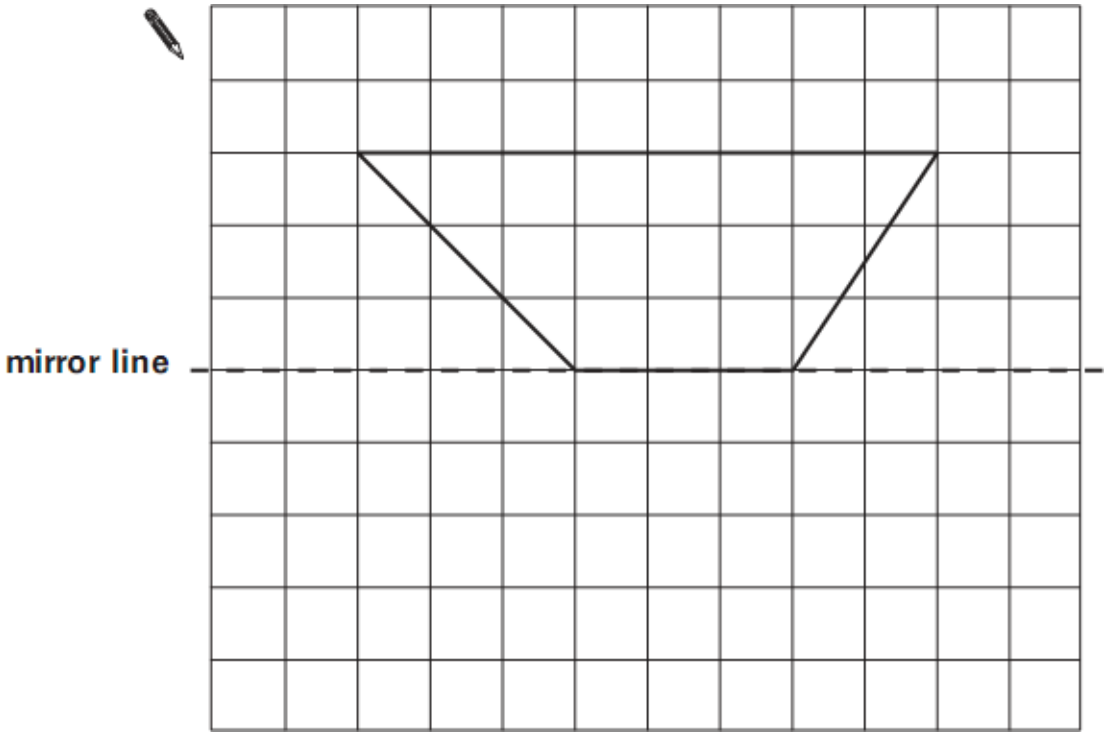
H I J K L M N O

P Q

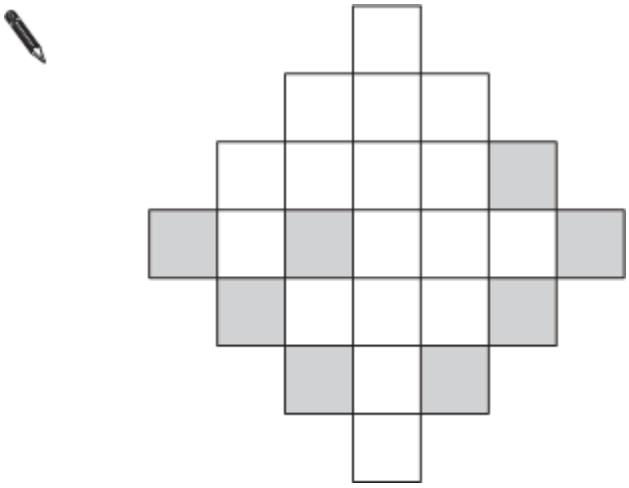
R S T U V W

X Y Z

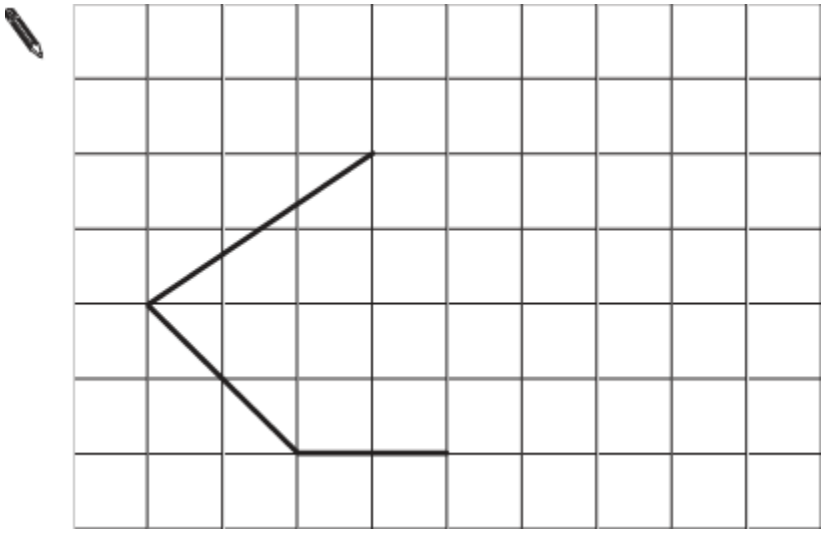
3. Complete the diagram below to make a shape that is symmetrical about the mirror line. Use a ruler.



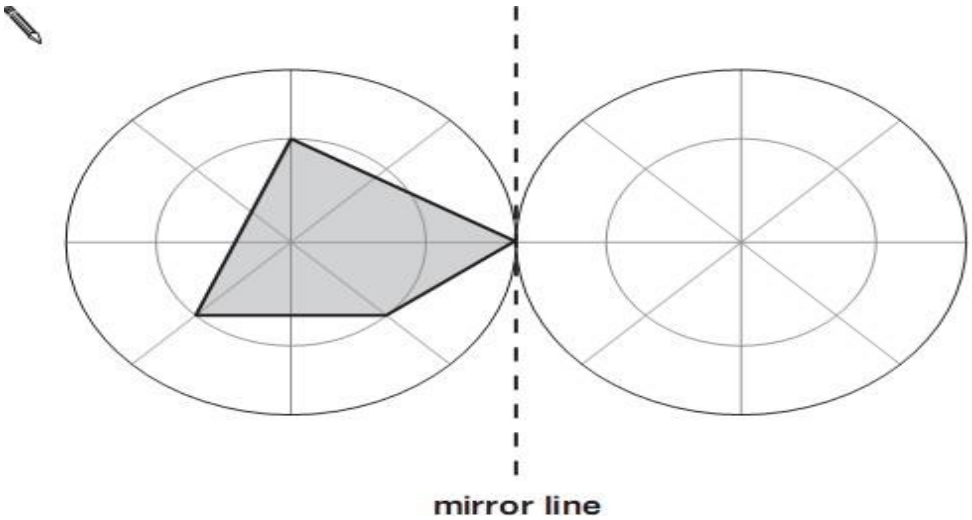
4. Here is a grid with eight squares shaded in.
Shade in **two more** squares to make a symmetrical pattern.



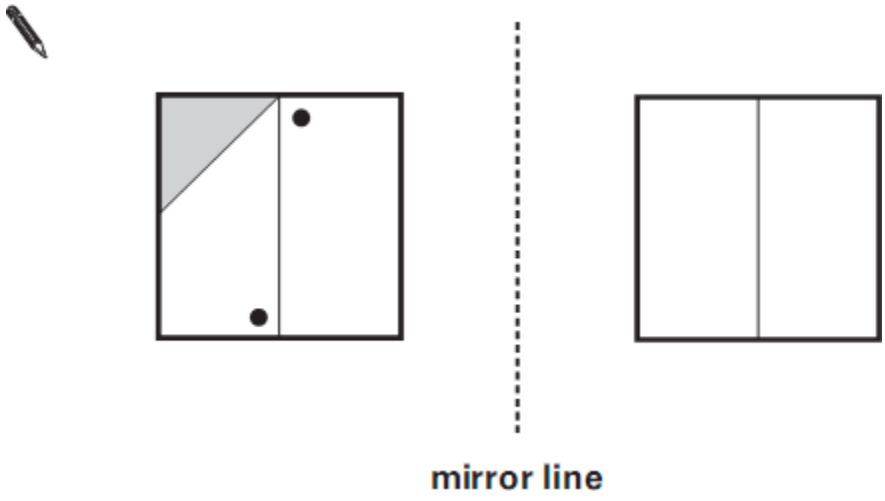
5. Here is part of a shape on a square grid.
Draw **two more** lines to make a shape which has a line of symmetry.
Use a ruler.



6. Draw the reflection of the shaded shape in the mirror line.
Use a ruler.

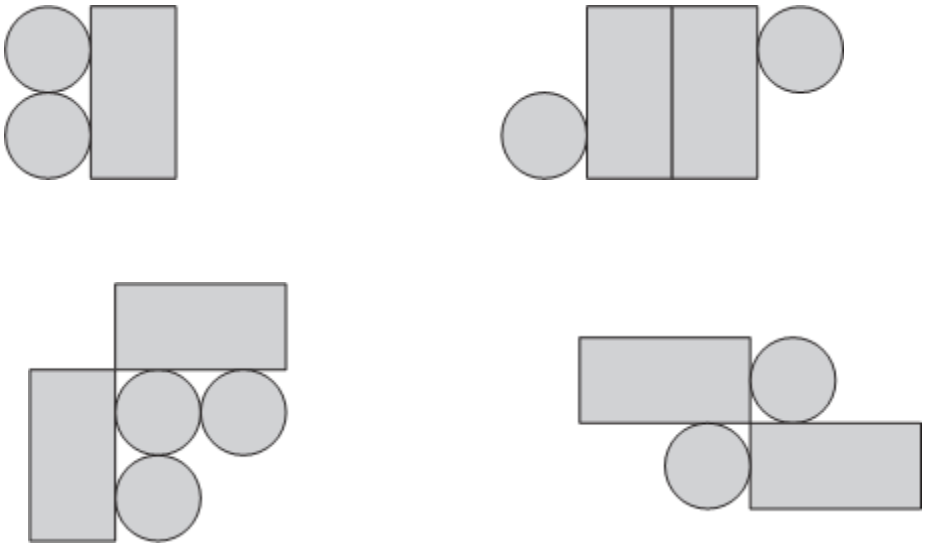


7. Here is a square with a design on it. The square is reflected in the mirror line.
   Draw the missing triangle and dots on the reflected square.
   You may use a mirror or tracing paper.

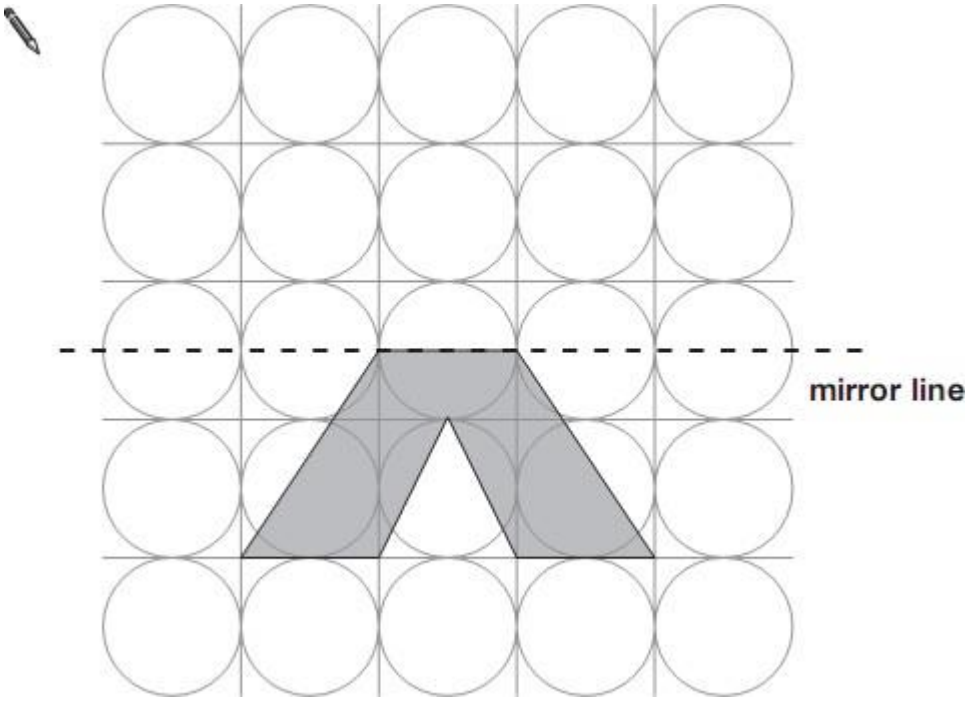


8. Which of these flags have a line of symmetry?

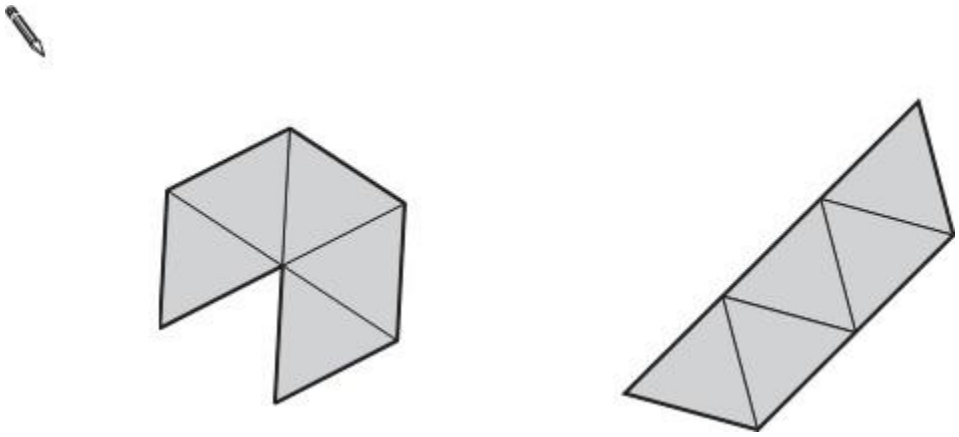
9. Which of these shapes have a line of symmetry?



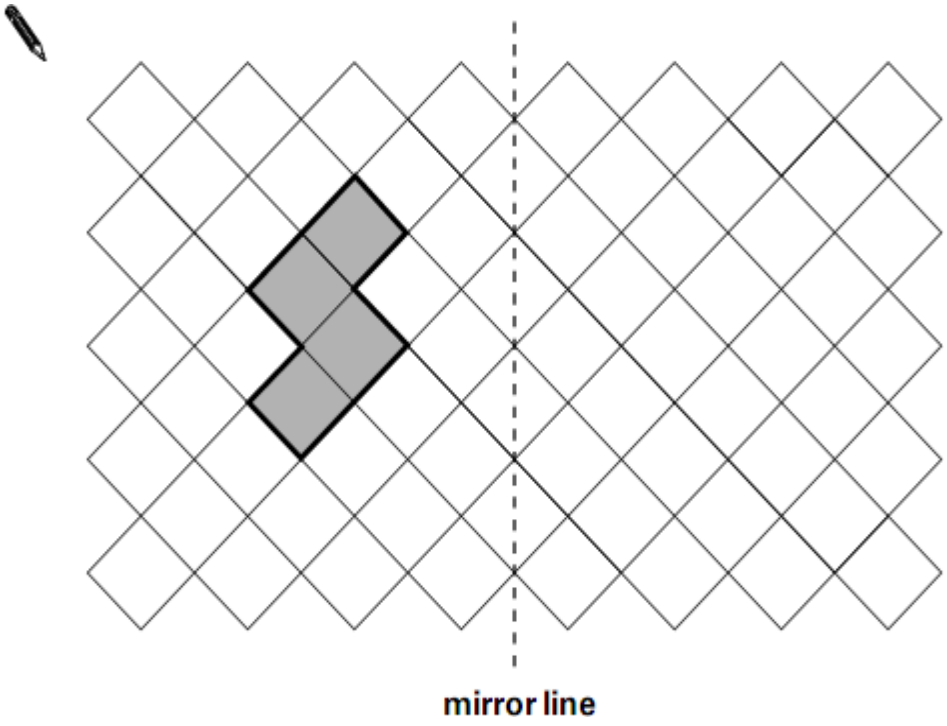
10. Draw the reflection of the shaded shape in the mirror line.



11. Draw **one** line of symmetry on each shape.
The shapes are made from equilateral triangles.
Use a ruler.

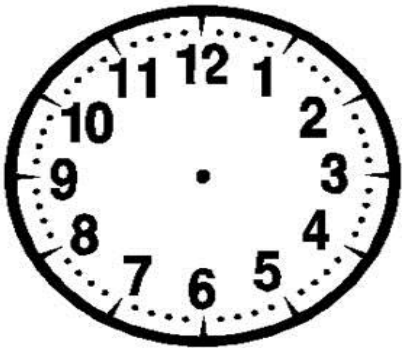


12. Draw the **reflection** of the shaded shape in the mirror line.
You may use a mirror or tracing paper.



TIME

Before we begin, make sure you can answer these questions:



- ✓ How many seconds are there in 1 minute?
- ✓ How many minutes are there in 1 hour?
- ✓ How many hours are there in 1 day?
- ✓ How many days are there in 1 week?
- ✓ How many weeks are there in 1 month?
- ✓ How many months are there in 1 year?

1. Ryan walks to school each morning. He leaves at 8.05 and arrives at 8.40. How many minutes does it take Ryan to walk to school?

2. Ryan walks home after school each day. He leaves at 3.15. He always stops for 10 minutes to buy a ginger bread man. What does Ryan get home?

3. Ryan decided to run to school for 5 days. Here are his times:
   30 mins - 28 mins - 26 mins - 31 mins - 30 mins.
   Explain how you would calculate the mean (average) time he took that week.

4. The train from Whitstable to London Victoria usually takes 1 hour 30 minutes. On Tuesday, it was delayed at Faversham for half an hour. It left Whitstable at 10.30am. What time did it reach London Victoria?

5. On Sports Day, here are the top times in the 100 metres race:
   Kieran – 17.2 secs Jake – 15.5 secs Spike - 15.6 secs Adam - 19.7 secs

   1. Who finished first?
   2. Who finished in third place?
   3. Which boys nearly had a photo-finish?
   4. By how much time did Kieran beat Adam?
   5. By how much time did Jake beat Kieran?

6. Taz helps his dad in their shop every weekday. For this he gets £2 every time.
   How much does Taz earn every 3 weeks?

7. The play starts at 6.45pm. It lasts 2 hours 15 minutes. There is a 15 minute interval. What time do people leave the theatre?

8. Timetable

Edinburgh	–	09:35	–	–	13:35	–	–
Glasgow	09:15	–	11:15	13:15	–	13:45	15:15
Stirling	09:57	–	11:57	13:57	–	14:29	15:57
Perth	10:34	10:51	12:34	14:34	14:50	15:15	16:35
Inverness	–	13:10	–	–	17:05	–	–

1. What time does the first train from Edinburgh arrive at Inverness?
2. How does the train from Edinburgh take to reach Inverness?
3. What time does the 13.35 from Edinburgh reach Perth?
4. Does any Edinburgh train stop in Glasgow?

9. On the Radio

7:00	Music show
7:55	Weather report
8:00	News
8:15	Travel news
8:25	Sport
8:45	Holiday programme

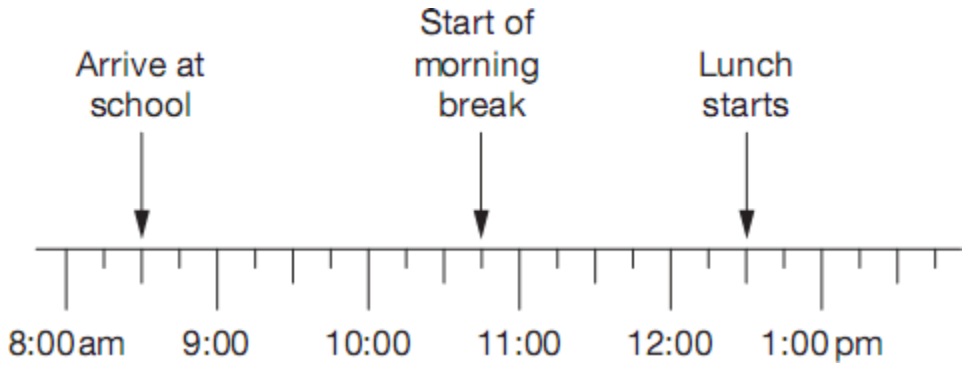
1. Josh turns on the radio at 7.25am. How long must he wait for the Weather Report?
2. Except for the Holiday programme, which programme last longest?
3. Why can't we say which is longer – Music Show or Holiday programme?

10. **24 hour clock** - Express these times in the 24 hour clock.

(a) 10am (b) 11.45am (c) 12 lunchtime (d) 2.15 pm (e) 8.45pm

11. Time Line

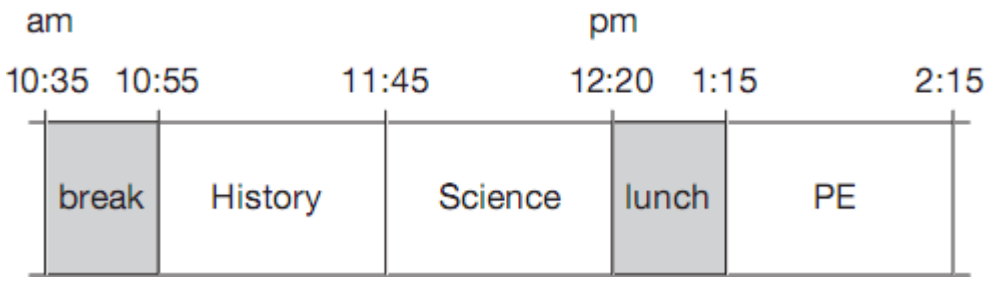
Jamie makes a time line of part of his day.



1. What time does Jamie arrive at school?
2. If lessons start at 9 am, how long does Jamie wait till it's morning break?
3. If Jamie has lunch at Second Sitting, what time does he have lunch?
4. If afternoon lessons begin at 1.30pm and end at 3.15pm, how long does school last in the afternoon?

12. Another timetable

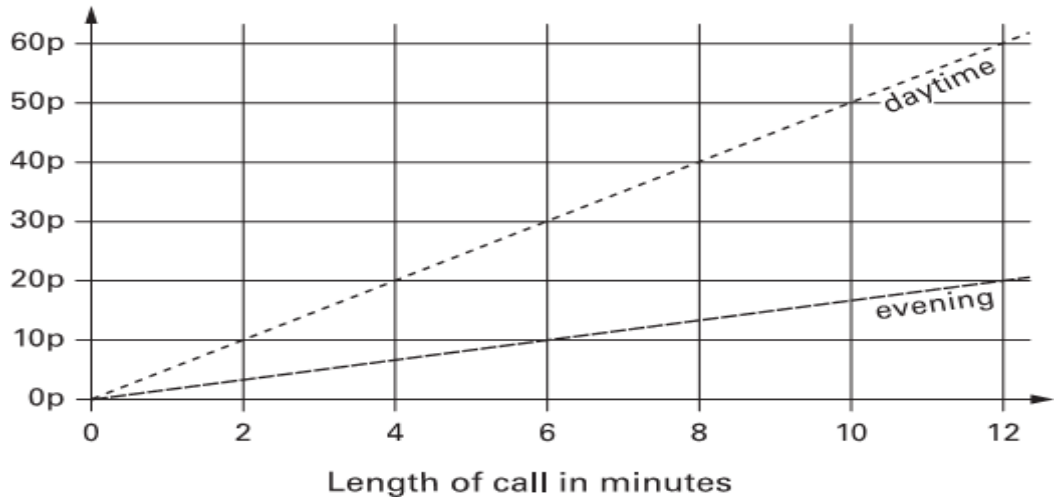
Here is part of the timetable for Year 6 on a Monday



1. How long do the children have for break?
2. How long is a History lesson?
3. How long is a Science lesson?
4. How long is a PE lesson?
5. What is the average (mean) length of each lesson?

13. Time to Make a Call

This graph shows the cost of phone calls in the daytime and in the evening.



1) How much does it cost to make a 6 minute call in the evening?
2) How much does it cost to make an 8 minute call in the evening?
3) How much does it cost to make a 10 minute call in the day time?
4) If I make a 2 minute call in the daytime, and a 12 minute call in the evening, how much will the calls cost me altogether?
5) How much more does it cost to make a 6 minute call in the daytime than in the evening?

14. 30 days hath September, etc.

March 23rd is a Bank Holiday Monday, on what day of the week is April 1ST?

15. Which expression is correct?

Tom earns £X per day. He works 3 days a week. He also gets £Y per week as a bonus. If he works for 6 weeks, which one of the following is correct?

Tom earns 6X + 3Y Tom earns 18X + 6Y Tom earns 3Y + 18X

16. A very long walk

This was the time on Selin's watch when she **set off** for a walk.

1. What time did the watch show 20 minutes **before** this?
2. What time did it show an hour and a half **after** she set off for the walk?
3. Selin got home at 15.00 hours. How l**ong** did her walk take?

17. Time after Time

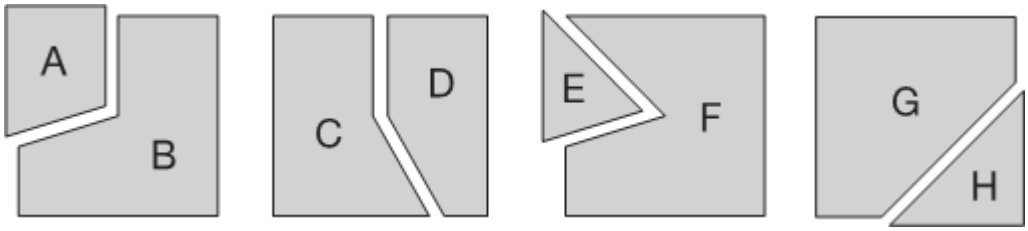
12:30am 12:30pm 11:30am 11:30pm 3am

1. Which time is 30 minutes **before** midnight?
2. Which time is 30 minutes **after** midnight?
3. Express all these times using the **24 hour** system.

WORKING WITH SHAPES

1. Hexagons and pentagons

Each of these four squares has been cut into two new shapes.

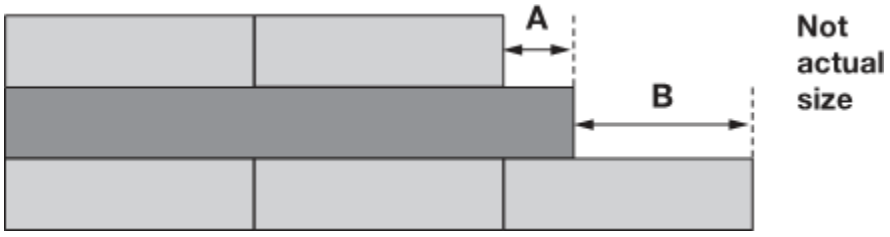


1. Write the letters of all the new shapes that are hexagons.
2. Write the letters of all the new shapes that are pentagons.

2. Rectangles

Liam has two different sizes of rectangles.

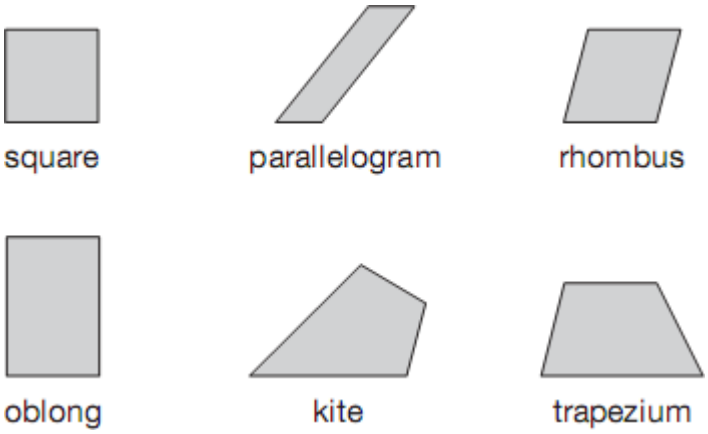
He makes this pattern with them.



Calculate the lengths of **A** and **B**.

3. Quadrilaterals

Here are six quadrilaterals with their mathematical names.

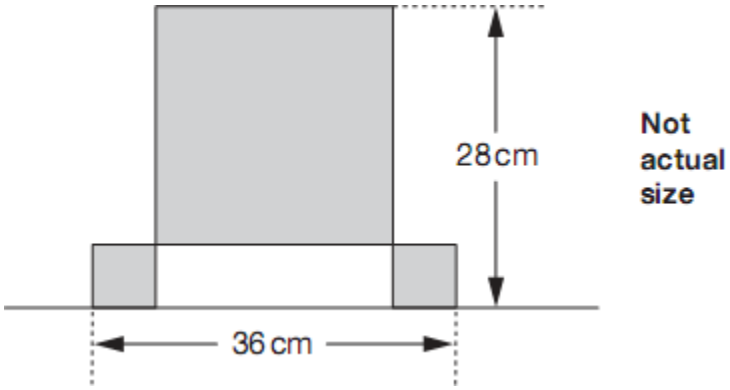


Lara chooses **one** of the quadrilaterals.
She says, 'It has two acute angles. All four sides are the same length'.
Which quadrilateral did Lara choose?

Stefan chooses **one** of the quadrilaterals.
He says, 'It has more than one obtuse angle It has no parallel sides'.
Which quadrilateral did Stefan choose?

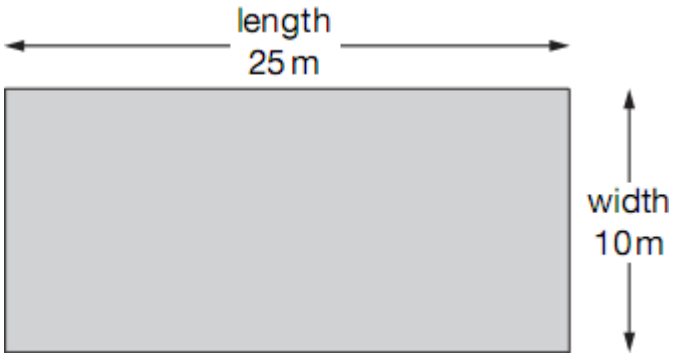
4. Squares

This design has one large square and two identical small squares.
The design measures 36 centimetres by 28 centimetres.
Calculate the length of a side of the **large** square.



5. A **rectangular** swimming pool

A rectangular swimming pool is 25 metres long and 10 metres wide.

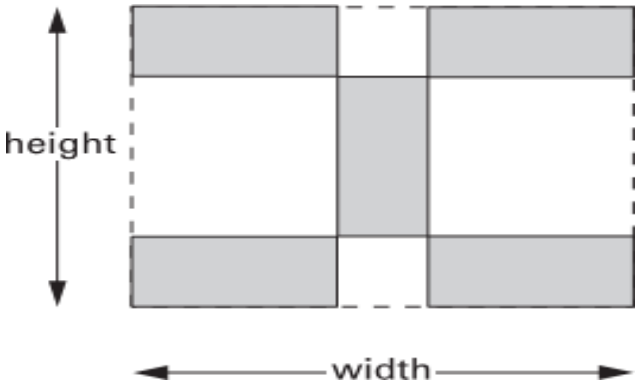


David swims **5 lengths.**
Rosie swims **12 widths**.
How **much further** does David swim than Rosie?
For 2 extra marks can you work out these:

1. What is the perimeter of the pool?
2. What is the area of the pool?

6. Even more **rectangles**

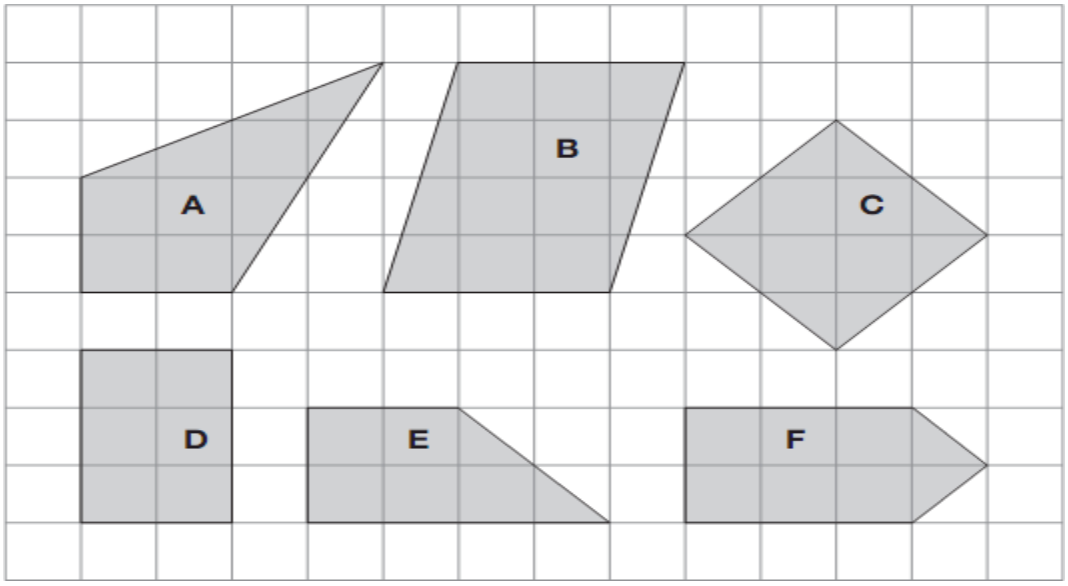
Kim has some rectangular tiles.
Each one is 4 centimetres by 9 centimetres.She makes a design with them.



Calculate the **width** and **height** of her design.

7. **Mixed shapes**

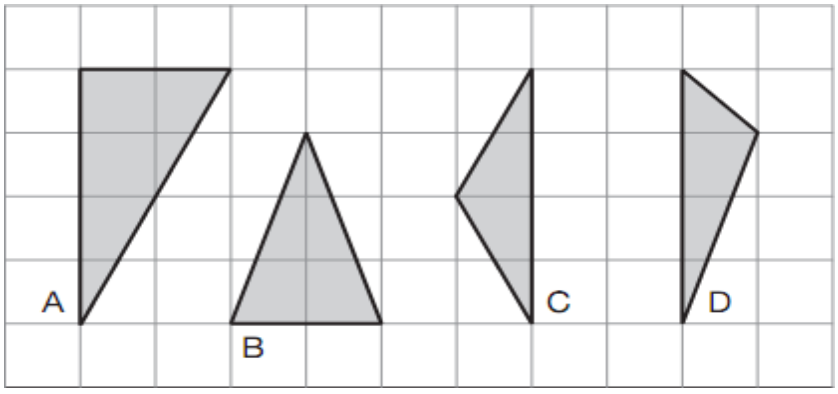
Look at these shapes.



Complete the sentences below. One has been done for you.

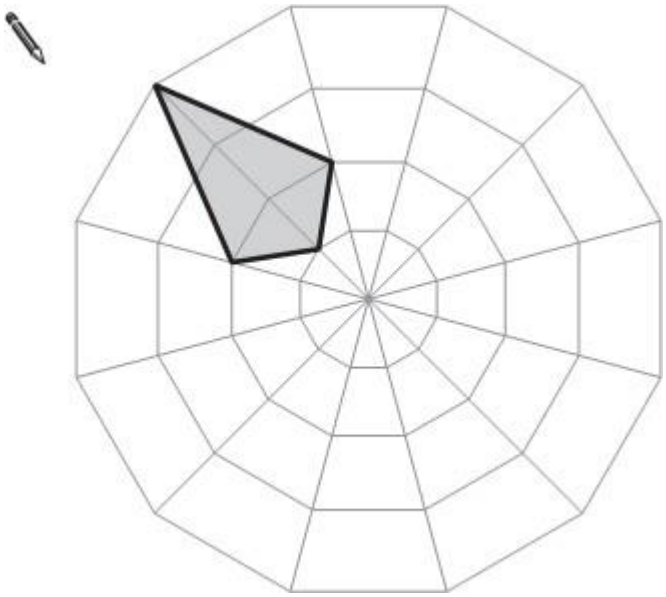
A is a kite
? is not a quadrilateral
? has only 2 right angles
? has 2 acute angles
? has equal sides and equal angles

8. **Isosceles triangles -** Identify the **two** isosceles triangles



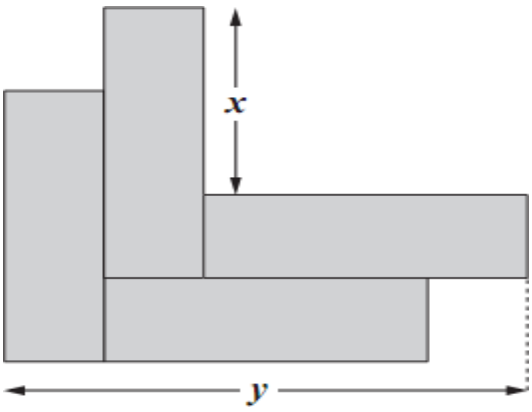
9. Rotate the shape

Here is a shaded shape on a grid.
Jamie rotates the shape 90° **clockwise** about the centre of the grid.
Draw the shaded shape in its new position.
Explain how you worked it out.



10. Even more **rectangles**!

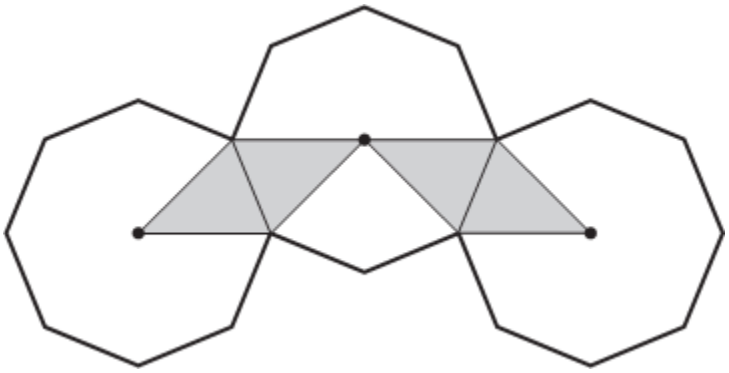
Kate has some rectangles.
They each measure 16 cm by 50 cm.
She makes this design with four of the rectangles.
Work out the lengths ***x*** and ***y*.**



11. Octagons

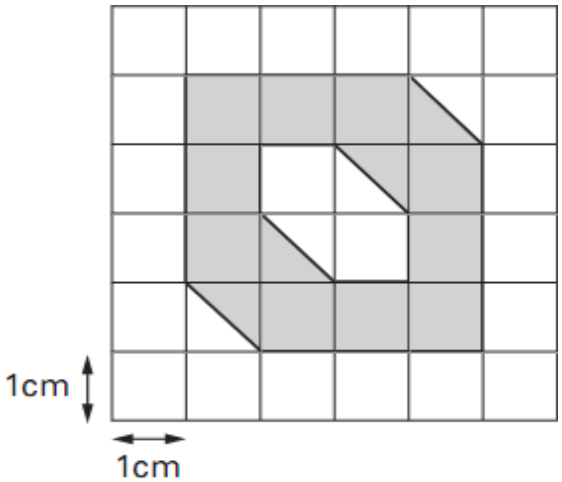
The diagram shows three regular octagons joined together.
There is a dot at the centre of each octagon.
What **fraction** of the diagram is shaded?

Hint! How many sections could be shaded in the 3 octagons all together?
How many have actually been shaded?

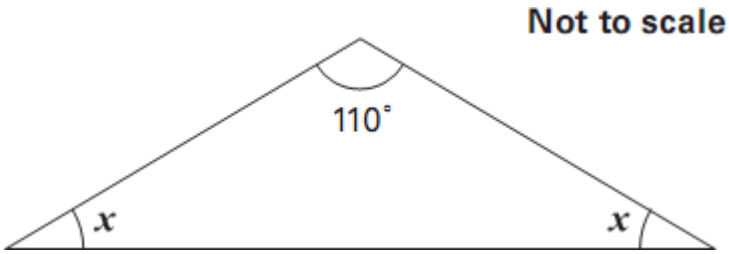


12. Squares

Here is a 1cm square grid.
Some of the grid is shaded.
What is the area that is shaded?



13. Isosceles triangle

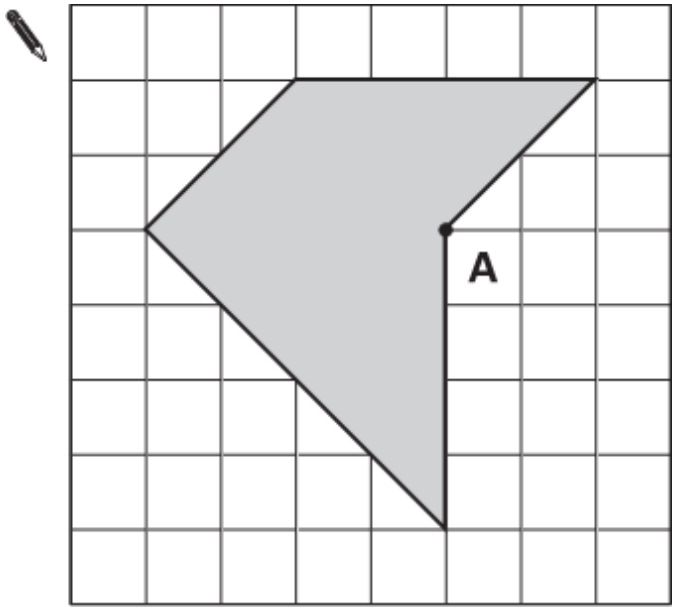


Calculate the size of angle ***x.***
Do not use a protractor (angle measurer).

$x =$ ☐ °

14. A square and two triangles

Draw two straight lines from point A to divide the shaded shape into a square and two triangles.



Magical Maths A - AREA AND PERIMETER

1. The new carpet

Mrs. Shilling has bought a new carpet.
It measures 5 metres by 4 metres.

What is the area of the carpet?

1. What is the perimeter of the carpet?
2. Yes or no? Is 2x + 2y = p an appropriate formula for the perimeter?
3. What would be the formula, using x and y, for the area?

2. Millie's tiles

Millie has some star-shaped tiles.
Each edge of a tile is 5 centimetres long.
She puts two tiles together to make this shape.

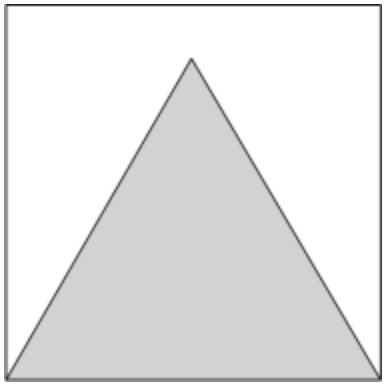
Work out the perimeter of Millie's shape.

3. From area to perimeter

1. If the area of a square is 16 square centimetres, how long is the perimeter?
2. If the area of a square is 25 square metres, how long is the perimeter?
3. If the area of a square is 81 square inches, how long is the perimeter?
4. If the area of a square is 144 square feet how long is the perimeter?
5. If the area of a square 49 square *X*, how long is the perimeter?

4. Work itout

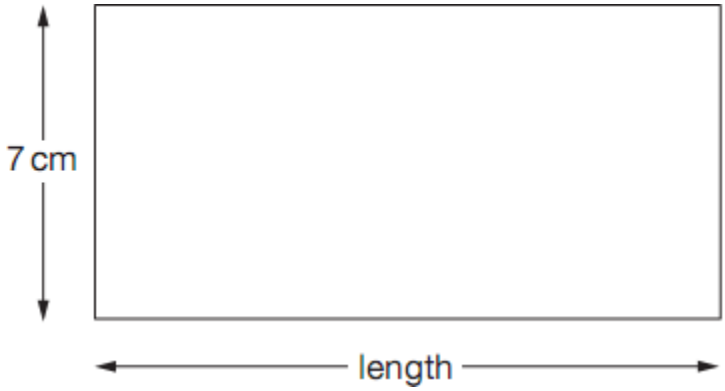
Here is an **equilateral** triangle inside a square.



The perimeter of the triangle is 48 centimetres.

1. What is the length of each side of the triangle?
2. What is the perimeter of the square?
3. What is the area of the square?

5. Calculate and show your workings



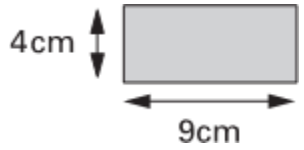
1. What is the perimeter of the rectangle?
2. What is the area of the rectangle?

6. From perimeter to area

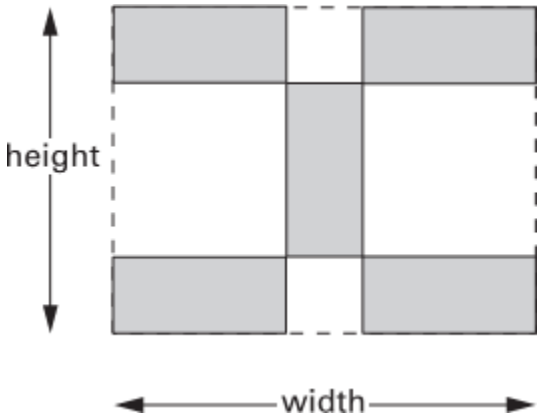
1. If the perimeter of a square is 16 feet, what is its area?
2. If the perimeter of a square is 24 inches, what is its area?

7. Work them out - read carefully!

Kim has some rectangular tiles.
Each one is **4 centimetres** by **9 centimetres**.



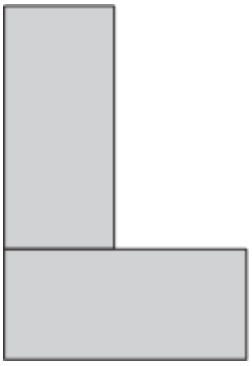
She makes a design with them.



1 Calculate the height and width of Kim's design.
2 Calculate the area of the **tiles** she has used.
3 Calculate the perimeter around the tiles she has used.

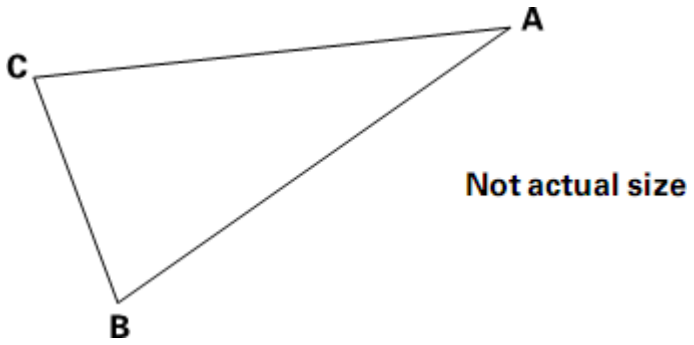
8. Perimeter, please?

What is the perimeter of this shape, if you know that each rectangle is 11cm by 5cm?



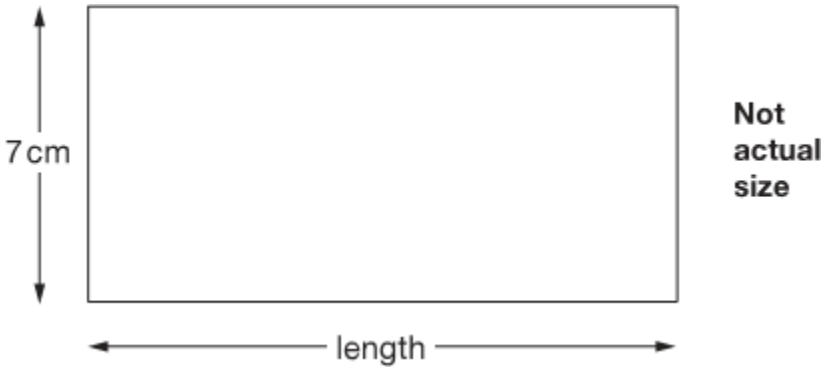
9. An isosceles triangle

Triangle **ABC** is isosceles and has a perimeter of 20 centimetres. Sides **AB** and **AC** are each twice as long as **BC**.



Calculate the length of the side **BC**.
Do not use a ruler.

10. Another rectangle



The perimeter of this rectangle is 50 centimetres.

1. Calculate the **length** of the rectangle.
2. Calculate the **area** of the rectangle.
3. Using x and y, what is the formula for calculating **area**?
4. Using x and y, what is the formula for calculating **perimeter**?

FRACTIONS

A **fraction** simply means a part of the whole. So if I have a cake and I want to give four people the same amount, I will divide it up into four equal pieces and I will give each person a quarter or ¼ of the cake. If there are two of us, I will divide the cake into two equal pieces and give you a half or ½ and each the other ½ myself.

The **denominator** is the bottom part of the fraction. The denominator tells us how many parts the 'thing' has been divided into. The top part of the fraction is called the **numerator**. The numerator tells us how many pieces there are in the fraction.

We have a box of gingerbread men. There are 5 men in the box. Each man is 1/5 of the contents of the box.

$\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{5}$ $\frac{1}{5}$

As you can see, 3/5th of the men are brown, and 2/5th of the men are pink.

So the **denominator** for these fractions are 5 (because there are 5 equal parts),
And the **nominators** are 1, 3, and 5 (1/5th – 3/5th – 3/5th).

Proper fractions have the nominator part **smaller** than the denominator,
$\frac{1}{2}$, $\frac{2}{5}$ or $\frac{19}{20}$

Improper fractions have the nominator **greater or equal** to the
$\frac{5}{5}$ $\frac{7}{2}$ denominator, or

Mixed fractions have a **whole number *plus* a fraction**, for example **2** $\frac{1}{3}$ $\frac{19}{20}$ or **123** **.**

1. **Simplify or Reduce** fractions

1. Tom has 16 cards. He gives Tara 8 cards. What fraction of the cards does Tom have? What fraction of the cards does Tara have? Simplify the fractions.

2. Tom has 12 cards. He gives Tara 3 cards. What fraction of the cards does Tom have? What fraction of the cards does Tara have? Simplify the fractions.

3. Tom has 27 cards. He gives Tara 9 cards. What fraction of the cards does Tom have? What fraction of the cards does Tara have? Simplify the fractions.

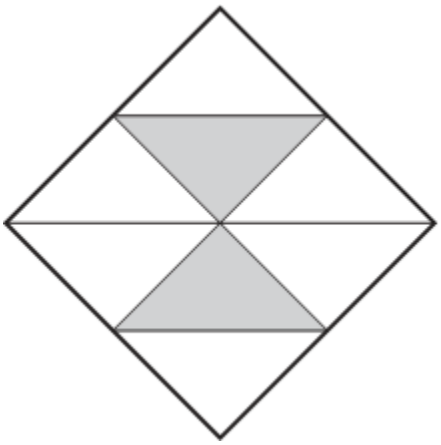
2. Work out the number

1. Tara has 12 cards. She gives Tom a quarter of them. How many does Tom have?
2. Tara has 18 cards. She gives Tom two thirds of them. How many does Tom have?
3. Tara has 52 cards. She gives Tom three quarters of them. How many does Tom have?
4. Tara has 16 cards. She gives Tom five eighths of them. How many does Tom have?
5. Tom has 17 chips. He gives Tara half of them. How many chips does each person get?

3. What is the number?

1. Three-quarters of a number is 48. What is the number?
2. Two-thirds of a number is 8. What is the number?
3. Five-twelfths of a number is 10. What is the number?
4. Seven-eighths of a number is 14. What is the number?
5. Ten-twentieths of a number is 50. What is the number?

4. What fraction of the square is shaded?



5. Calculate.....

Calculate **5%** of **£3600**

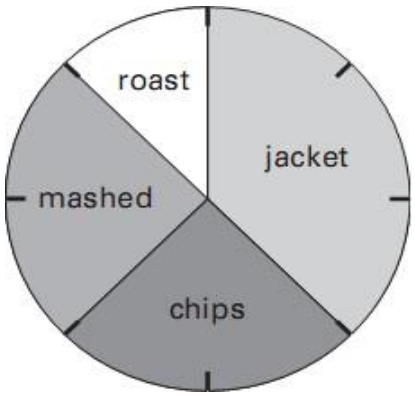
6. Smallest to largest

Write these fractions in order of size starting with the smallest.

$\frac{3}{4}$ $\frac{3}{5}$ $\frac{9}{10}$ $\frac{17}{20}$

7. Correct or not correct?

This pie chart shows how children in Class 6 best like their potatoes cooked.



32 children took part in the survey.
Look at the 4 statements below.

For each statement put a tick (✓) if it is **correct**.
Put a cross (✗) if it is **not correct**.

10 children like chips best. ☐

25% of the children like mashed potatoes best. ☐

$\frac{1}{5}$ of the children like roast potatoes best. ☐

12 children like jacket potatoes best. ☐

8. Peanuts

Emily makes 250 grams of a snack mixture.
15% of the weight is raisins, 25% is banana chips and the rest is peanuts.

How many grams of **peanuts** does she use?

9. Fractions of an hour

What fraction of an hour is (1) 6 minutes (2) 12 minutes (3) 15 minutes
(4) 30 minutes (5) 45 minutes.

10. Calculate the difference.

Calculate the difference between 20% of £20 and 20% of £100.

11. Circle the fraction

Circle the fraction which is **not** equivalent to $\frac{3}{5}$.

$$\frac{12}{20}, \quad \frac{30}{50}, \quad \frac{18}{30}, \quad \frac{21}{35}, \quad \frac{9}{25}, \quad \frac{27}{45}$$

12. Louis' sweets

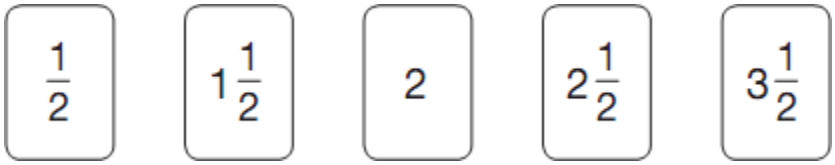
1. Louis has a bag of sweets. He eats half of the sweets, then eats another quarter of the sweets. What fraction of the sweets are left?
2. If Louis started out with 32 sweets, how many has he got left?

13. How many?

In the test there were 50 questions. You got 90% correct.
How **many** did you get correct?

14. Correct calculation, please.

Here are five number cards.



Use **three** of the number cards to make this calculation correct.

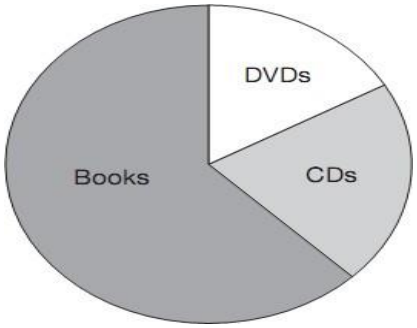
14. Circle , please.

Circle the fraction that is greater than $\frac{1}{2}$ but less than $\frac{3}{4}$

$\frac{7}{8}$ $\frac{2}{5}$ $\frac{1}{3}$ $\frac{5}{8}$ $\frac{3}{6}$

15. **Estimate** the fraction

A shop sells books, CDs and DVDs.
This pie chart shows the sales each week.



Estimate the **fraction** of the total sales that were DVDs.

In this week, 200 CDs were sold.

Estimate how many books were sold.

16. Explain…..

If you know **40%** of a number, explain how you could work out the original number.

17. Explain…..

Which is larger, $\frac{1}{3}$ or $\frac{2}{5}$?

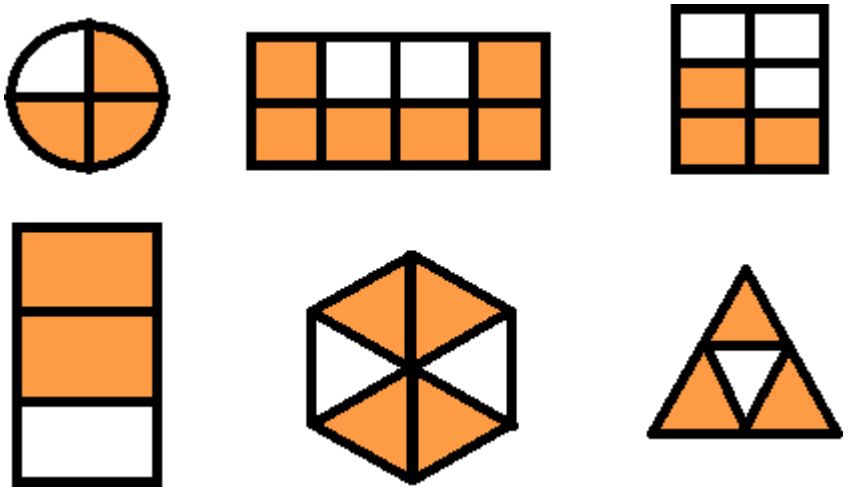
Explain how you know.

18. Lucy's marbles

Lucy's Mum gave her a bag of marbles.
Lucy lost 2 of the marbles. She gave ½ of the rest of the marbles to Suzie to play with. Suzie gave 1/3 of the marbles Lucy gave her to Adam. Adam got 7 marbles.

How many marbles did Lucy's mum give her?

19. Circle all the shapes with 2⁄3 (two thirds) shaded.



20. Circles, please

1. Circle the two fractions that are equivalent.

3/5	**3/12**	**6/12**	**3/8**	**2/8**	**3/9**

2. Circle the equivalent decimal **0.25 0.4 0.75 0.2 0.3 0.5 0.6**

21. Complete the fractions

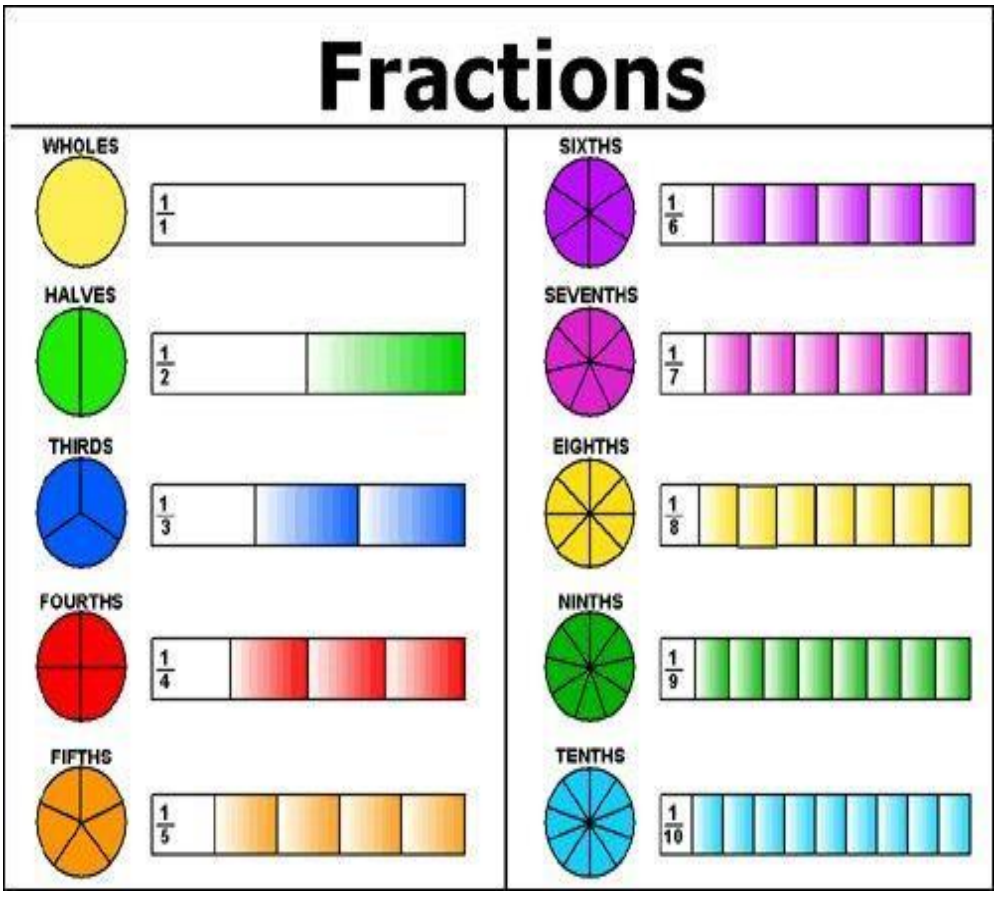
Complete these fractions to make each equivalent to $\frac{3}{5}$

$\frac{?}{10}$ $\frac{?}{15}$ $\frac{12}{?}$

22. More equivalent fractions

Two of the fractions below are equivalent.
Circle them.

$\frac{2}{3}$ $\frac{6}{10}$ $\frac{9}{12}$ $\frac{10}{15}$ $\frac{16}{20}$



MONEY MONEY MONEY

1. **From smallest to largest**

   Put these prices in order from the smallest to the largest

   72p £2.70 £0.27 £7.20 £2.07

2 **How much money altogether?**

   In his pocket, Danny has 3 fifty pence pieces, 4 twenty pence pieces, 6 ten pence pieces, 5 five pence pieces and a £1 coin.
   How much money does he have in his pocket altogether?

3. **How much change?**

   Bacon & Onion crisps cost 50p per packet.
   Sally bought 5 packets for herself and her friends.
   How much change did she get from a £5 note?

4. **How much did the tickets cost?**

   Mr. and Mrs. Jones take their 3 children to the cinema. Tickets cost £5 for an adult. Children's tickets cost half the price of an adult ticket.
   How much do the tickets cost the Jones' family?

5. **How much do they earn?**

   Barbie earns £23,500 a year and her partner Ken earns £700 less than Barbie.
   How much do the couple earn altogether?

6. **Find the cost**

   If 250 grams of pasta cost 30p, find the cost of 1 kilogram.

7. Answer the questions

This table shows how many journeys Joe, a taxi driver, made on five days and how much money he collected.

	number of journeys	money collected
Monday	23	£85
Tuesday	36	£112
Wednesday	18	£69
Thursday	31	£124
Friday	35	£109

1. On which day did Joe make most money?
2. On which day did Joe make least money?
3. How much money did Joe make on his busiest day?
4. How much money did Joe make on his least busy day?
5. How much more money did Joe make on Thursday than on Wednesday?

8. How much change?

Jon's mother gave him £20 to buy some animal food. Jon bought a bag of dog food priced £2.99, some hamster treats priced 89p, and some fish food priced £1.76. How much change did Jon get from the £20?

9. How much did I pay?

The Co-op had a sale of bottles of lemonade. The normal price is £1 per bottle. In the sale the price was reduced by 25%. I bought 10 bottles.
How much did I pay for them?

10. Calculate, please.

Calculate **5%** of **£3600**

11. How much for a racquet?

The sports shop is offering Wilson tennis racquets at 20% less than the usual price which is £50. How much does each racquet cost now?

12. How much do they pay?

Sandwiches		Drinks		Fruit	
cheese	£1.45	milk	55p	apple	15p
tuna	£1.70	cola	45p	pear	20p
salad	£1.20	juice	65p	melon	25p

Adam, Emily and Mary buy things to have a snack. The price list is above. Work out how much money each person spends.

1. Adam buys a salad sandwich, cola and a melon.
2. Emily buys a tuna sandwich, milk and two apples.
3. Mary buys a cheese sandwich, juice and a pear.
4. How much do the children spend altogether?

13. Candles, please.

1. What's the cost of 2 plain candles and 2 stripe candles?
2. What's the cost of 2 plain candles, 1 star candle, and 2 stripe candles?
3. If I buy 1 candle of each type, what change do I get from a £5 note?
4. Special Offer – Buy 10 candles of any type and get 50p off!
   Using the Special Offer, how much will 10 star candles cost me?

14. Show your working

A torch costs £7.65p

Kate buys a torch and two batteries.

She pays £8.75 altogether.

How much does **one** battery cost?

15. Show your working

A shop sells note books and pens.

Hasan bought a notebook and a pen. He paid £1.10p.

Kate bought a notebook and two pens. She paid £1.45.

How much does **one** battery cost?

16. Work out the cost

An iced cake costs 10p more than a plain cake.

Sarah bought two of each cake.

They cost £1 altogether.

What is the cost of an **iced** cake?

17. Show your working

Big Wheel £2.50 each ride	Rollercoaster £1.50 each ride

Liam spends £14 altogether on the Big Wheel and the Rollercoaster.
He goes on the Big Wheel twice.

How many times does he go on the Rollercoaster?

18. Work them out

1. What is 10% of £100?
2. What is 25% of £100?
3. What is 75% of £100?
4. What is 15% of £100?
5. What is the **total** of these four sums?

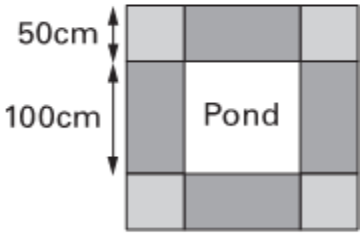
19. Show your working

Mr. Singh buys paving slabs to go round his pond.

PAVING SLABS

£1.95 each — Square slabs 50cm by 50cm

£3.50 each — Rectangular slabs 100cm by 50cm



He buys 4 rectangular slabs and 4 square slabs.

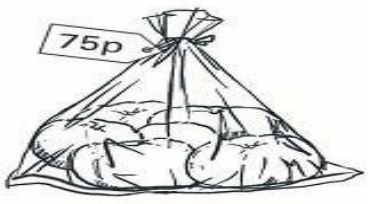
What is the total cost of the slabs he buys?

Mr Singh says,

'It would cost more to use square slabs all the way round.'

Explain why he is correct.

20. Show your working



6 green apples for 75p

10 red apples for 90p

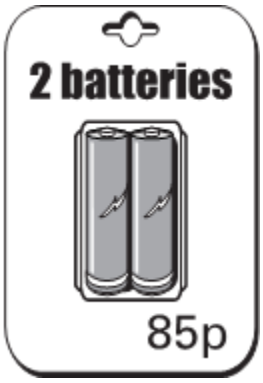
Jason bought some bags of green apples and some bags of red apples.

He spent **£4.20**

How many **bags** of each type of apple did he buy?

21. How much for the batteries?

A shop sells batteries in **packs of four** and **packs of two**.



1. Simon and Nick want two batteries each.
   They buy **a pack of four** and share the cost equally.
   How much does each pay?

2. Mary buys **2 packs of two** batteries.
   Hamid buys **1 pack of four**.
   How much **more** does Mary pay than Hamid?

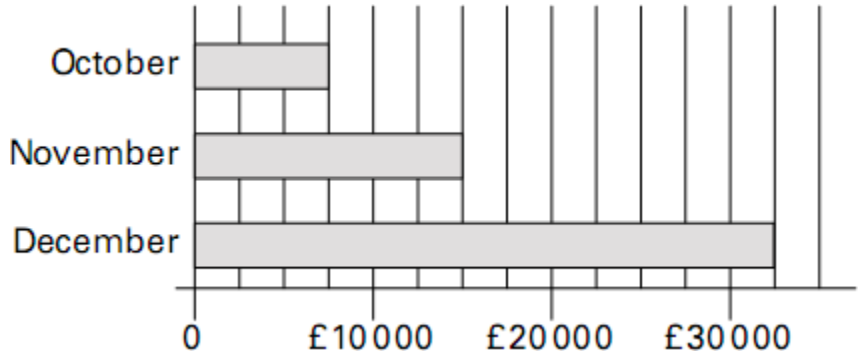
22. How much money has Lewis got left?

Lewis makes a call from a telephone box.
He has £2 in coins.
He uses these five coins to make the call.

How much money has he got **left from the £2**?

23. How much more money was spent?

This chart shows the amount of money spent in a toy shop in three months.

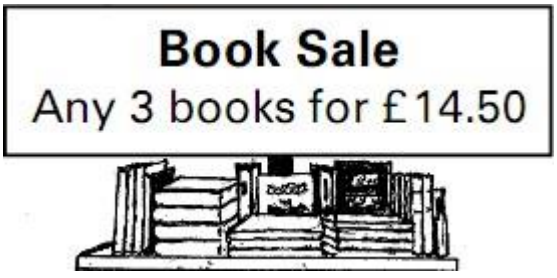


How much **more** money was spent in the shop in **December** than in **November**?

Stepan says,
'In November there was a 100% increase on the money spent in October'.
Is he correct? Circle Yes or No.

Explain how you can tell from the chart.

24. How much money did Lee save?



Lee bought these **three books** in the sale for £14.50

How much money did he save altogether compared to the **full price** of the books?

26. Amir and Lara go shopping

grapes
£2.50
for 1 kilogram

pineapples
£1.40
each

peaches
£1.99
for a box

1. Amir buys two pineapples and a box of peaches.
   How much does he pay?
2. Lara buys half a kilogram of grapes and one pineapple.
   How much change does she get from £5?

Patterns and Sequences

We often need to spot a pattern in order to predict what will happen next.

In Maths, the correct name for a pattern of numbers is called a **sequence**.

The first number in a **sequence** is called the **first term**, the second number is the **second term**, and so on.

For any pattern it is important to try to spot what is happening before you can predict the next numbers. The first two or three numbers is rarely enough to show the full pattern: 4 or 5 numbers are best.

Before we begin, try these sequences:

3, 7, 11, 15, 19, …, …
128, 64, 32, 16, 8, …, …
1000 100, 10, 1, …, …
,
5, 15, 45, 135, …, …

1 A sequence starts at **500** and **80** is **subtracted** each time.
500 420 340 ...

The sequence continues in the same way.

Write the **first two numbers** in the sequence which are **less than zero**.

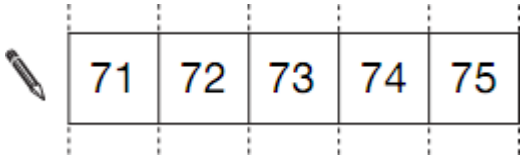
2 Liam makes a sequence of numbers starting with **300**. He **subtracts 125** each time.
Write the **next two numbers** in Liam's sequence.

300 175 50 ☐ ☐

3 Here is a sequence of numbers.

3 – 6 – 12 – 15 – 18 – 21

Which of these numbers belong in the sequence?



Explain how you worked this out.

4 The numbers in this sequence **increase by 75** each time. Write in the **two** missing numbers.

5 The numbers in this sequence increase by **7** each time.

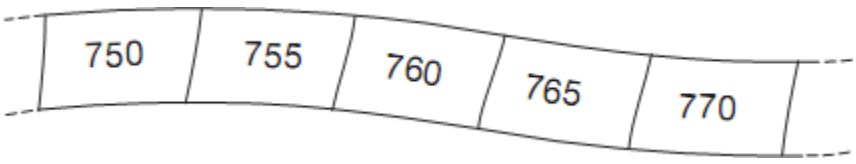
1 8 15 22 29 ....

The sequence continues in the same way.

Will the number **777** be in the sequence? Yes or No? Explain.

6 Here is part of a number sequence.

The numbers increase by the same amount each time.



The sequence continues.

Circle **all** of the numbers below that would appear in the sequence.

7 840 905 989 1000 2051

The first two numbers in this sequence are **2.1** and **2.2**
The sequence then follows the rule
'to get the next number, add the two previous numbers'
Write in the next two numbers in the sequence.

2.1 2.2 4.3 6.5 ☐ ☐

9 Ascending and descending order

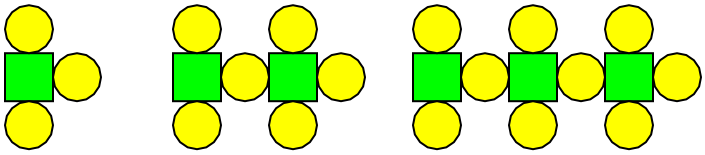
Complete the number sequences by filling in the spaces below. State whether the sequences are ascending or descending order.

1. -16, -9, -2, ___, ___ ___ ___

2. 20, 31, 42, ___, ___ ___ ___

3. 133, 130, 127, ___ ___ ___ ___

10 What comes next? **Complete the grid**.



No. of term	1st	2nd	3rd	4th	5th	6th	7th
Squares	1	2	3				
Circles	3	6	9				

Learning Intention - To recognise and extend number sequences

What are the missing numbers in this sequence?
How do you know?

58, 67, 76, 85, ?, 103, 112, ?

The missing numbers are **94** and
121. It is an ascending sequence.

The **Rule** here is **NN = LN + 9**

Remember! NN means 'Next Number'
LN means 'Last Number

So we can say: the next number in this sequence is the last (previous) number plus 9.

Can you **write down the rule** for each of these sequences?

1. 1, 2, 3, 4, 5, ?, ?
2. 1, 3, 5, 7, 9, ?, ?
3. 21, 18, 15, 12, 9, ?, ?
4. 50, 40, 30, 20, 10, ?, ?
5. 5, 11, 23, 47, 95, ?, ?

GRAPHS and COORDINATES

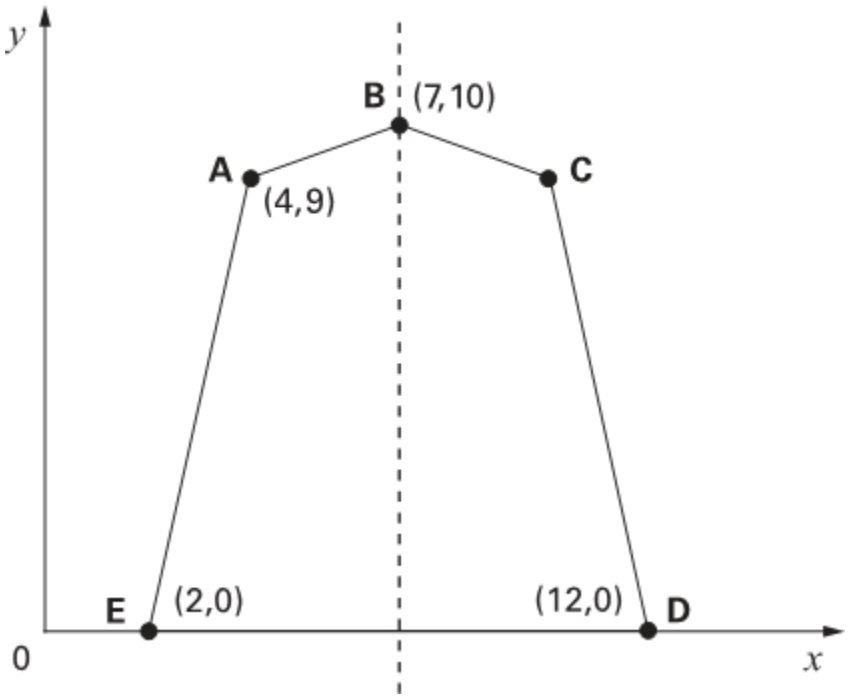
We use coordinates to allow us to pinpoint an exact location on a graph or a map. Coordinates are pairs of numbers that identify how far along (on the **horizontal**, **X axis**) and how far up (on the **vertical**, **Y axis**) the point is located.

Coordinates are written in brackets and are separated by a comma. The **first** number is the **X coordinate (along)** and the **second** number is the **Y coordinate (up)**. Here's a way to remember this. Imagine a plane taking off, along the runway and then up into the air.

When working out the position of a point we begin at the '**Origin**' - this is where the X and Y axes intersect, at zero. Therefore, the coordinates of the Origin are (0,0).

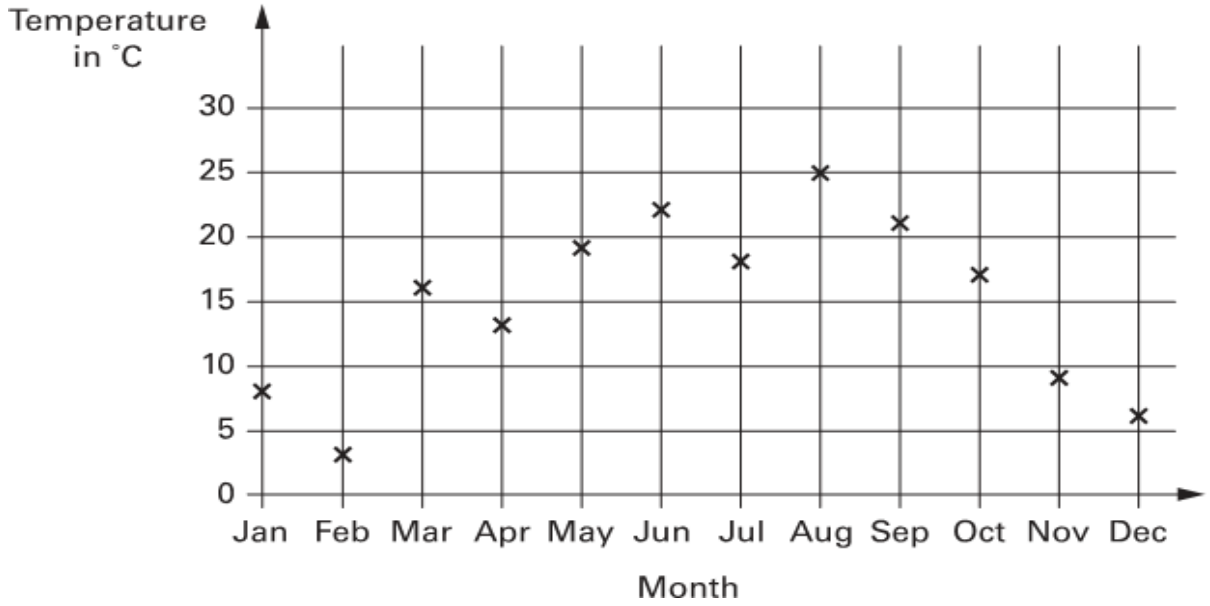
1. Name the coordinates

Here is a pentagon drawn on a coordinate grid.
The pentagon is symmetrical.
What are the coordinates of point **C**?



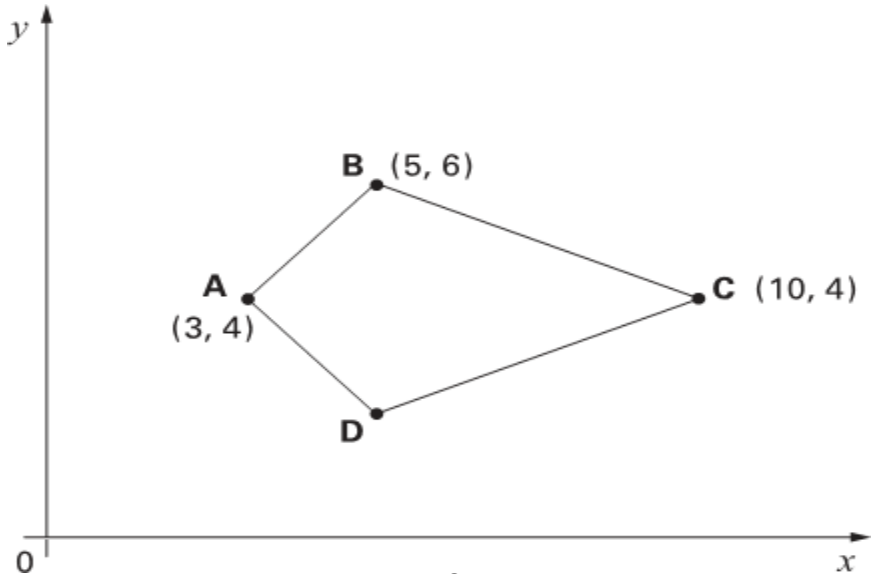
2. A temperature graph

Abbie takes the temperature outside at midday on the first day of each month. The graph shows her results from January to December.



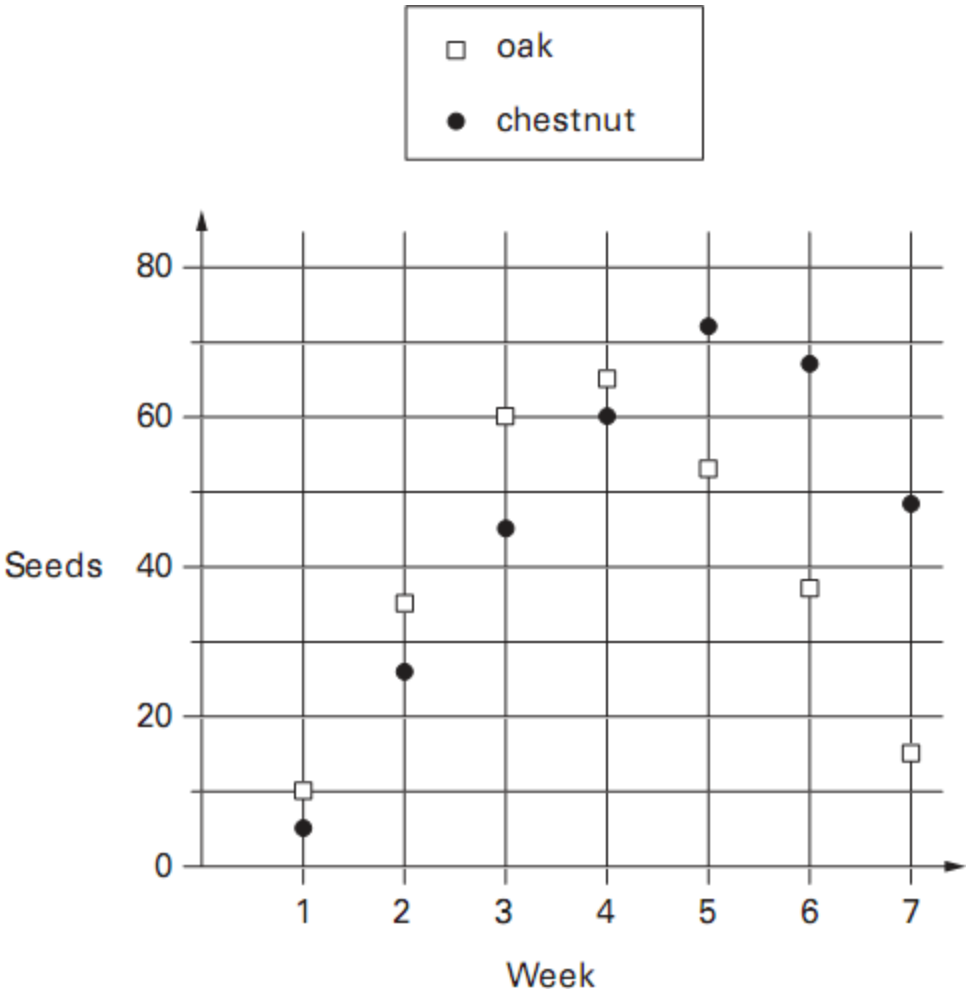
1. How many months on the graph show a temperature between **10C** and **20C** degrees?
2. Find the difference in temperature shown on the graph between **July** and **August**.

3. Name the coordinates of point D on this kite



4. A seed graph

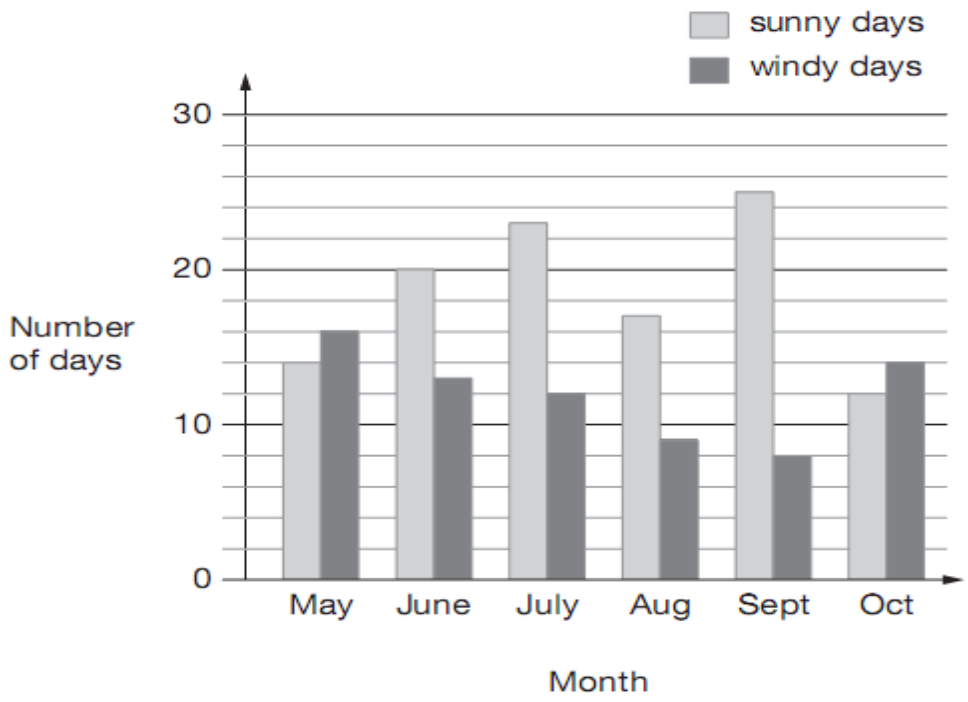
Class 6 count how many seeds they find under two trees.
They show the data in a graph.



1. In which week did they find most chestnuts seeds?
2. In which week did they find least chestnut seeds?
3. How many oak seeds did they find in Week 2?
4. How many oak seeds did they find in Week 7?
5. How many seeds did they find in Week 3 altogether?
6. In how many weeks did they find more than 40 chestnuts seeds?
7. In how many weeks did they find fewer than 40 oak seeds?
8. How many chestnuts seeds did they find altogether?
9. Which did they find more of – oak seeds or chestnut seeds?
10. Extra! Can you explain why the graph looks like it does?

5. Sunny days – windy days

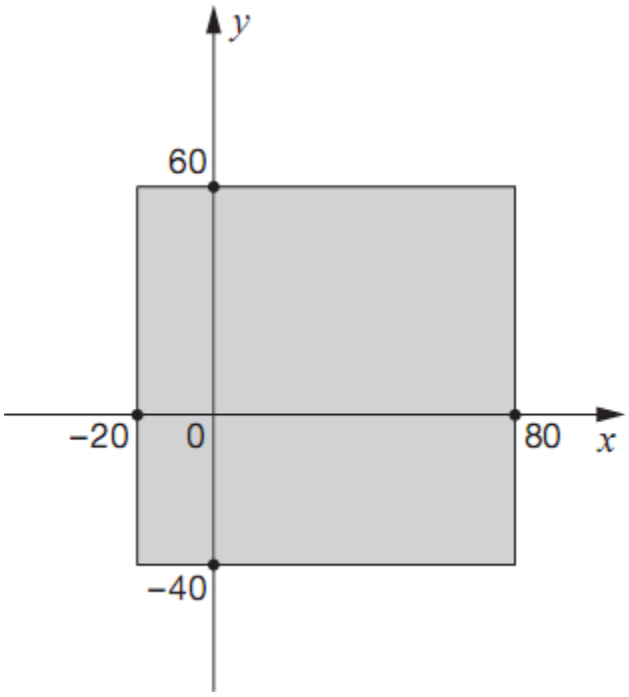
The chart shows the number of sunny days and the number of windy days in six months.



1. What was the sunniest month?
2. What was the windiest month?
3. Which months had more windy days than sunny days?
4. How many months had more than 15 sunny days?
5. How many more sunny days than windy days were there in June?

6. Tick to show your answer

Here is a shaded square on x and y axes.

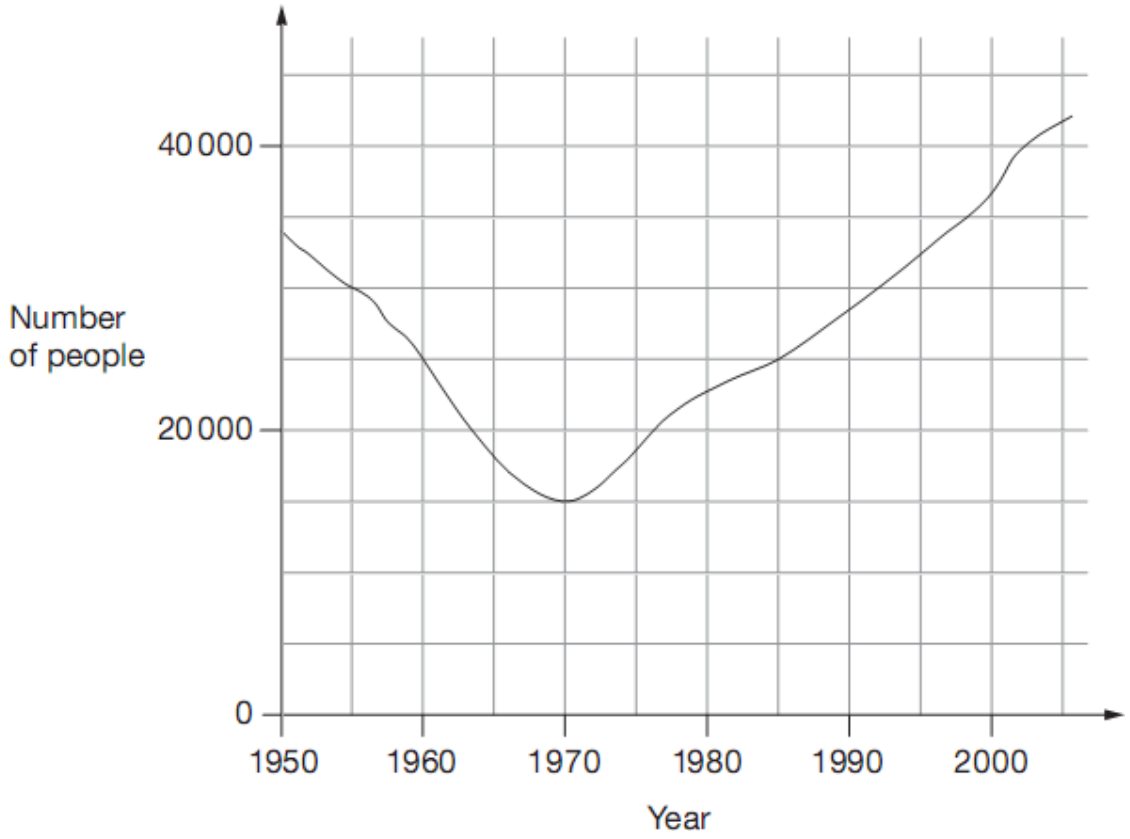


For each of these points, put a tick (✓) to show if it is inside the square or outside the square.

	inside the square	outside the square
(50, 70)	☐	☐
(60, −30)	☐	☐
(−10, 50)	☐	☐
(−30, −30)	☐	☐

7. Number of people living in a town

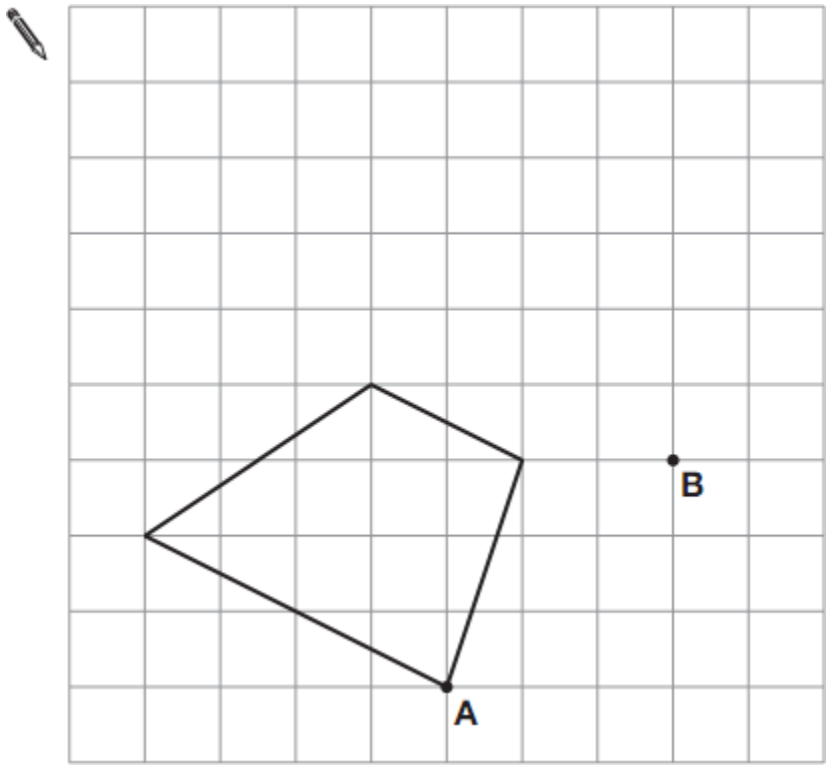
This graph shows the number of people living in a town.



1. How many people lived in the town in 1985?
2. In which year was the number of people the same as in 1950?
3. Find the year in which the number of people first went below 20,000.
4. How many people moved into the town between 1970 and 1985?
5. In what year did the population rise above 40,000?

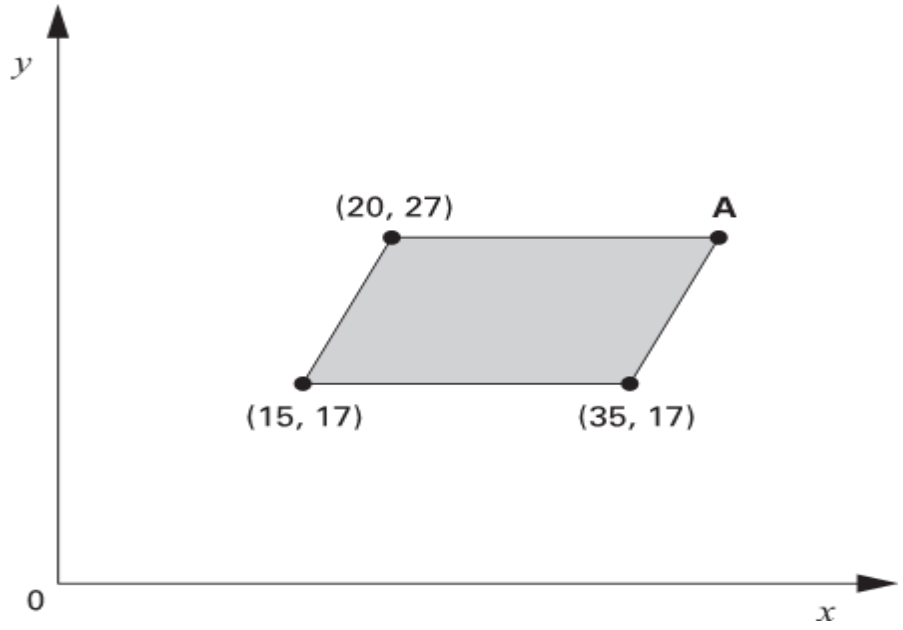
8. Move the quadrilateral

Here is a quadrilateral on a square grid.
The quadrilateral is translated so that point A moves to point B.
Use a ruler to draw the quadrilateral in its new position on the grid.



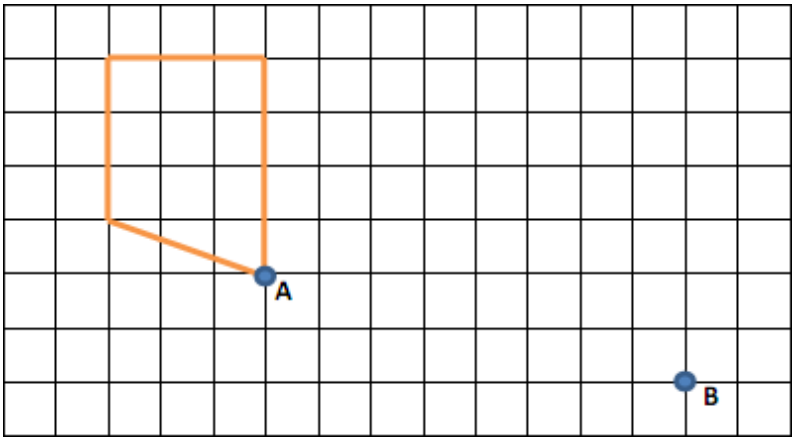
9. Name the coordinates

The shaded shape is a parallelogram.
What are the co-ordinates of point **A**?

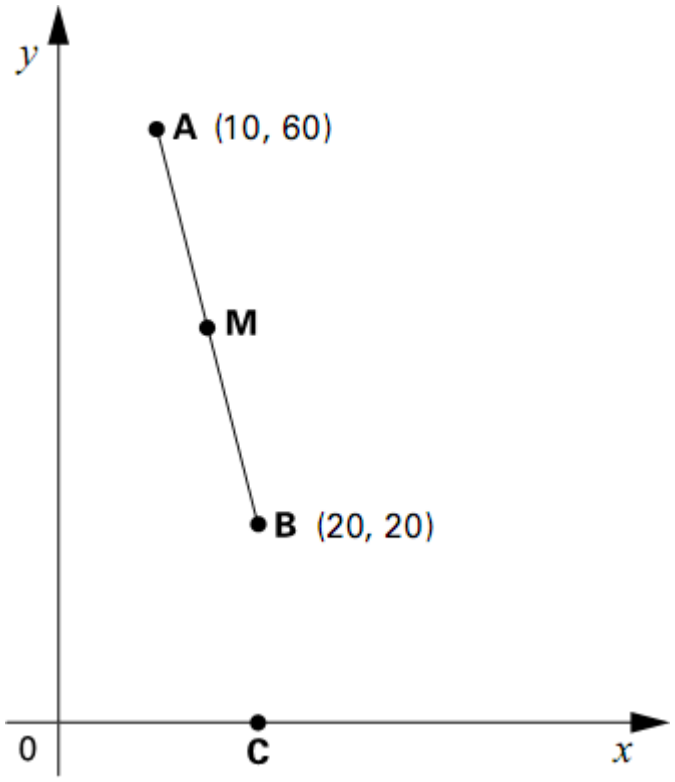


10. Move the shape

If point A on the shape is moved to point B,
draw the rest of the shape in its new position.



11. What are the coordinates?



A is the point **(10, 60)**

B is the point **(20, 20)**

M is the midpoint of line AB.

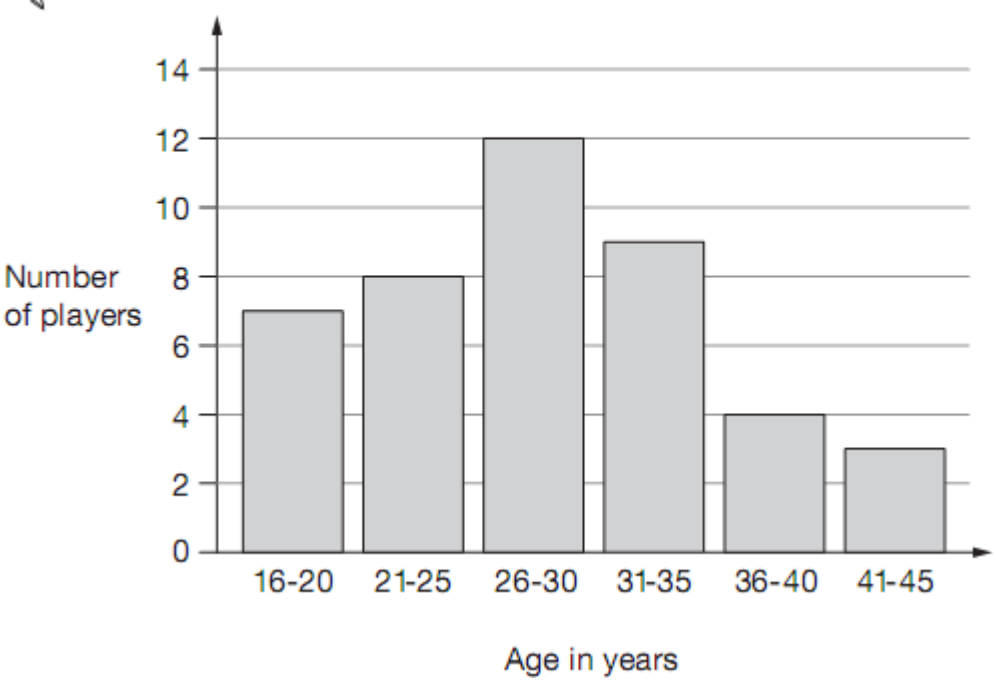
Write the coordinates of **M**.

C is on the x-axis, directly **below B**.

Write the coordinates of **C**.

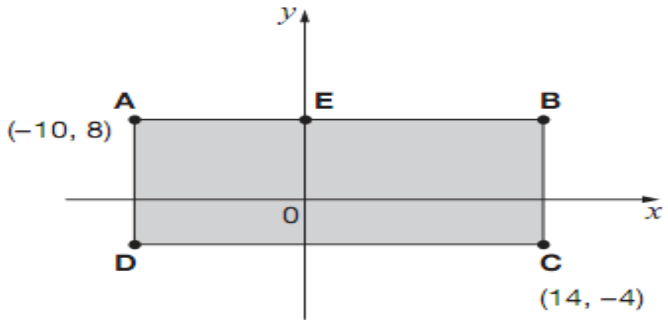
12. The players at the football club

This graph shows the age of players at a football club.



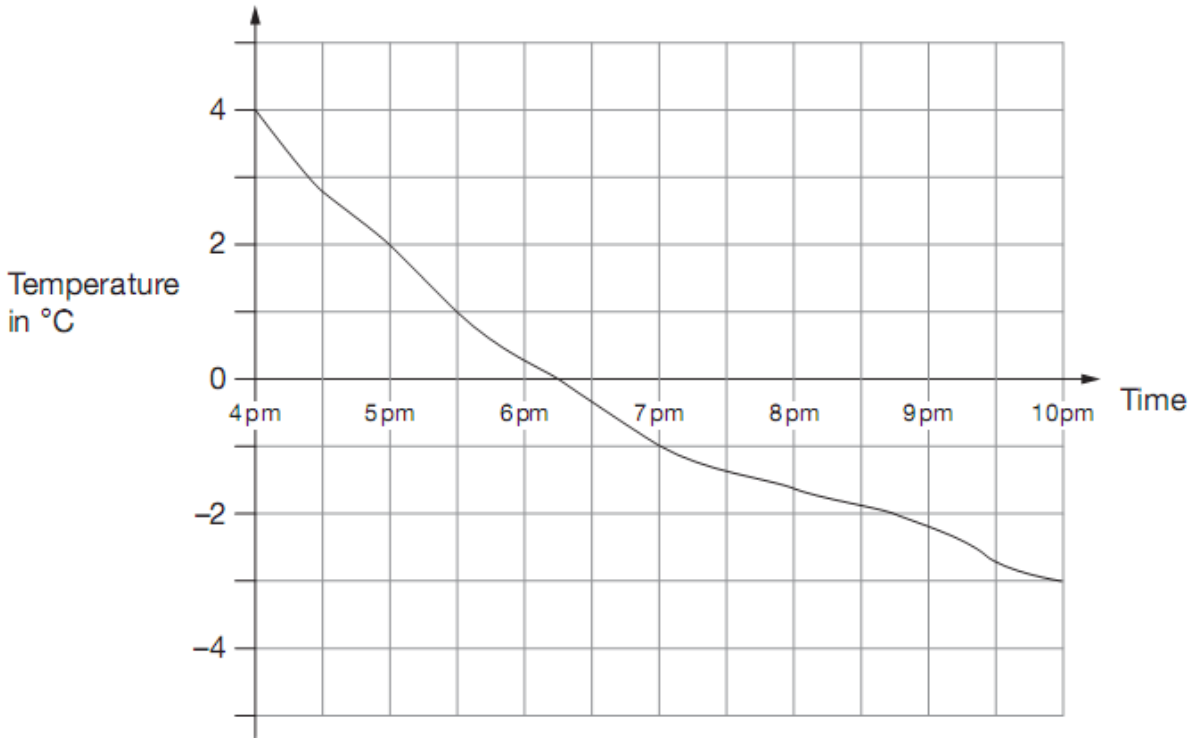
1. How many players are aged 36 or older?
2. How many players are aged 30 or younger?
3. **Estimate** the average age of the players.
4. A player aged 36 and a player aged 39 join the club.
   Add this information to the graph above.

13. Name the coordinates of D and E



14. Winter temperatures

This graph shows the outside temperature from 4pm to 10pm on a day in winter.



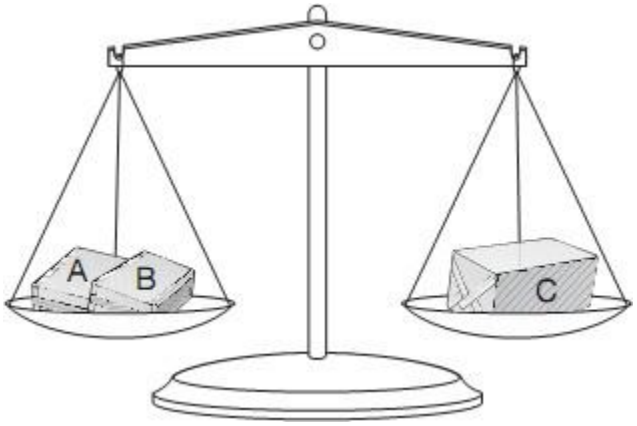
1. What was the highest recorded temperature?
2. What was the lowest recorded temperature?
3. At what time was the temperature –2°C?
4. How many degrees did the temperature drop from 5pm to 7pm?
5. What was the average temperature during the recorded period?

Interpreting Information

1 **Work out the weight**

Amir has three parcels.

Parcels **A** and **B** together weigh the same as parcel **C**.



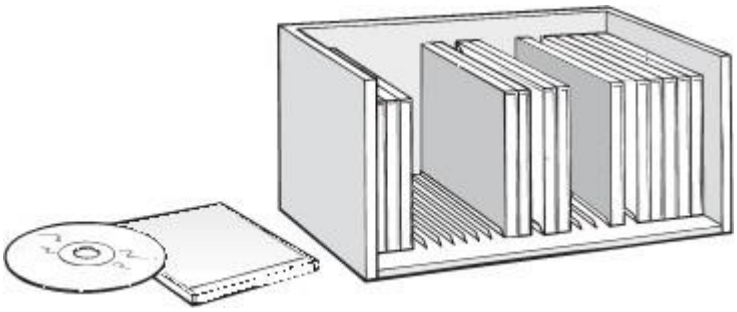
The three parcels weigh **800 grams** altogether.

Parcel **A** weighs **250g**.

How much does parcel B weigh?

Hint: Try this using basic algebra and see how easy it becomes!

2 **Here is a CD rack.**



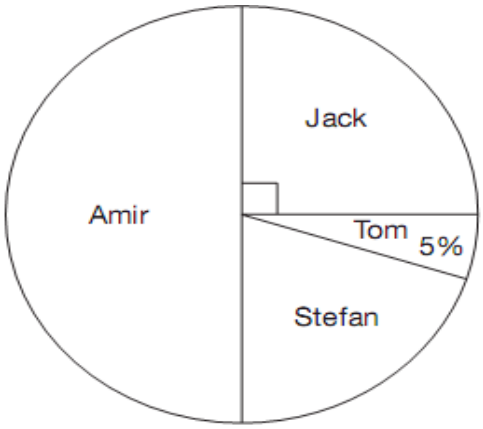
One rack holds **25** CDs.

David has **83** CDs.

How many racks does he need to hold **all** his CDs?

3 Pie chart predictions

40 children predicted who would win the boys' race at sports day.
This pie chart shows their predictions.



What percentage of the children predicted that Stefan would win?

10 children predicted the winner of the race correctly.

Who won the race? _____

Explain how you know.

4 How much does the battery cost?

A torch costs £7.65

Kate buys a torch and **two** batteries.

She pays £8.75 altogether.

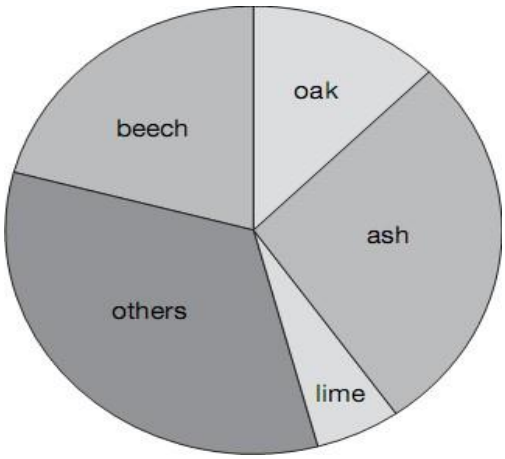
How much does **one** battery cost?

Try basic algebra. Let the torch be t. *Let a battery be* b.

5 Pie chart survey

Class 6 did a survey of the number of trees in a country park.

This pie chart shows their results.

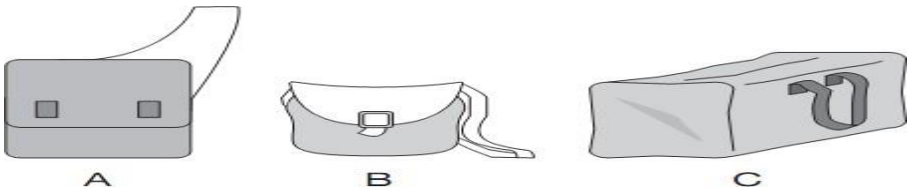


Estimate the **fraction** of trees in the survey that are **oak** trees.

The children counted **60** ash trees.

Use the pie chart to estimate the **number** of **beech** trees they counted.

6 The bags in the shop

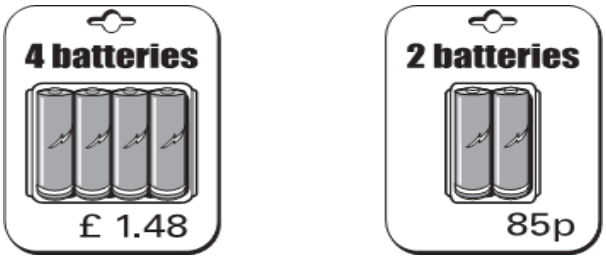


What is the cost of each bag **to the nearest pound** if

1. Bag A costs £12.51?
2. Bag B costs £12.50?
3. Bag C costs £12.49?

7 Buying batteries

A shop sells batteries in **packs of four and packs of two**.



Simon and Nick want two batteries each.
They buy **a pack of four** and share the cost equally.
How much does each boy pay?

Mary buys **2 packs of two batteries**.
Hamid buys **1 pack of four**.
How much **more** does Mary pay than Hamid?

8 Walking – sailing – climbing

This table shows the numbers of children who went walking, sailing or climbing at an outdoor centre.

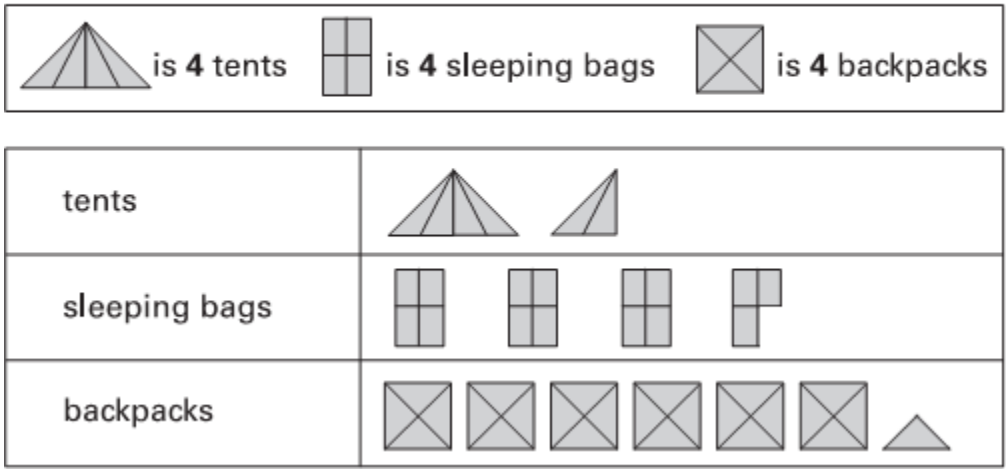
	May	June	July
walking	25	80	75
sailing	15	42	50
climbing	18	27	23

1 How many children went **sailing** in **May, June and July** altogether?
2 How many more children went **walking** in **June** than **climbing** in **June**?
3 What was the **most popular activity** over the three months?

9 At the camping shop

A camping shop sells **tents**, **sleeping bags** and **backpacks**.
This chart shows how many of each they sold in June.

Items sold in June



The shop had **20 sleeping bags** at the **beginning of June**.

1. How many of these **sleeping bags** did the shop have **left** at the **end of June**?
2. In **July**, the shop sold **three times as many tents** as in **June**.
   How many tents did the shop sell in **July**?

10 Cakes

An iced cake costs 10p more than a plain cake.

Sarah bought two of each cake.

They cost £1 altogether.

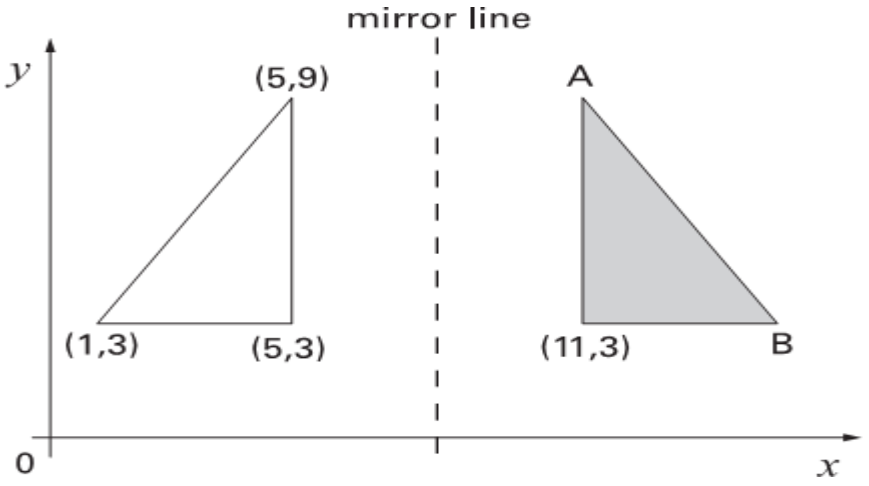
What is the cost of an **iced** cake?

You might like to try basic algebra to solve this problem.

Call one of the cakes a *and call the other cake* b.

11 Co-ordinates

The shaded triangle is a reflection of the white triangle in the mirror line.



Write the **co-ordinates** of point **A** and point **B**.

12 Notebooks and pens

A shop sells notebooks and pens.
Hassan bought a **notebook** and a **pen**.
He paid **£1.10**
Kate bought a **notebook** and **2 pens**.
She paid **£1.45**
Calculate the **cost of a notebook**.

Using basic algebra. $p + n = 110$ *this means* $n = 110 - p$

$n + 2p = 145$

substituting for n *means*

$110 - p + 2p = 145$

$p = 145 - 110 = 35$

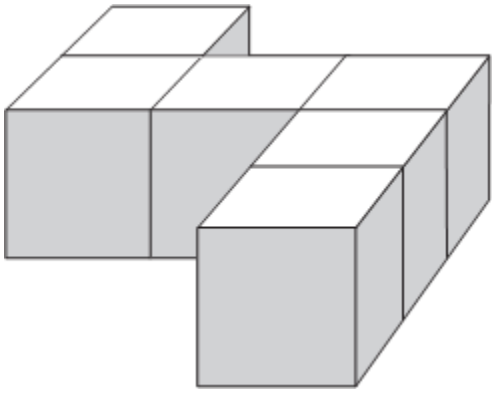
this means

$n = 110 - 35 = 75$

The **notebook** costs **75pence**. A **pen** costs **35pence**.

13 Painted cubes

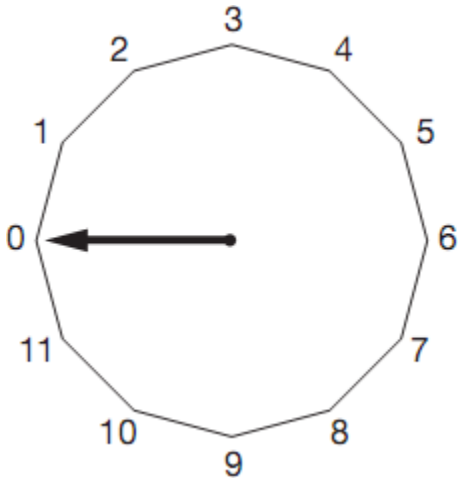
Emily has **6 cubes**.
She sticks them together to make this model.



She paints the sides of the model **grey all the way round**.
She leaves the **top** and the **bottom** of the model **white**.
How many of the cubes in the model have exactly **two faces painted grey**?

14 Turn the pointer

This regular 12-sided shape has a number at each vertex.

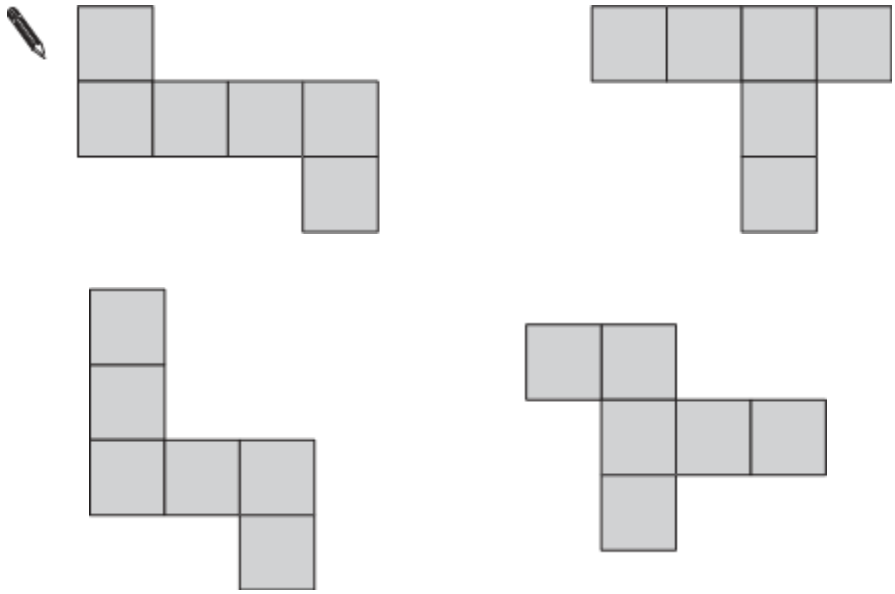


Charlie turns the pointer from zero, clockwise through 150°
Which number will the pointer now be at?

15 Net of a cube – or not?

Here are four diagrams.

On each one put a tick (✓) if it is a net of a cube.
Put a cross (✗) if it is not.



16 Off to the movies

The film lasts **2 hours 35 minutes**.
What time will it **finish** if it begins at

1. **5.15pm** 2. **6.45pm** 3. **19.00** 4. **20.25**

17 Mari's Radio Show

Mari is the presenter of a weekly radio show.

She always plays **five** new songs for every **two** old songs.
Last week she played **15 new** songs.
How many songs did she play **altogether**?
Hint! Think ratio - 5:2

18 Repeating pattern

Here is a repeating pattern of shapes. Each shape is numbered.

The pattern continues in the same way.
What are the numbers of the next **two stars** in the pattern?

Complete this sentence:

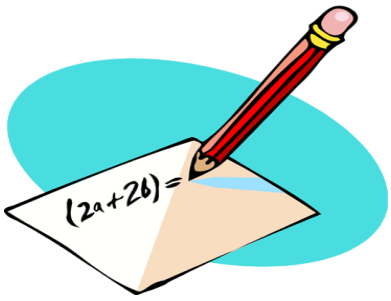
Shape number 35 will be a circle because ...

.....

.....

.....

INTRODUCING ALGEBRA



In algebra we use the **letters of the alphabet** to represent **unknown values**, and we are going to learn how to work out how much these values are actually worth. It's a lot easier than it sounds, and it makes mathematics a lot easier.

1. Work out the value of the letters.

2a + 2a = 8 6b – 4b = 10 d + 2d + 3d = 12 7f + 2f = 18

8g – 4g = 24 9m – 4m = 20 60p – 30p = 300 5x – 4x = 2

Notes: We can use any letter of the alphabet to stand for a value.

We don't bother writing the number 1 before a letter because this would be confusing.

2. Work out the value of the letters.

4a + 2a – 3a = 9 6n – 5n + 4n = 20 -2r + 4r + 2r = 40

-8w + 4w + 3w = 2 5d + 3d + 2d – 4d = 12 27m – 7m = 40

Notes: You can **simplify** things if you **gather the same terms** together.

Term is the word we use for the letters we use in algebra.

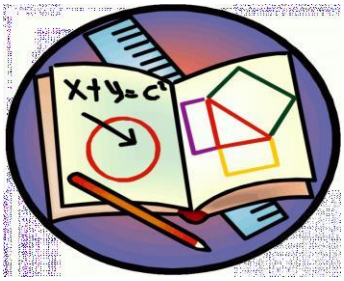
3. Algebra in Action

Tomorrow's temperature is going to be 4°C hotter than yesterday's temperature. Using 'terms', this can be written: t = y + 4

What would tomorrow's temperature be if yesterday's was:

a) 10°C b) 16°C c) -2°C d) -6°C

4. When we are given the values of the letters in an equation, we can **solve these equations** by **substituting** the values for the letters, and then **working out** the maths.



If a = 5, b = 3 and c = 1, solve these equations;

1. 3a + b = ?
2. 2b – c = ?
3. a + 3b = ?
4. 2b – 2c = ?
5. a – b – c = ?
6. 5b + 7c = ?
7. 4a ÷ 2 = ?
8. 10c x 10 = ?
9. 6b + 3c + 8a = ?

5. Whenever it's possible, we must **gather** together the same **terms** and **simplify** the equation.

Examples a + a + a simplified is 3a.
c + c – f simplified is 2c – f

10. h + h + h + h =
11. 3 x f =
12. b x b x b =
13. g + g – g =
14. d + f + d + f =
15. (a + a + a) x (b + b)
16. d x f x d x f =

6. If we know the value of one of the terms, we can work out the value of the other term.

If x = 9, what is y?

17. x + y = 13
18. y + x = 18
19. 2x + y = 20
20. 2x + y = 25
21. 3x + y = 50

Challenge

Have a go at making up some **algebraic** equations of your own. Choose one of the ways above to do it. We will test them at the end of the lesson so make sure that you know the answers!

7. The Quickie Test – work these out

1. If 5n = 20 what does n equal?
2. If 4t + 10 = 18 what does t equal?
3. If 12b – 3 = 45 what does b equal?
4. Write down the equation which shows how many sweets are left if you start with 25 sweets and n sweets are then taken away.
5. There are 40 books in a classroom. If n books are taken away, what is the equation which shows how many books are left?

8. Using algebra to make Function Machines easy!

Look at the following function machine:

IN → x 4 → - 2 → *OUT*

For the following *IN* values, work out the correct *OUT* values:

(a) 3

(b) 5

(c) 7

(d) 10

For the following OUT values, work out the correct IN values by working backwards:

(e) 42

(f) 18

(g) 46

Now think of it like this!

4a - 2 = b

Now all you have to do is put in the value for a to find the value for b.

Or put in the value for b to find the value for a.

Try it – you'll like it!

9. Combining terms that are the same – exactly the same!

Remember terms can be combined, gathered together, ONLY IF they have the exact same variable part.

1. Combine these terms where it is possible.

1	5 apples + 6 apples = ?
2	5 apples + 6 oranges = ?
3	4 + 3 = ?
4	$3x + 4 = ?$
5	$5x + 5y = ?$
6	$7x + 3x = ?$
7	$4x + 3x^2 = ?$
9	$9x - 5x = ?$
10	$9x - 7x + 1 = ?$

2. Simplify these by combining the terms which are alike (the same)
The first one is done for you.

1 $2x^2 + 3x - 4 - x^2 + x + 9$

$2x^2 - x^2 + 3x + x + 9 - 4$

$x^2 + 4x + 5$

2 $10x^3 - 14x^2 + 3x - 4x^3 + 4x - 6$

3 $3a + 2b - 4 + 2a - 5b + 10$

4 $25 - (x + 3 - x^2)$

5 $x + 2(x - [3x - 8] + 3)$ Hint – work from the inside out!

10. Writing equations to represent word problems.

1. Josh took some nuts from a bowl. He ate 3 of them and had 10 nuts left. Write the equation which, when solved, will tell you how many nuts Josh took from the bowl.

   Let a represent the number of nuts Josh took from the bowl. The equation will be $a - 3 = 10$

2. Sue had 26 postcards. After she sent some in the post, Sue had 20 postcards left. Write the equation which, when solved, will tell you how many postcards Sue posted. Let p represent the number postcards Sue posted.

   $26 - p = 20$

3. Dino bought some stamps. He used 27 of the stamps and had 23 stamps left. How many stamps did he buy? Write the equation using s.

   $s - 27 = 23$

4. Kathleen bought a box of pushpins. She put 9 pushpins on the bulletin board and had 19 left. Which equation, when solved, will tell how many pushpins were in the box? Let p represent the number of pushpins in the box.

   $p - 9 = 19$

5. A glass company needs to ship 12 glass vases to another city. Each box can hold 3 vases. Which equation, when solved, will tell the number of boxes the company will use? Let b represent the number of boxes.

   $12 \div b = 3$

THE ORDER OF OPERATIONS - BIDMAS

Order of operations simply means the order in which we carry out a calculation. Here's an example:

Look at this calculation ... 5 + 2 x 4

If you work from **left to right** - you would get, **5 + 2 = 7** and then **7 x 4 = 28**

BUT try this with a scientific calculator ... the result is **13**!

Which answer is correct? You guessed it - the calculator. It did the multiplication first, **2 x 4 = 8**, and then added the 5, **8 + 5 = 13** ✔

So, we need to know which calculation to do first – the order in which we should carry out the operations (calculations).

The Order of Operations is just a set rules to tell you which order you must do operations (like add, subtract, multiply etc) to get the correct answer. And here's what you must memorise!

B stands for Brackets. Do the brackets first.

I stands for Indices. Do the powers 2^2 next.

D stands for Divide. Do any divisions.

M stands for Multiplication. Do any multiplications.

A stands for Add. Do any additions.

S stands for Subtract. Do any subtractions.

Don't worry if this seems a bit difficult.

You'll soon get used to BIDMAS as we'll see on the next page.

Let's work through an example… $10 + (8-6) \times 5$

1st Deal with the brackets, $8 - 6 = 2$, which results in ... $10 + 2 \times 5$
2nd Any powers? No..... Any divisions? No
3rd Any multiplications? Yes - work them out, $2 \times 5 = 10$ leaving ... $10 + 10$
Finally, any additions? Yes, work them out, $10 + 10 = 20$ ✔

Now have a go at these: BIDMAS

1. $3 + 3 \times 3 =$
2. $5 + 4 \times 4 =$
3. $9 - 4 \times 2 =$
4. $8 - 8 \div 4 =$
5. $15 - 6 \div 2 =$
6. $50 - 5 \times 5 =$
7. $(3 \times 2) + 4 =$
8. $4 + (3 \times 6) =$
9. $3 + (3 \times 3) =$
10. $(4 + 4) + (4 - 2) =$
11. $(4 \times 2) + (2 - 1) =$
12. $(4 + 2) \times (8 - 5) =$
13. $6 - 8 \div 2$
14. $50 - 8 \div 2 =$
15. $3 \times 4 \div 2 + 6 =$

Put the brackets in the right places to make these statements true.

1. $9 - 1 \times 7 = 56$
2. $40 - 10 \times 2 = 20$
3. $6 - 8 \div 2 = 2$
4. $50 - 8 \div 2 = 21$

1. What is the value of $3x^2$ when $x = 2$?
2. What is the value of $(3x)^2$ when $x = 2$?
3. What is the value of $(3 + a)(4 + a)$ when $a = 4$?
4. What is the value of $2a^3 - a$, when $a = 4$?
5. What is the value of $x^3 / (4y - 7)$, when $x = 5$ and $y = 8$?

RATIO & PROPORTION

A **ratio** is a way of comparing the sizes of two or more quantities.

- a colon (:) is used to show ratios 3:4 7:2
- a quantity can be divided into **portions** that are in a given **ratio**.
- the process has three steps.

1. **Add** the separate portions of the ratio.
2. **Divide** the number into the original quantity.
3. **Multiply** this answer by the original portions of the ratio.

For example:
Jack and Jill win £40. They decide to share the money in the ratio of 2:3.

1. To find the number of portions, add 2 and 3. This equals 5 portions.
2. Divide £40 by 5. This gives the value of each portion = £8
3. Jack gets 2 portions = 2 x 8 = **£16**. Jill gets 3 portions = 3 x 8 = **£24**.

It's a good idea to think of the **portions as fractions** of the whole quantity.
It's easy to see that Jack gets $\frac{2}{8}$ of the £40, and Jill gets $\frac{3}{8}$ of the £40.

You probably noticed that $\frac{2}{8}$ is the same things as $\frac{1}{4}$.

It's a good idea to simplify fractions when you can
because it makes the maths a lot easier if you're not using a calculator.

1. Divide the following quantities/amounts in the given ratios.

a. £500 in the ratio 1:4
b. 300 grams in the ratio 3:2
c. £280 in the ratio 3:4
d. 240 kg in the ratio 1:2

2.

A: Sam is a DJ. On his radio show he always plays 5 new songs for every 2 old songs he plays. In other words, the ratio is 5 new for every 2 old, or 5 to 2, or 5:2.

(a) If he plays 10 new songs, how many old songs does he play? ____
(b) If he plays 15 new songs, how many old songs does he play? ____
(c) If he plays 25 new songs, how many old songs does he play? ____

Let's see how we worked that out.

(a) The ratio is 5:2. 10 new songs is 5 x 2. So old songs must be 2 x 2.
(b) The ratio is 5:2. 15 new songs is 5 x 3 So old songs must be 2 x 3.
(c) The ratio is 5:2. 25 new songs is 5 x 5. So old songs must be 2 x 5

On Monday. Sam played 20 new songs. How many old songs did he play?
On Tuesday, Sam played 14 old songs. How many new songs did he play?
On Wednesday, Sam played 30 new songs. How many old songs did he play?
On Thursday, Sam played 18 old songs. How many new songs did he play?

Mon. ____ Tues. ____ Wed. ____ Thurs. ____

B: We can also think of ratio as fractions

(a) On Friday, Sam played 35 records. How many old. How many new?
(b) On Saturday, Sam played 21 records. How many old? How many new?
(c) On Sunday, Sam played 49 records. How many old? How many new?

(a) Old = 2/7^{ths} of 35 = 10 New = 5/7^{ths} of 35 = 25 Total = 35
(b) Old = 2/7^{ths} of 21 = 6 New = 5/7^{ths} of 21 = 15 Total = 21
(c) Old = 2/7^{ths} of 49 = 14 New = 5/7^{ths} of 49 = 35 Total = 49

3. Some word problems involving ratio

A: Dad wins £**1000** on the lottery. He decides to share it between his four children in the ratio **4: 3: 2: 1**.

(a) How many parts/shares are there in total?
(b) How much is each part/share worth?
(c) How much does each child get?

B: Megan has a cat, Fizzy, and a dog, Molly. She buys **800gm**s of food. She decides to share it in the ratio 5 parts Molly, 3 parts Fizzy – 5:3.

(a) How many shares are there in total?
(b) How much does Molly get?
(c) How much does Fizzy get?

C: Abby and Maddie played netball for **an hour** against Holly and Ivy. The ratio of possession was A: M: H: I - 4: 1: 2: 3

(a) How long in minutes did the girls play netball?
(b) How many parts/shares was the time divided into?
(c) Who had the ball for the longest time?
(d) Who had the ball for the shortest time?
(e) How long did Maddie have the ball?
(f) How long did Holly have the ball?
(g) Which team scored the most points?

D: Sir had **4** pupils and **5** sweets. He decided that each pupil would get **1** sweet each with the extra sweet going to the hardest-working pupil.

What was the ratio of sweets to pupils? ___ ___ ___ ___

This, of course, means A gets $1/5^{th}$, B gets $1/5^{th}$, C gets $1/5^{th}$, D gets $2/5^{ths}$

.

4 Some more word problems.

a) In a bag of mixed nuts, there are **2** peanuts for every **3** cashew nuts. If there are **15** nuts in total, how many peanuts are there?

b) In a bag of mixed nuts, there are **9** peanuts for every **1** cashew nut. If there are **100** nuts in total, how many peanuts are there?

c) In a bag of mixed nuts, there are **3** peanuts for every **4** Brazil nuts and **5** cashew nuts for every 4 Brazil nuts. There are **96** nuts in the bag. How many nuts of each kind are there?

d) A mother sea lion is fed **5** fish for every **1** fish its baby gets. Marco fed the mother **10** fish. How many fish did the baby get?

e) The next day, Marco fed the baby **6** fish. How many did he feed to the mother?

f) Two weeks later, Marco changed the ratio to 5:2 in favour of the mother. The mother now got **15** fish. How many did the baby get?

g) Jane got **60p** pocket money a week and saved **30p**. David got **£3** and saved **£1**. Who saved the greater proportion of pocket money?

h) Year 6 go flower-picking, with permission. Amy picks **15**, Dan picks **12**, Zoe manages only **6**, Curtis picks **9**, and Eva picks a wonderful **24**.

Express the **ratio** of the flowers picked from highest to lowest and express in its **simplest form.** Then express the ratios as **fractions**.

i) Gita got **40** out of **80** correct in her Maths test. She got 45 out of 100 correct in her Science test. Is Gita better at Maths or Science? *(Explain your working.)*

Important!

When one value of a ratio is known, we can calculate the other values. This means that if we know the ratio, and the value of one amount, we can work out all the other amounts. We call the value of one portion of the whole amount the **unit value**.

Example: The Smith family and the Jones family decided to share the cost of a meal in the ratio **3:5**. The smaller share cost **£22.50p**. How much did the meal cost all together?

a. Ratio is **3:5** so there are **8** shares,
b. The smaller bill was **£22.50p**.
c. So one share is **£22.50p divided by three** = **£7.50p** *(unit value)*
d. so the whole bill was **8 x £7.50p**.
e. which is **£60**.

5 Even more word problems!

1. At the football club there are **3** girls for every **5** boys.

· There are 6 girls. How many boys?
· There are 15 boys. How many girls?
· There are 9 girls. How many boys?

2. To make **5** cans of purple paint, there are **2** cans of blue for every **3** cans of red.

· There are 4 cans of blue. How much red?
· There are 9 cans of red. How much blue?
· There are 10 cans of purple paint. How much red and how much blue?

3. A father lion is fed 6 kg of meat for every 2kg for its cub.

- The father lion has 12 kg. How much does the cub get?
- The cub has 6kg. How much does the father get?
- The father lion has 18kg. How much does the cub get?
- There is 24kg of meat altogether. How much does the lion get and how much does the cub get?

1.

Eva makes a fruit salad using bananas, oranges and apples.
For every one banana, she uses 2 oranges and 3 apples.
Eva uses 24 fruits. *(Think ratio!)*

How many **oranges** does she use?

Show your **method**. You may get a mark.

2.

Sarah has a packet of balloons.
The contents of the packet are
5 red balloons
5 blue balloons
10 yellow balloons
Sarah says, 'One-quarter of the balloons are red'.

Is Sarah correct?
Circle **Yes** or **No**.

Yes / No

Explain how you know.

(Think fractions!)

3.

Here are two bags of marbles, **A** and **B**.
Each bag contains blue marbles and red marbles only.

3 blue marbles
and
3 red marbles

6 blue marbles
and
9 red marbles

Liam chooses a marble from each bag without looking.

From which bag is he more likely to choose a **blue** marble?

*Think in terms of the **ratio** of blue marbles to red marbles in each bag!*
*Remember to **simplify** a ratio when you can!*

4.

David and his friends prepare a picnic.
Each person at the picnic will get:
3 sandwiches
2 bananas
1 packet of crisps
The children pack 45 sandwiches.

How many **bananas** do they pack?

Thinking it through.
There are three sandwiches in each bag.
There's a total of 45 sandwiches.
So there must be_____bags.
There are 2 bananas in each bag.
So there must be a total of_____bananas.

Calculator Not Allowed

1.

Mari is the presenter of a weekly radio show. She always plays **five** new songs for every **two** old songs. Last week she played **15 new** songs.

How many songs did she play altogether?

Thinking it through.
For every 5 new songs she plays 2 old songs.
So the ratio is 5:2.
So when she played **15 new songs**, she must have played

$\frac{15}{5} \times 2$ old songs

and that equals $3 \times 2 = 6$ old songs.

Challenge! Can you prove you're right by using the ratio 5:2?

2

A box of crisps has two flavours: plain and beef,
in the ratio **3:4**.

There are **42** packets of plain crisps.
How many packets of beef crisps are there in the box?
How many packets of crisps are there altogether?

No peeking!

The ratio is **3:4**. This means there's a total of **7** shares.
One share is **42** divided by **3** = **14** *(unit value)*
So number of beef packets = **4 x 14** = **56**
So number of packets altogether is **7 x 14** = **98**

3

The ratio of male teachers to female teachers in a school is **3:7**,
so for every **3 male** teachers there are **7 female** teachers.
If there are **21 fem**ale teachers, how many male teachers are there?

No peeking!

The ratio is **3:7**. This means there's a total of **10 units**.
One unit is **21** divided by **7** = **3** *(unit value)*
So the number of male teachers must be **3 x 3 = 9**.

Challenge: Check the answers by using fractions.

USING A FORMULA TO CALCULATE THE AREA OF PLANE (2D) SHAPES
(Higher Level)

We often use a formula (formulae) to calculate the area of 2D shapes such as squares, rectangles, parallelograms, trapeziums, traingles and circles.

We take the formula and we put the numbers in the place of the letters. Then we make our calculations to work out the area.

Don't worry about memorising the formulae. If you need them in an examination, they give them to you.

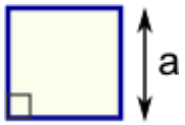
SOME PRELIMINARY PRACTICE

These are not formulae for area.

1. $x + 2y$ (x is 4, y is 3)
2. $2a - 3b$ (a is 12, b is 6)
3. $(m + n)(m + 1)$ (m is 3, n is 2)
4. $a + b + 2c$ (a is 1, b is 2, c is 3)
5. $x^2 + y^2$ (x is 2, y is 3)
6. $\frac{e - d}{3}$ (e is 9, d is 6)
7. $\frac{x + y}{25}$ (x is 60, y is 40)
8. $2a^2 - b^2$ (a is 3, b is 4)

Hint! Always write down the formula first. Put in the numbers in place of the letters, and calculate step by step, showing your working.

1. SQUARES



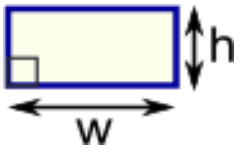
Square

Area = a^2
a = length of side

Calculate the area of the square when **a** is

1. 5 centimetres
2. 10 feet
3. 25 yards
4. 1 mile
5. 10 millimetres

2. RECTANGLES



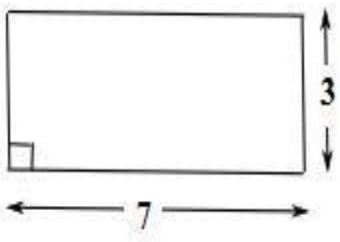
Rectangle

Area = w × h
w = width
h = height

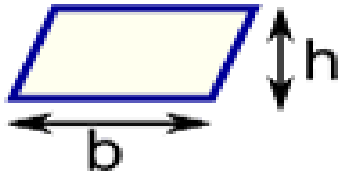
Calculate the area of the rectangle when

1. the width is 6 inches and the height is 4 inches.
2. the width is 7feet and the height is 5 feet.
3. the width is 1 foot and the height is 3 inches.
4. the width is 10 miles and the height is 2 miles.
5. the width is 2 metres and the height is 5 centimetres.

What is the area of the rectangle?



3. PARALLELOGRAMS



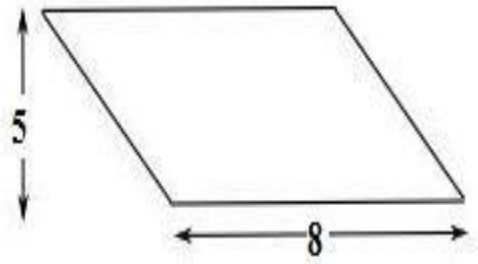
Parallelogram

Area = b × h
b = base
h = vertical height

Calculate the area of the parallelogram when

1. the base is 5 inches and the height is 4 inches.
2. the base is 8 feet and the height is 7 feet.
3. the base is 1 foot and the height is 4 inches.
4. the base is 1 mile and the height is ½ mile.
5. the base is 2 metres and the height is 10 centimetres.

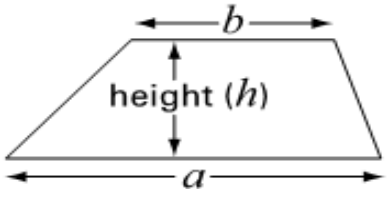
What is the area of the parallelogram?



4. TRAPEZIUMS (UK) TRAPEZOIDS (USA)

You might need to use this formula in this test.

Trapezium

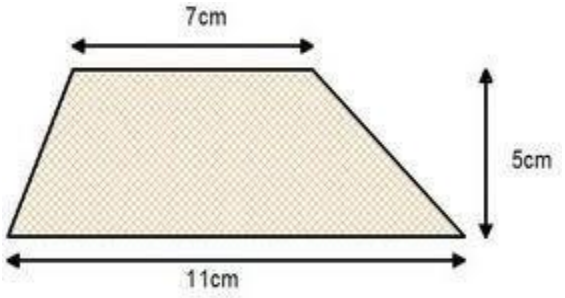


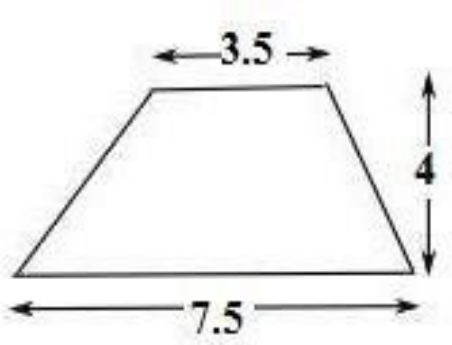
$$\text{Area} = \frac{(a+b)}{2} \times h$$

Example: Let's imagine the longer length a of this trapezium is 8 cm, and that the shorter length b is 6 cm, and that the height h is 4 cm.

We now put these figures into the formula.
This gives us: **½ (8 + 6)4** = **½ x 14 x 4** = **28 square centimetres**

Use the formula to work out the area of these trapezium**s.**





$$\text{Area} = \frac{(a + b)}{2} \times h$$

Calculate the area of the trapezium when

1. ***a*** is 6 inches, ***b*** is 5 inches and the height is 4 inches.
2. ***a*** is 8 feet, ***b*** is 6 feet and the height is 7 feet.
3. ***a*** is 1 foot, ***b*** is 2 feet, and the height is10 inches.
4. ***a*** is 1 mile, ***b*** is 3 miles and the height is ½ mile.
5. ***a*** is 4 metres, ***b*** is 2 metres and the height is 10 centimetres.

$$\text{Area} = \frac{(a + b)}{2} \times h$$

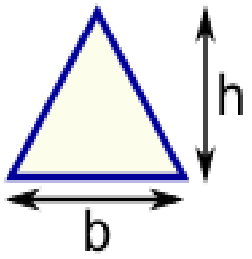
Remember!

- ✓ Always write down the formula first.
- ✓ Put the numbers in the place of the letters.
- ✓ Always do the thing (operation) in brackets first.
- ✓ Do the calculation (operations) step by step because if you make a mistake, it's easier to find where you made it.

Challenge: Calculate the area of the desktop; it's a trapezium.

Finally, if you don't think that trapeziums are fun, think again.
Here's a class who certainly do!

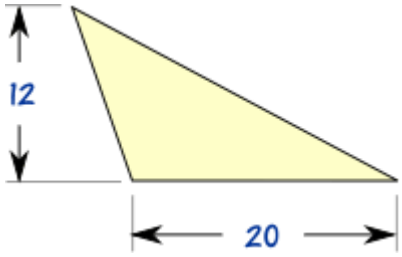
5. TRIANGLE



Triangle

$$\text{Area} = \frac{b \times h}{2}$$

Example: What is the area of this triangle?



height = h = 12 base = b = 20

$$\text{area} = \frac{b \times h}{2} = \frac{12 \times 20}{2} = \frac{240}{2} = 120 \text{ squared 'whatever it is'}$$

Calculate the area of the triangle when

1. the base is 1 foot and the height is 2 feet
2. the base is 25 centimetres and the height is 10 centimetres
3. the base is 6.7 miles and the height is 3.4 miles
4. the base is 10 inches and the height is 5.5inches
5. the base is 23 yuks and the height is 12 yuks.

Note: The 'yuk' is a unit of measurement in the Klingon Empire (Star Trek). 1 yuk is equal to 1 furlong (201.16800 metres).

6. CIRCLES

If we divide the circumference of any circle by its diameter, we always come up with exactly the same number: 3.14159265359…… It has been represented by the Greek letter "π" since the mid-18th century. We pronounce π as 'pi' – and we call it pi (pie).

Unfortunately, or fortunately, this number goes on, as far as we know, forever. You can be happy if you learn it as 3.14.

We can use π for lots of things, but at the moment we will use it only when we want to calculate the area of a circle. To do this, we need to know two things: π and the length of the radius of the circle.

Here's the formula!

$A = \pi r^2$ This means **Area** = **3.14** X **r^2** (the **radius** squared)

Calculators at the read please! What is the area of a circle if

(a) the radius is 5 cm?
(b) the diameter is 8 feet?
(c) the radius is 2 miles
(d) the diameter is 20 inches

(e) A dartboard has a radius of 20c. The bullseye in the centre of the board has a radius of 1 cm. Calculate the area of the of the two circles and find the area outside the bullseye.