Exploring data and contextualising mathematics

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GCSE Mathematics – Numeracy

Will have an emphasis on **solving problems** in the **real world** and the problem-solving cycle. The more numerical aspects of mathematics will feature prominently within the specification but there will also be opportunities for learners to make informed decisions about the use of technology, the management of money and the **use of statistics**.

Weighting of Numeracy Paper

Assessment objectives		Weighting
AO1	Recall and use their knowledge of the prescribed content	15%–25%*
AO2	Select and apply mathematical methods in a range of contexts	50%–60%*
AO3	Interpret and analyse problems and generate strategies to solve them	20%–30%*

Dragon CarCare is a car cleaning company.

Dragon CarCare is charged the following costs for products and services.

Car cleaning products	Costs
Car wash liquid	£1 per 5 litre bottle
Window spray	£2 per 2 litre bottle
Wax	£2.50 per 2 litre drum
Cloths and sponges	10p each

Service	Unit cost
Water	£2 per m³ + Standing charge £4 per month
Electricity	25p per kWh + Standing charge £10 per month + 5% VAT

How much did *Dragon CarCare spend on car cleaning products in June* 2014? (3 marks)

Calculate the total cost of the water and electricity used by *Dragon CarCare* during June 2014. (4 marks)

During June *Dragon CarCare* used the following quantities of products.

Car cleaning products	Quantity used
Car wash liquid	12 bottles
Window spray	8 bottles
Wax	6 drums
Cloths and sponges	100 cloths + 100 sponges

At the beginning and at the end of June, the meter readings for water and electricity were recorded.

Service	Time: 00:01 Date: 1 June 2014 Meter reading	Time: Midnight Date: 30 June 2014 Meter reading
Water	3450 m³	3950 m³
Electricity	3000 kWh	3800 kWh

Numerical reasoning

☐ Are students taught numerical reasoning skills and then given enough opportunity to develop and master those skills?

Identify

What is the key information?

Are there any key words?

Which maths topics will I need to use?

Sian buys and sells hoodies for a living. She buys 60 hoodies and pays £6 for each one.

50% of the hoodies are blue. She sells these for £10 each.

25% of the hoodies are red. She sells these for £8 each.

The remainder of the hoodies are green.

Sian wants to make a total profit of £150. How much should Sian sell each of the green hoodies for?
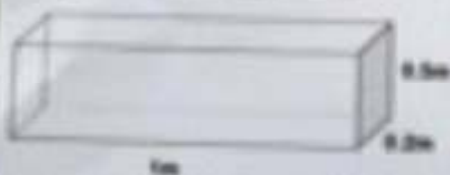
What do I already know about these topics?

What do I need to find out?

Will I need any equipment?

- Work out the amount Sian pays for all of the hoodies.

- Find 50% of 60 and use this to work out how much the blue hoodies were sold for in total.

- Find 25% of 60 and use this to work out how much the red hoodies were sold for in total.

- Work out how many green hoodies there are.

- Work out how much money Sian has earned in total selling blue and red hoodies.

- Work out the profit that Sian has made from selling blue and red hoodies.

- Work out how much more money Sian will need to make to reach her target of £150 profit.

- Work out how much she needs to sell each green hoodie for.

- Write your answer as a full sentence.

✓ Check

Has the question *actually* been answered?

Does the answer make sense?

Is the answer bigger or smaller than you would expect?

Have the correct units been used?

Is the answer rounded correctly?

Review

'Ticktastic' and 'Tickymaster' are two websites selling concert tickets for the Motorpoint Arena in Cardiff. Each of the websites adds a credit card charge and a booking fee to the ticket price.

Ticktastic	Tickymaster
Credit card charge: 2.5% of ticket price.	Credit card charge: 1% of ticket price.
Booking fee: 80p	Booking fee: £1.40

David wants to buy 2 concert tickets. Tickets cost £30 each on both of the websites. David will pay by credit card.

Will it be cheaper for David to buy the concert tickets from Ticktastic or Tickymaster?

Identify

Scribble your ideas in...

+ What is the key information?
+ Are there any key words?
+ Which maths topic will I need to use?
+ What do I need to find out?

Communicate

Flip your ideas over and write it up clearly...

Check:

Tick this box once you're...

+ Have I actually answered the question?
+ Does my answer make sense?
+ Is my work easy to follow? Is it set out logically?
+ Have I used the correct units?

RELAY QUESTION 1 — GRADE E

20 cm
40 cm
50 cm
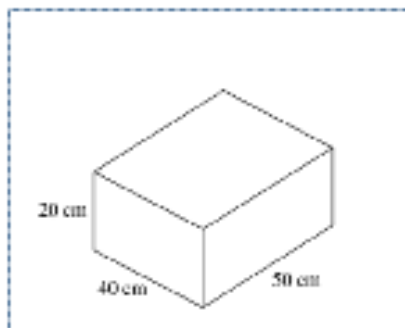
The diagram shows a cuboid.

Work out the volume of the cuboid.

RELAY QUESTION 11 — GRADE C

The shape below is the cross section of a prism 10cm long.

Calculate the volume of the prism.

2 cm

2 cm

4 cm
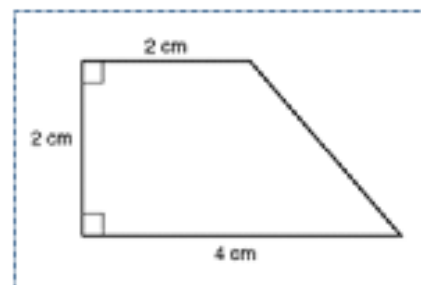
RELAY QUESTION 6 — GRADE D

The diagram shows a circle of diameter 70cm inside a square of side 70cm.

Work out the area of the shaded part of the diagram

70cm

70cm
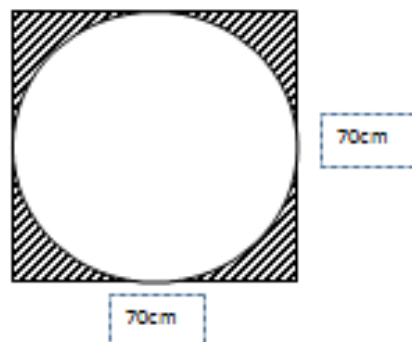
RELAY QUESTION 16 — GRADE B

Twelve rectangles, all the same size, are arranged to make a square outline, as shown in the diagram. Calculate the area of one of the rectangles

50 cm

40 cm
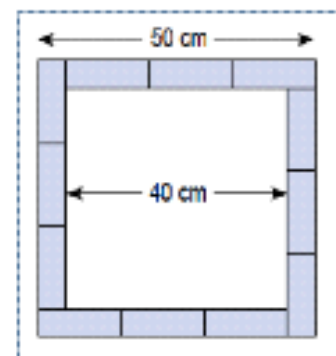
Contextual Learning

□ Do learning activities include real, believable problem-solving situations that students can recognize as being important to their current lives, possible future lives or the world they live in?

□ Are students expected to participate regularly in interactive groups where sharing, communicating, and responding to the important concepts and decision-making occur?

Extended learning Tasks

- Used Real data
- Topics that were interesting, relevant, exciting
- Used a range of procedural skills
- Focus on numerical reasoning and problem solving
  - Identify or obtain required information to complete the task
  - select appropriate mathematics and techniques to use
  - explain results and procedures precisely using appropriate mathematical language
- Students given the opportunity to discuss, struggle and to learn from each other

The causes of wildlife decline based on analysis of 3,430 species' populations

Exploitation 37%

Climate change
7%

other
11%

Habitat degradation/change
31%

13%

Habitat loss

-76%

THE LPI FOR FRESHWATER SPECIES SHOWS AN AVERAGE DECLINE OF 76 PER CENT

-39%

MARINE SPECIES DECLINED 39 PER CENT BETWEEN 1970 AND 2010

-39%

TERRESTRIAL SPECIES DECLINED BY 39 PER CENT BETWEEN 1970 AND 2010

INTERNATIONAL ANIMAL RESCUE

WWF

the guardian

Extract from The Guardian

Earth lost 50% of its wildlife in the past 40 years, says WWF.

The number of wild animals on Earth has halved in the past 40 years, according to a new analysis. Creatures across land, rivers and the seas are being decimated as humans kill them for food in unsustainable numbers, while polluting or destroying their habitats, the research by scientists at WWF and the Zoological Society of London found.

Extract from Wikipedia

Endangered animals and the reasons for population decline

Endangered animal	Population in 1974	Population in 2014	Reasons for low numbers in population
Amur Leopard	120	40	Poaching and forest degradation (human)
Javan Rhinoceros	60	50	Poaching for horns
California Condor	220	130	Poaching and loss of habitat
Sumatran Rhinoceros	500	275	Poaching for their horns
Cross River Gorilla	730	300	Fragmented population (human activity)
Asiatic Lion	180	410	Recovered from extinction in conservation area
North Pacific Right Whale	120	30	Poachers and change in environment (climate)
Indochinese Tiger	1,200	500	Hunters (body parts used as adornments)
Leatherback Turtle	115,000	30,000	Drowned in fishing nests

Central South Consortium
Consortiwm Canolbarth y De

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Endangered species

Question 1
According to Wikipedia, which species does not follow the trend of population decline between 1974 and 2014? Why is this?

Question 2
Calculate how many species of wildlife declined in population due to habitat loss, according to the Born Free Foundation.

Question 3
Using the template provided, complete an infographic showing the decline in population of the species given in the extract from Wikipedia.
See the source from the International Animal Rescue as a guide.
Show all your workings.

Question 4
Predict the population of the Asiatic lion in 2054 (another 40 years).
What assumptions have you made?
You must justify your answer mathematically.

Question 5
Predict the population of the leatherback turtle in 2054 (another 40 years).
What assumptions have you made?
Why might your answer be unreliable?

Question 6
It is predicted that the Sumatran Rhinoceros is declining in numbers by 7% per annum. Assuming the percentage decrease in population remains constant, by what year will the Sumatran Rhinoceros become extinct?
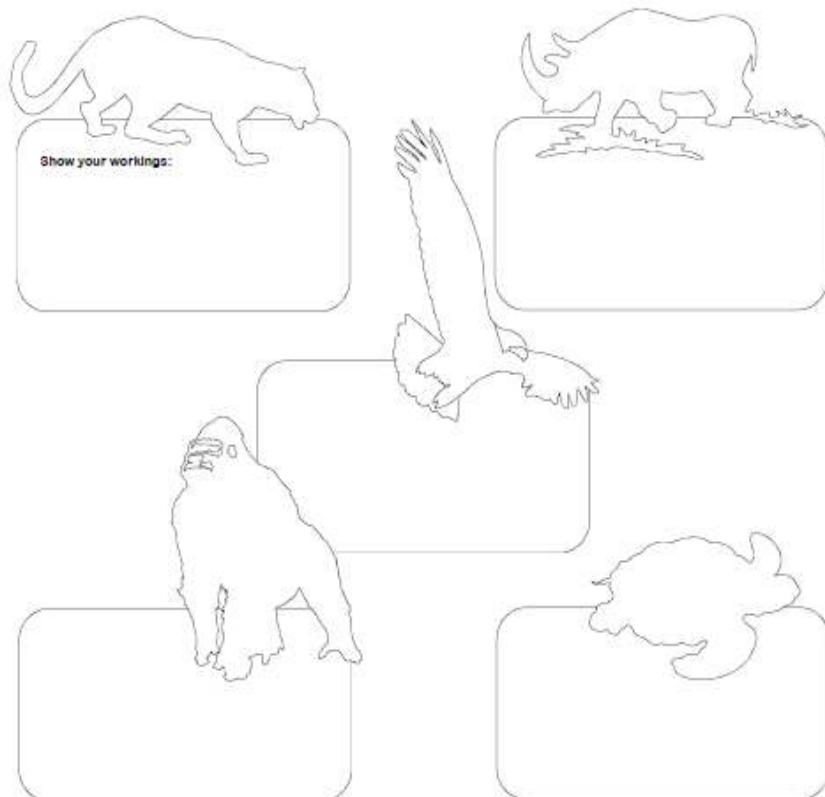You must justify your answer mathematically.

Extract from Wikipedia

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Endangered

Show your workings:

-76%

-39%

-39%

THE LPI FOR FRESHWATER SPECIES SHOWS AN AVERAGE DECLINE OF 76 PER CENT

MARINE SPECIES DECLINED 39 PER CENT BETWEEN 1970 AND 2010

TERRESTRIAL SPECIES DECLINED BY 39 PER CENT BETWEEN 1970 AND 2010

Question 3

Using the template provided, complete an infographic showing the decline in population of the species given in the extract from Wikipedia.

See the source from the International Animal Rescue as a guide.

Show all your workings.

Question 1

According to the guardian, what percentage of wildlife has been lost in the last 40 years?

Question 2

According to Wikipedia, which species **does not follow** the trend of **population decline** between 1974 and 2014? Why is this?

Question 3

What percentage of wildlife declined in population due to habitat loss, according to the Born Free Foundation?
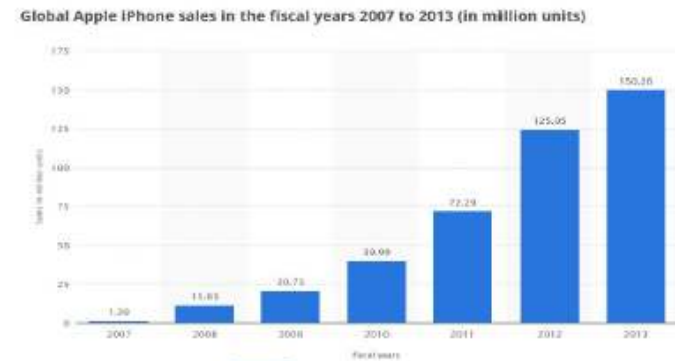
Question 4

According to the infographic from International Animal Rescue, what species has declined the most?

Challenge question

According to Wikipedia, how many Asiatic lions are there in the world today?

What is the percentage increase from 1974?

Extract from Office for National Statistics

Chart of Global iPhone sales per quarter (USA)

Fiscal Year	Quarter	Sales (millions)
2012	1	36
	2	34
	3	27
	4	28
2013	1	47
	2	38
	3	31
	4	34
2014	1	51

Global Apple iPhone sales in the fiscal years 2007 to 2013 (in million units)

Extract from Wikipedia

A fiscal year (or financial year) is not the same as a calendar year in 35% of the world's countries.

For example, the United States government fiscal year for 2014 is:

- 1st quarter: 1 October 2013 – 31 December 2013
- 2nd quarter: 1 January 2014 – 31 March 2014
- 3rd quarter: 1 April 2014 – 30 June 2014
- 4th quarter: 1 July 2014 – 30 September 2014

Extract from Encyclopaedia Britannica

Chart of various Fiscal Years by country

Country	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
China				■	■	■	■	■	■	■	■	■	■	■	■			
Hong Kong							■	■	■	■	■	■	■	■	■	■	■	■
India							■	■	■	■	■	■	■	■	■	■	■	■
Germany				■	■	■	■	■	■	■	■	■	■	■	■			
Netherlands				■	■	■	■	■	■	■	■	■	■	■	■			
UK							■	■	■	■	■	■	■	■	■	■	■	■
USA	■	■	■	■	■	■	■	■	■	■	■	■						

1) What percentage of countries' fiscal (financial) year runs exactly the same as their calendar year?

2) Name two countries whose fiscal and calendar years do not match.

3) In the USA, which three months represent quarter 1?

4) During which quarter of the year are most iPhones sold? Why do you think this might be?

5) According to the extract from the Office for National Statistics, how many iPhones were sold in the 2012 fiscal year?

Give one reason why these figures differ slightly to those shown on the graph from Statista.

6) What percentage of iPhones sold in the 2012 fiscal year were sold in quarter 1?

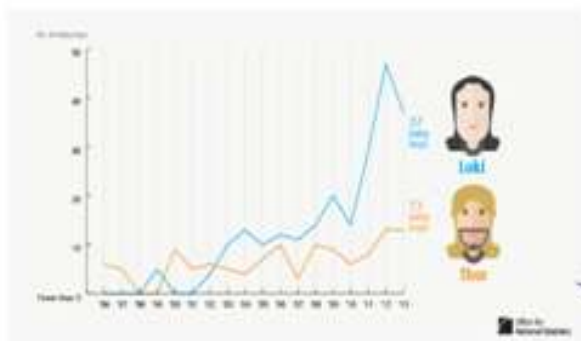Does the percentage for quarter 1 sales increase or decrease in 2013?

7) Represent the data from the Office for National Statistics using an appropriate chart or diagram.

8)The graph shown does not include data for 2014. Do you think that the upward trend of iPhone sales continues? Can you predict total sales for the 2014 fiscal year?

You must justify your answer mathematically.

Snowboarding
1 in 2.5 million

1 in 2.5
Heart attack

1 in 3,500,000
Snake bite

Plane crash
1 in 11 million

Scuba diving
1 in 30,000

Lightning strike
1 in 10,000,000

Running
1 in 1 million

Hiking
1 in 15,000

Shark attack
1 in 300 million

Left-handedness*
1 in 4.5 million

Central South Consortium
Consortiwm Canolbarth y De
Joint Education Service
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There were **more than 27,000** different boys' names in 2013.

(21,000 in 2003)

There were **more than 35,000** different girls' names in 2013.

(27,000 in 2003)

Office for National Statistics

BBC NEWS

statista

mumsnet

Winter Themed Girl's Names 2014 (total of 3610)

Winter Themed Boys names 2014 (Total of 1158)

NEWS MAGAZINE

Who, What, Why:
Why do some countries regulate baby names?

A 15-year-old Icelandic girl has won the right to keep her first name, despite it being "unapproved" by the state. Why do some countries restrict baby names?

Bjork Eidsdottir had no idea when, in naming her newborn girl **Blaer** 15 years ago, she was breaking the law. In the eyes of the authorities Blaer, which means "light breeze", was a male name and therefore not approved. It meant that for her entire childhood, Blaer was known simply as "Girl" on official documents.

newsround

French court stops child from being named Nutella

A French court has stopped parents from naming their baby girl Nutella after the hazelnut spread.

It was decided that the name would make her a target for people to pick on her.

The judge ordered that the child be called Ella instead.

He said in his ruling that Nutella was a spread that is commonly found in a lot of French homes and it would be bad for the child to have a name "that can only lead to teasing."
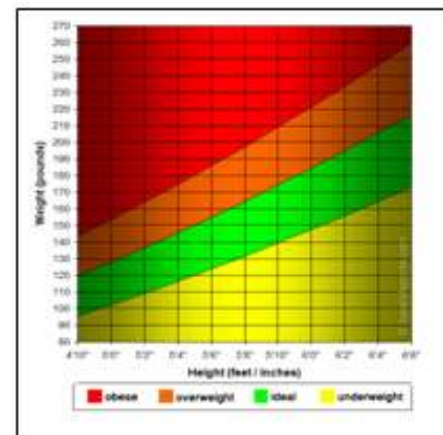
French parents are usually free to choose the names of their children, but local officials do have the power to report what they think to be unsuitable names to a family court

	kJ	kcal	fat	sat fat	sugars	salt
per portion	2125	508	25g	9.5g	9.0g	2.3g
%RI* (Adult)	25%	25%	36%	47%	10%	38%

*Reference Intake (RI) of an average adult (8400 kJ/2000 kcal)

	kJ	kcal	fat	sat fat	sugars	salt
per portion	1410	337	17g	1.5g	0.6g	0.62g
%RI* (Adult)	17%	17%	24%	7%	1%	10%

*Reference Intake (RI) of an average adult (8400 kJ/2000 kcal)
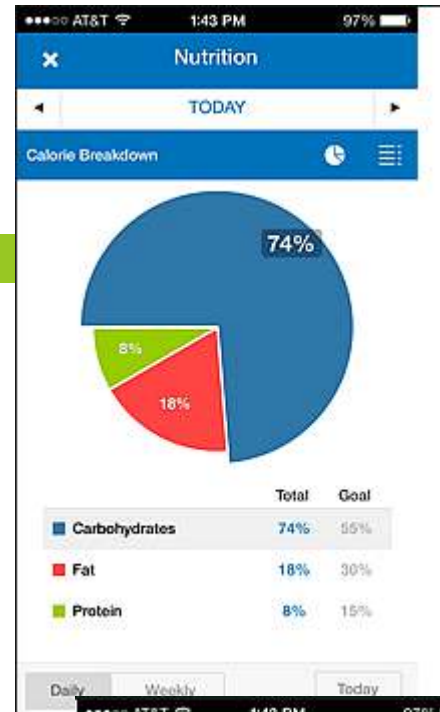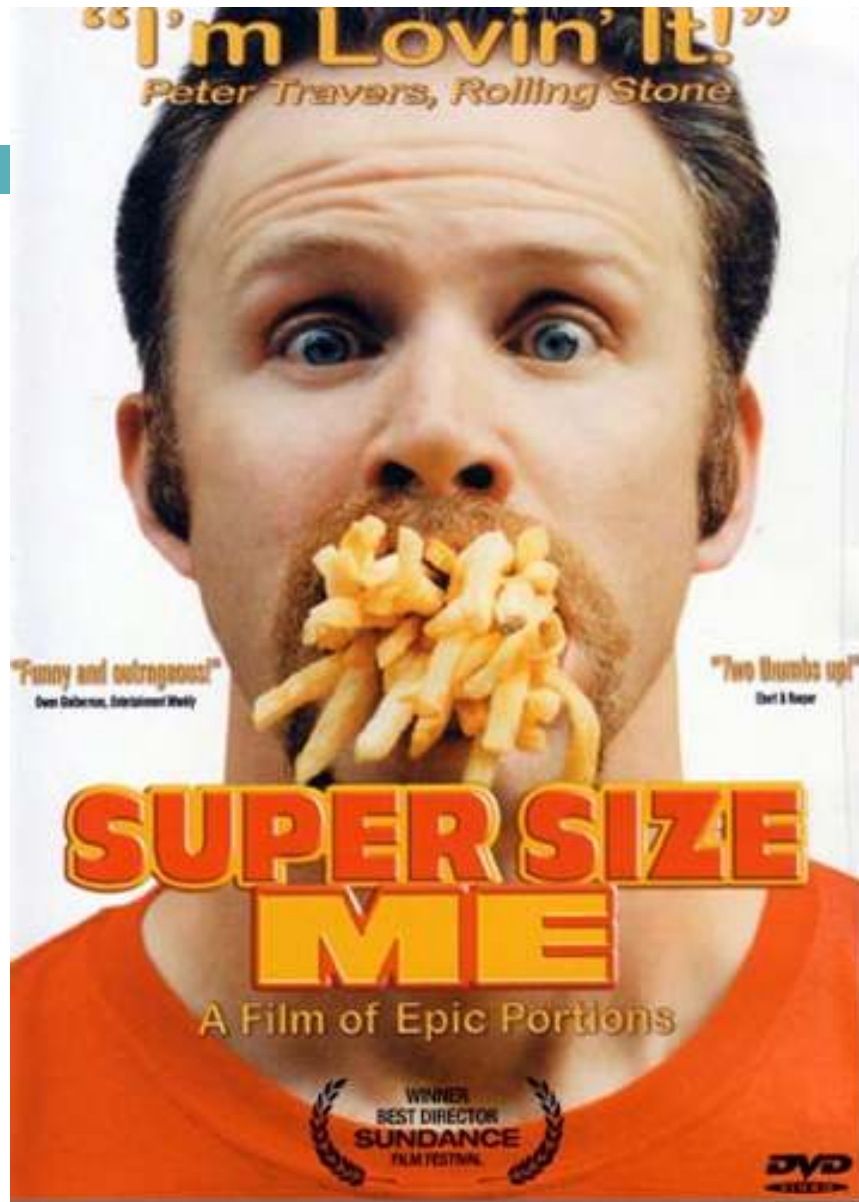
The table to the right shows the estimated calorie intake needs for children in order to maintain energy balance.

Sedentary = Only light physical activity typical of a normal day.

Moderately Active = Includes physical activity equivalent to walking 1 1/2 to 3 miles per day at a pace of 3 to 4 mph. This activity is in addition to the normal daily activity.

Active = Includes physical activity equivalent to walking more than 3 miles per day at a pace of 3 to 4 mph. This activity is in addition to the normal daily activity.

Gender	Age (years)	Sedentary	Moderately Active	Active
Child	2 - 3	1,000	1,000 - 1,400	1,000 - 1,400
Female	4 - 8	1,200	1,400 - 1,600	1,400 - 1,800
	9 - 13	1,600	1,600 - 2,000	1,800 - 2,200
	14 - 18	1,800	2,000	2,400
Male	4 - 8	1,400	1,400 - 1,600	1,600 - 2,000
	9 - 13	1,800	1,800 - 2,200	2,000 - 2,600
	14 - 18	2,200	2,400 - 2,800	2,800 - 3,200

Profile of Wales

Population
5% of the UK

3.1 million

mid-2012

Median Age
Wales
41.7 years

Scotland
41.5 years

England
39.5 years

Northern Ireland
37.6 years

mid-2012
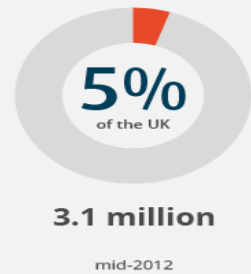
DDA Disabled and work limiting disabled
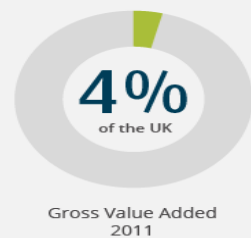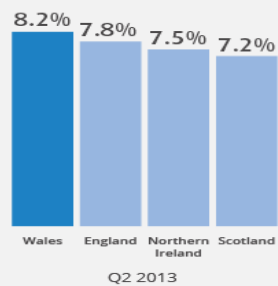
Wales	Scotland	Northern Ireland	England
14.3%	14.0%	13.7%	11.8%

2012/13

Economic Output
4% of the UK

Gross Value Added 2011

Wrexham

Cardigan

Swansea

Bridgend

Newport

Cardiff

Unemployment

Wales	England	Northern Ireland	Scotland
8.2%	7.8%	7.5%	7.2%

Q2 2013

Weekly Earnings

Wales **£455**

Scotland **£498**

Northern Ireland **£460**

England **£513**

Median earnings of full-time employees
April 2012

House Prices

Northern Ireland £130K

Wales £162K

Scotland £181K

England £251K

June 2013

Regional Profile of the North West

Population
11% of the UK

7.1 million

Third highest in the UK
mid-2012

Life Expectancy

North West
77.4 years | 81.5 years

South East
80.0 years | 83.8 years

One of the **lowest** in England
2009–2011
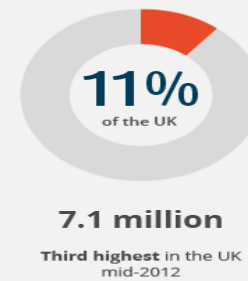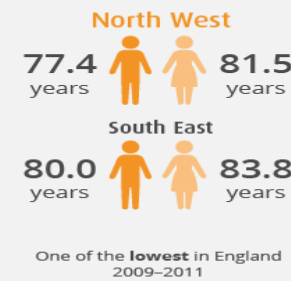
Children living in workless households
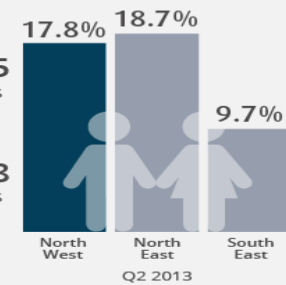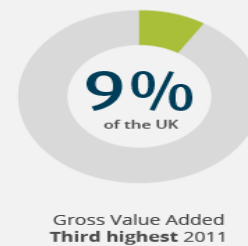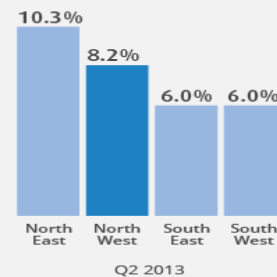
North West	North East	South East
17.8%	18.7%	9.7%

Q2 2013

Economic Output
9% of the UK

Gross Value Added
Third highest 2011

Carlisle

Lancaster

Blackpool

Bolton

Manchester

Liverpool

Warrington

Crewe

Unemployment

North East	North West	South East	South West
10.3%	8.2%	6.0%	6.0%

Q2 2013

Weekly Earnings

North West **£473**

London **£613**

Median earnings of full-time employees
April 2012

House Prices

North West £161,000

London £425,000

June 2013

Business use of social media in the UK in 2012

The vast majority of businesses had internet access and over 4 out of 10 used social media
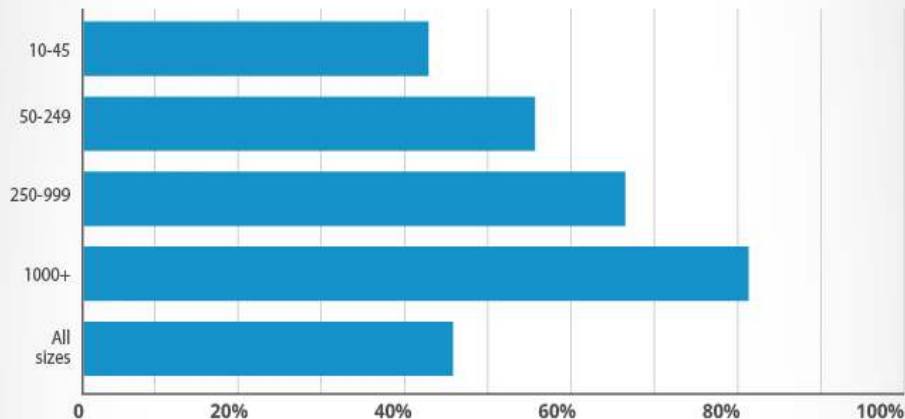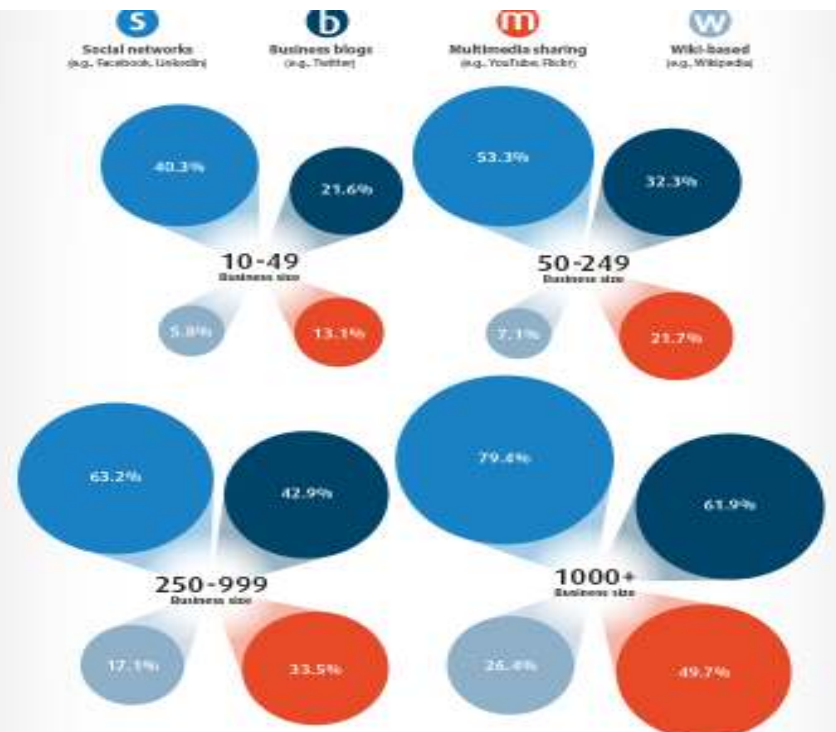
96% of businesses had internet access

44% of businesses used social media

PERCENTAGE OF UK BUSINESSES USING SOCIAL MEDIA BY SIZE

Business size by employees

- 10-45
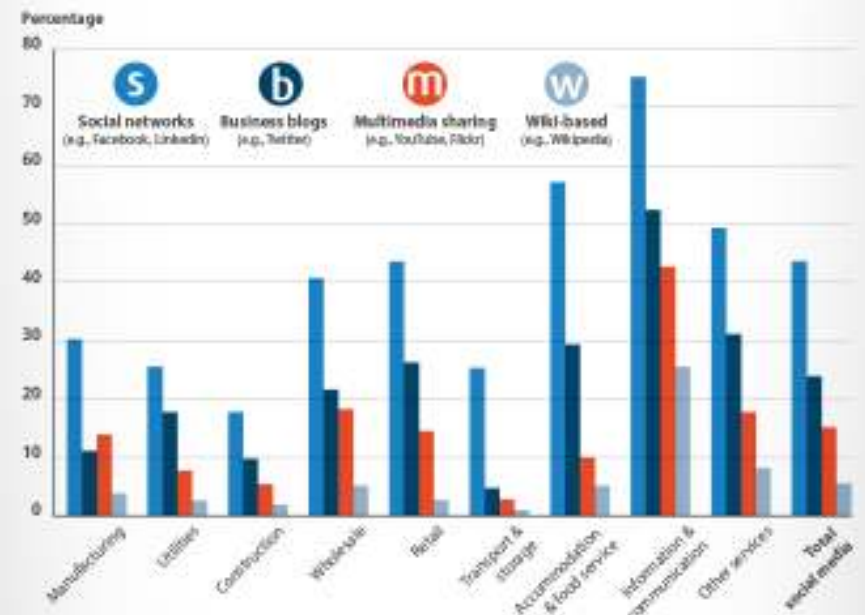- 50-249
- 250-999
- 1000+
- All sizes

0   20%   40%   60%   80%   100%

The likelihood of a business using social media is linked to business size. **81%** of businesses with **1,000 or more** employees used social media compared with **42%** of businesses with between **10 and 49** employees.

Social networks (e.g. Facebook, LinkedIn)
Business blogs (e.g. Twitter)
Multimedia sharing (e.g. YouTube, Flickr)
Wiki-based (e.g. Wikipedia)

10-49 Business size
- 40.3%
- 21.6%
- 5.8%
- 13.1%

50-249 Business size
- 53.3%
- 32.3%
- 7.1%
- 21.7%

250-999 Business size
- 63.2%
- 42.9%
- 17.1%
- 33.5%

1000+ Business size
- 79.4%
- 61.9%
- 26.4%
- 49.7%

SOCIAL MEDIA USAGE BY INDUSTRY

Percentage

Social networks (e.g. Facebook, LinkedIn)
Business blogs (e.g. Twitter)
Multimedia sharing (e.g. YouTube, Flickr)
Wiki-based (e.g. Wikipedia)

Industries: Manufacturing, Utilities, Construction, Wholesale, Retail, Transport & storage, Accommodation & food service, Information & communication, Other services, Total social media

Dan Meyer – Maths class needs a makeover

- TED Talk
  - Ask the shortest question possible