THE BRITISH INTERNATIONAL SCHOOL ABU DHABI

A NORD ANGLIA EDUCATION SCHOOL

Year 9 Maths

Topic 7–8–9 Workbook

In the table below translate the key terms into your home language and write a short definition for each term [if needed visit www.mathsisfun.com/definitions/].

TOPIC 7 – SET LANGUAGE AND NOTATION		
Universal Set		
Empty Set		
Union		
Intersection		
Venn Diagram		
TOPIC 8 - POLYGONS		
Interior Angle		
Exterior Angle		
Regular Polygon		
Irregular Polygon		
Congruent		
TOPIC 9 - PROBABILITY		
Outcome		
Sample Space		
Frequency Table		
Mutually Exclusive		
Expected Frequency		

Venn Diagrams

1. The universal set $\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$.
The set A = {even numbers} and the set B = {factors of 20}.

a) List all the members of:

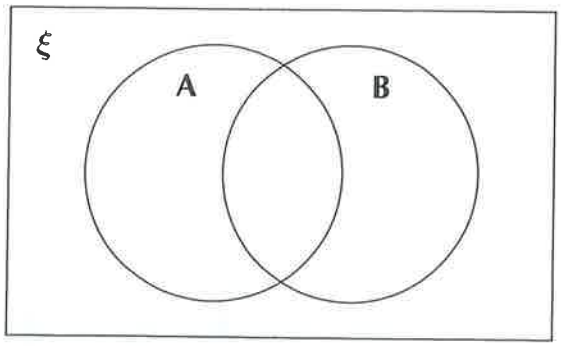
(i) A

.....

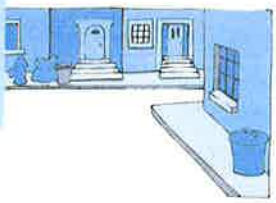
(ii) B

.....

b) Write all the numbers in ξ in the correct places on this Venn diagram.



2. There are 50 houses on Pavement Street. An energy company provides gas and electricity to some of these houses. 4 of the houses receive just gas, 8 receive just electricity and 12 receive both gas and electricity.



In the space below, draw a Venn diagram to show this information.

3. The set ξ consists of the dogs in a doggy daycare centre.
The set P = {terriers} and the set Q = {dogs whose names end with a vowel}.

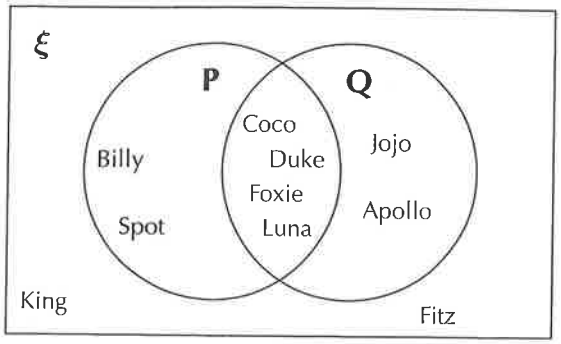
a) What is the value of n(P)?

n(P) means the number of elements in the set P.

.....

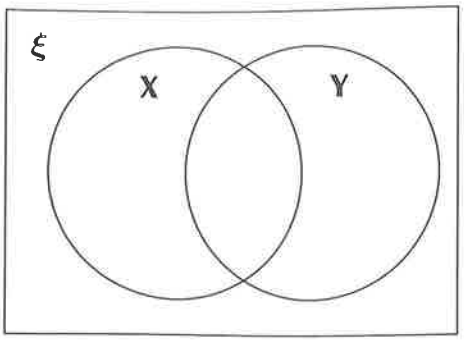
b) A dog is picked at random from ξ.
What is the probability that the name of the dog does **not** end with a vowel?

.....



Venn Diagrams

4. The universal set ξ is the first 13 letters of the alphabet. The set X is the letters in the word LLAMA and the set Y is the letters in the word BEAGLE.



a) Put the elements of ξ into the correct places on the Venn diagram.

b) Write down the letters which are in the union of X and Y.

The 'union' of X and Y is the set of all the things in at least one of X or Y (i.e. in X, in Y or in both).

.....

c) A letter is selected at random from ξ. What is the probability that it belongs to $X \cap Y$?

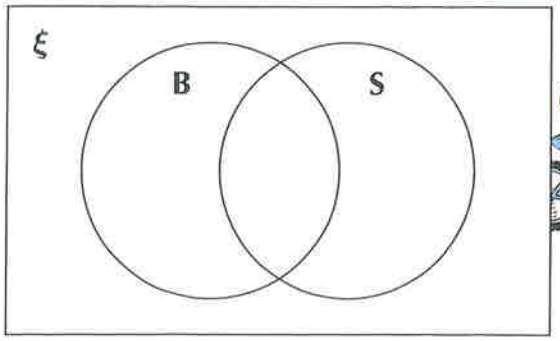
$X \cap Y$ is the set of elements that are in both X and Y.

.....

5. There are 31 children in Eddie's class. 17 of them own a bicycle and 13 of them own a scooter. 3 children own both a bicycle and a scooter. Let B = {children who own a bicycle} and S = {children who own a scooter}.

a) Fill in this Venn diagram to show the number of children in each set.

Be careful — some of the 17 who own a bicycle also own a scooter, and some of the 13 who own a scooter also own a bicycle.



b) (i) How many children own either a bicycle, a scooter or both?

.....

(ii) How many children don't own a scooter?

.....

How did you do?

Venn diagrams are named after a pretty fly guy from Hull called John Venn. You don't need to remember that bit of trivia, but what you do need to be able to do is:

☐ **Interpret and construct Venn diagrams.** ☐ **Find the probability of events from Venn diagrams.**

Venn Diagrams

Don't be put off by the weird symbols that go with the sets. Remember, the squiggly symbol ξ just means the 'universal set' — it contains all the elements that you need to consider for a particular question.

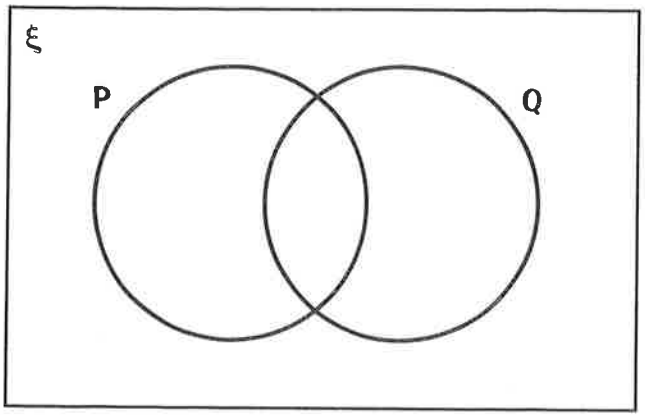
Q1 The elements of ξ are the whole numbers from 1 to 10.
Set P contains the multiples of 3, and set Q contains the prime numbers.

a) Using set notation, write sets ξ, P and Q as complete lists of their elements.

ξ = ...

P = ...

Q = ...



b) Show the elements of these sets on the Venn diagram to the right.

Q2 Using the Venn diagram on the right, write down the following:

a) The elements of set S.

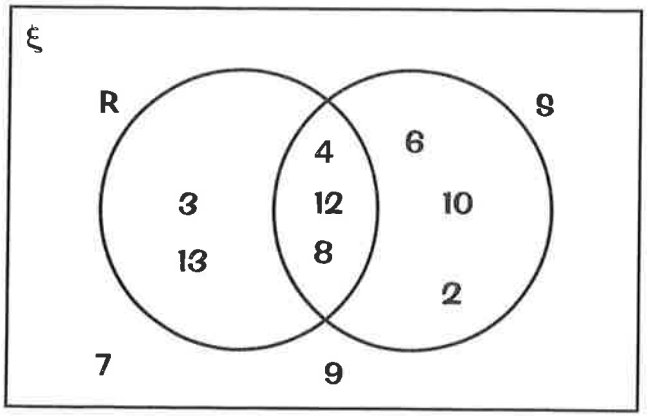
.....

b) The elements in both set R and set S.

.....

c) The elements in set S but not set R.

.....



Q3 ξ = {numbers from 1-10 inclusive}, A = {even numbers} and B = {square numbers}.

a) List the elements of each set.

ξ = ...

A = ...

B = ...

b) Draw a Venn diagram, showing the **number of elements** in each part of the diagram.

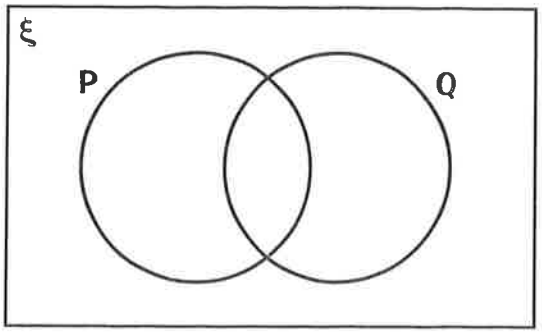
Venn Diagrams

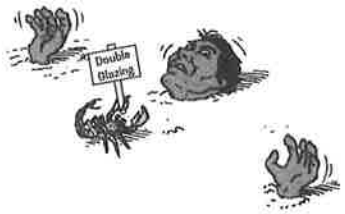
Don't be put off by the weird symbols that go with the sets — once you've figured them out you'll find that Venn diagrams are a pretty handy tool. Remember, the squiggly symbol ξ means the 'universal set' — that contains all the elements that you need to consider in a particular question.

Q1 The elements of ξ are the odd numbers between 0 and 16.
Set P contains the multiples of 3, and set Q contains the multiples of 5.

a) Using set notation, write sets ξ, P and Q as complete lists of their elements.

b) Show the elements of these sets on a copy of the Venn diagram below.





Q2 Using the Venn diagram on the right, write down the following:

a) The elements of set S.

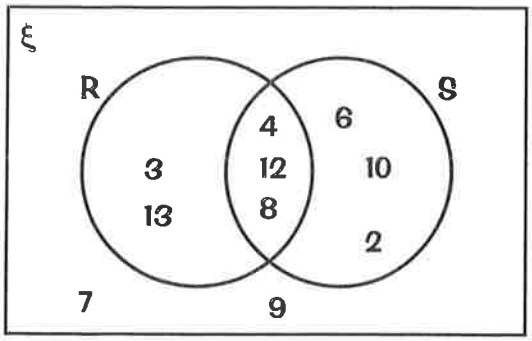
b) The elements of set R ∩ S.

c) n(R)

d) The elements of set S'.

e) n(R')

f) n(R ∪ S)



Q3 A survey asked people if they like cats and dogs.
8 people said they only like cats, 9 people said they only like dogs,
4 people said they like both and 6 people said they like neither.

a) Draw a Venn diagram to show this data.

b) A person from the survey is chosen at random.
What is the probability that the chosen person:

i) likes cats

ii) doesn't like dogs?

Q4 ξ = {integers from 1-16 inclusive}, A = {multiples of 2} and B = {square numbers}.

a) What are the elements of A ∩ B?

b) Draw a Venn diagram, showing the number of elements in each part of the diagram.

c) If a card from a set of cards numbered 1-16 is chosen at random, what is the probability that:

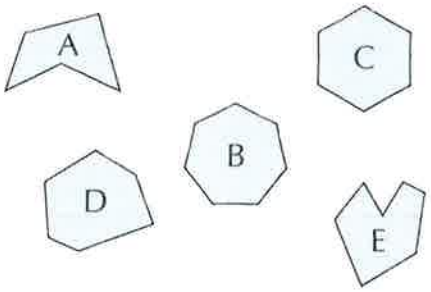
i) the card is a multiple of 2

ii) the card is both a multiple of 2 and a square number

iii) the number is not a square number?

Polygons

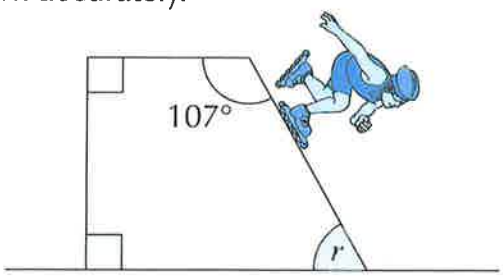
1. Sort the letters of the shapes into the table on the right.



Shape	Regular	Irregular
Pentagon		
Hexagon		
Heptagon		

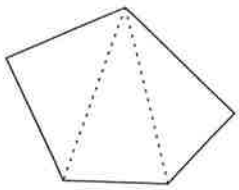
2. The diagram shows a ramp in a skate park.
It makes an angle r with the ground. Find r.

The diagram is not drawn accurately.



r = ... °

3. A pentagon can be split up into 3 triangles, as shown on the right.



a) Fill in the blanks to complete the working below.

> The interior angles in one triangle add up to ..... °,
>
> so the interior angles in a pentagon add up to ..... × ..... ° = ... °.

b) Adebayo splits an octagon into triangles in the same way.

(i) How many triangles are in an octagon?

Sketch an octagon if you need to.

.....

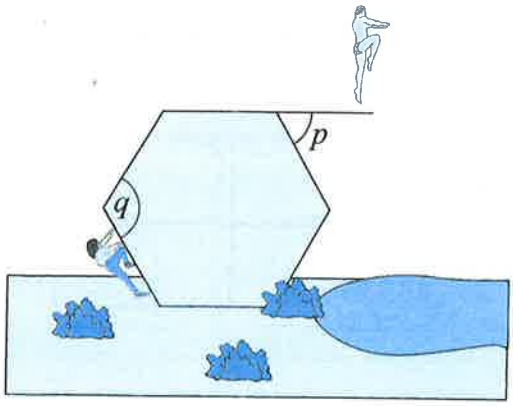
(ii) What is the sum of the interior angles in an octagon?

..... °

Polygons

4. Hexagon Rock is a regular hexagon and a popular diving spot by Lake Splashmere.

Find the angles p and q.



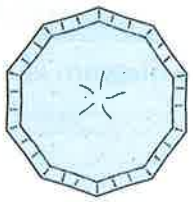
p = ... °

q = ... °

5. Afia has baked a pie in the shape of a regular decagon.

Work out the size of each interior and exterior angle of the pie.

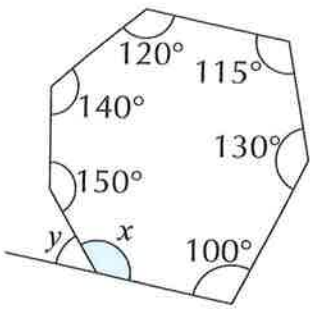
A decagon is a 10-sided polygon.



Exterior angle: ..... °

Interior angle: ..... °

6. Find x and y in the irregular polygon below.



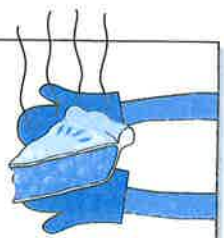
x = ... °

y = ... °

How did you do?

Freshly baked pie, anyone? Once you've finished these pages, make sure you can:

- ☐ **Find the sum of the interior angles in a polygon.**
- ☐ **Find interior and exterior angles in regular polygons.**
- ☐ **Use the sum of the interior and exterior angles to find unknown angles in irregular polygons.**



Interior and Exterior Angles

Running out of angles? Head to the corner shop...
Interior and exterior angles are kinda tricky, but sorry — you've got to know how to do them. Learn the formulas, then give this page a shot.

Q1 Write down the formulas for the exterior and interior angles of a regular polygon.

Exterior angle .....

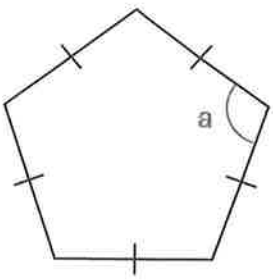
Interior angle .....

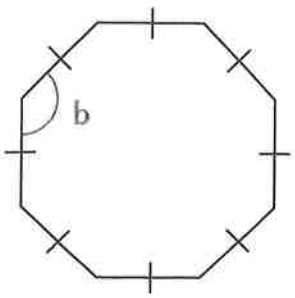
Q2 Calculate the exterior and interior angles of a hexagon.

Exterior angle .....

Interior angle .....

Q3 Calculate the missing angle in each of the following diagrams:

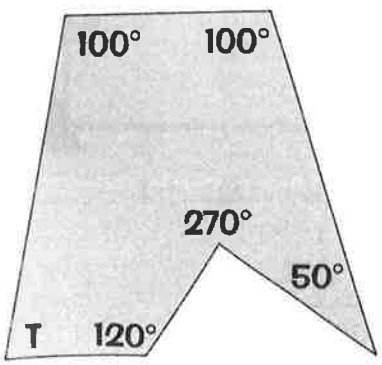




a = ...

b = ...

Q4 Calculate the missing angle T in this irregular polygon:



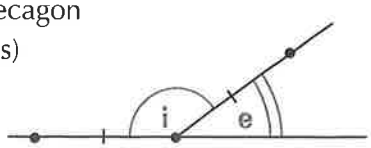
T = ...

Interior and Exterior Angles

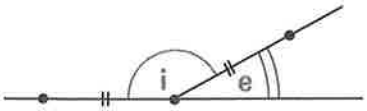
You're bound to get asked about these, so make sure you know the formulas...
For any polygon, the sum of the exterior angles is 360°, and interior angle = 180° – exterior angle.
In a regular polygon the exterior angle is just 360° ÷ number of sides.

Q1 These diagrams show parts of regular polygons.
Calculate the interior and exterior angles in each case.

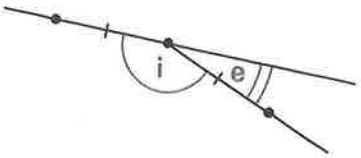
a) Regular decagon (10 sides)



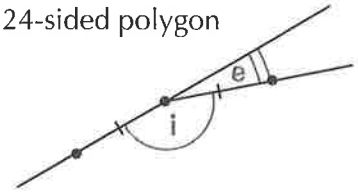
b) Regular 15-sided polygon



c) Regular 20-sided polygon



d) Regular 24-sided polygon



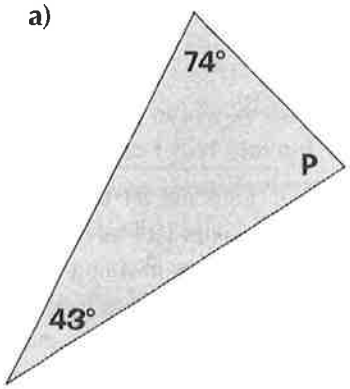
Q2 Find the number of sides of a regular polygon with an INTERIOR angle of:

a) 140° **b)** 150° **c)** 160° **d)** 168° **e)** 170°

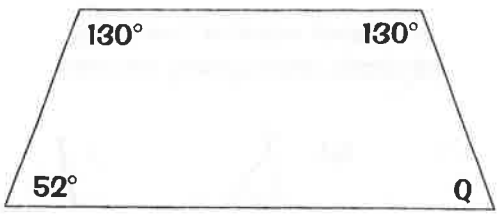
Q3 Find the missing angles:

For any polygon with n sides,
sum of interior angles = $(n - 2) \times 180°$

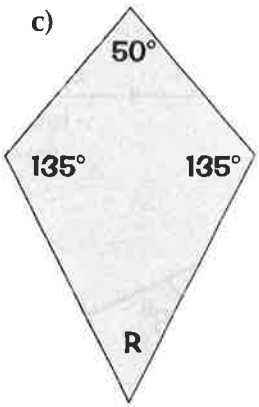
a)



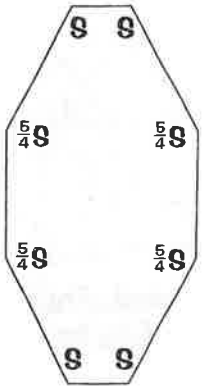
b)



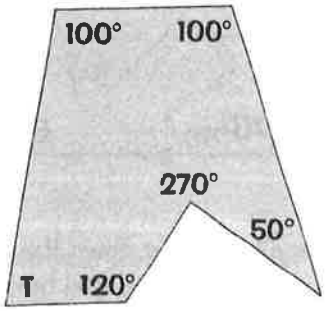
c)



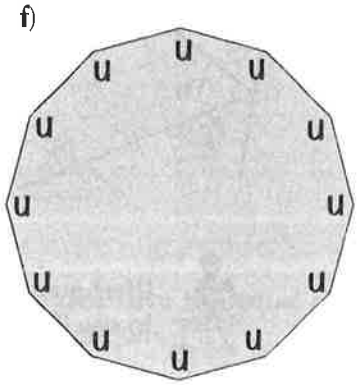
d)



e)



f)



Probability

1. 30 blue bottles and 50 grey bottles are put into a recycling box.
Two of the blue bottles and three of the grey bottles in the box are broken.

Give your answers to these questions as fractions in their simplest form.

a) What is the probability of randomly picking a blue bottle from the box?

.....

b) What is the probability of randomly picking a broken grey bottle from the box?

.....

c) What is the probability of randomly picking a bottle that is not broken from the box?

.....

2. A fair, six-sided dice (labelled 1-6) is rolled and a fair coin is tossed.

a) List all the possible outcomes of this experiment. The first two have been done for you.

1, Heads 1, Tails

b) What is the probability that the dice lands on 5 and the coin lands on tails?

.....

c) What is the probability that the coin lands on heads and the dice lands on a number less than 4?

.....

3. Amber writes the names of all of the members of her chess club in the appropriate place on this sorting diagram.

	Likes avocados	Doesn't like avocados
Likes olives	Ted Mackenzie	Virginia
Doesn't like olives	Katie Stanley Milly	Ekrem Katrina Leanne Olivia

a) Amber likes avocados but doesn't like olives.
Put her name in the correct part of the sorting diagram.

b) A member of the chess club is picked at random.

(i) What is the probability that Amber is picked?

.....

(ii) What is the probability that the person who is picked likes olives?

.....

Probability

4. A cinema is showing three comedy films, a horror film and two historical films. Claudia picks a film to watch at random.

a) What is the probability, as a decimal, that Claudia picks a comedy film?

.....

b) Whenever Claudia goes to the cinema, she either buys popcorn, a hot dog or neither — but never both. The probability that she will buy popcorn is 10% and the probability that she will buy neither is 50%.

What is the probability, as a percentage, that she will buy a hot dog?

..... %

5. Two fair spinners, numbered 1-4, are spun and the numbers that they land on are multiplied together.

a) Complete the sample space diagram on the right to show all the possible outcomes.

×	1	2	3	4
1	.....	.....	.....	.....
2	2	.....	.....	.....
3	.....	.....	.....	12
4	.....	.....	.....	.....

b) How many possible outcomes are there?

.....

c) Giving your answers as fractions in their simplest form, find the probability that the result is:

16 .....

a multiple of 3 .....

greater than 5 .....

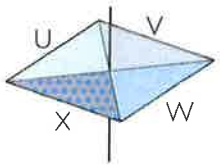
How did you do?

My favourite sample space is that little counter in the supermarket where they give out the free cubes of cheese. But enough about me. Before you move on, you should:

- ☐ **Be able to calculate the probability of events based on equally likely outcomes.**
- ☐ **Know that the probabilities of all possible outcomes add up to 1.**
- ☐ **Be able to list possible outcomes of experiments, and display these in a sample space diagram.**
- ☐ **Be able to calculate the probability of events using a sample space diagram.**

Probability from Experiments

1. The spinner below is spun 60 times. The table shows the results.



	U	V	W	X
Frequency	6	18	21	15
Relative frequency	.....	.....	.....	.....

To find the relative frequency of an event, divide its frequency by the number of times the 'experiment' was carried out.

a) Complete the table, giving the values as decimals.

b) Do you think the spinner is fair or biased? Explain your answer.

.....

.....

2. Felicity tosses a biased coin 600 times. How many times would you expect the coin to land on heads if the probability of it landing on heads is...

a) $\frac{1}{3}$? b) $\frac{2}{5}$? c) 1?

....

3. A game at a carnival guarantees that everyone who plays wins one of the prizes on the right. 40 people play the game.

a) 22 people win a rubber duck.
What is the relative frequency of winning a rubber duck?

.....

b) The relative frequency of winning an invisible marble is 0.35.
How many people have won an invisible marble?

.....

c) Work out an estimate for the probability of winning a huge teddy.

.....

How did you do?

I expect that you probably found this page a blast. But then I would say that — I'm pretty biased in favour of this kind of thing. Now then, before moving on make sure you know how to:

- ☐ **Find relative frequencies and use these to estimate probabilities.**
- ☐ **Work out expected frequencies.**
- ☐ **Decide if an experiment is fair or biased.**