

Core Maths

(AQA Level 3 Mathematical Studies)

Bridging Material

The Blue Coat School, Oldham

Core Maths

Welcome to The Blue Coat School Maths department! Thank you for choosing to study Core Maths (AQA Level 3 Certificate in Mathematical Studies) as your future pathway in our sixth form. Core Maths is a course for the maths you will use everyday and it is the application and interpretation of the maths you met at GCSE. At Blue Coat, you will have 2 lessons a week and you will sit an exam at the end of Year 12.

***** Equipment Recommendation/Expectation *****

There are two exams in the summer for Core Maths, both of these exam papers are calculator, it is important we have the correct and most useful equipment to help us get the best mark in the exam.

Therefore, we **strongly** recommend that you purchase the following calculator; **Casio FX991EX**.

This calculator will be very useful in tackling questions from the Statistics section of the paper.



Core Maths must be taken seriously as there are numerous benefits to studying this course; the skills developed in the study of Core Maths are increasingly important in the workplace and higher education. Also, taking Level 3 Core Maths, as a future pathway, can result in receiving alternative offers from many universities (University of Bath, University of Sheffield and many more). Below is an excerpt from the University of Sheffield website;

From September 2019, if we offer you a place on certain courses with a GCSE Maths requirement, and you're taking one of the following Core Maths qualifications, we'll make you an alternative offer equivalent to one A Level grade below the standard entry requirements for your course, subject to you achieving a specific grade in Core Maths.

- AQA Level 3 Certificate Mathematical Studies

So, as we now know how important it is to do well in Core Maths, we want to help you bridge the gap from wherever you may be up to at GCSE, to the point where you can make a smooth transition into the Level 3 Mathematical Studies course.

To give you an insight to the course, here are some aspects you can expect to study:

1. Representing and Interpreting Data

This section is about comparing and interpreting data and being able to justify and explain which set of data is 'better' and doing so in context.

2. Maths for Personal Finance

This section is about the maths most adults say they wish they learnt at school. You will learn how to calculate income tax, national insurance, student loan repayments. You will start to understand AER and APR. This section will mostly be applying the percentages used throughout GCSE Maths.

3. Fermi Estimation

“How many hairs on the average human’s head?”

“How many chips are stolen by seagulls in Torquay in the summer months?”

This section is about getting a ‘rough’ answer to a calculation you will never get the exact answer to! The questions above cannot have an exact answer – there are too many factors involved. In a group of 20 people, there could be 20 different answers, each of which would be correct if you can state the assumptions you make and justify YOUR calculations.

Watch this video to see how these sorts of calculations work and why they are called Fermi Estimations:

<https://ed.ted.com/lessons/michael-mitchell-a-clever-way-to-estimate-enormous-numbers>

4. Critical Analysis of Data

“81.6% of all statistics are made up on the spot!”

This section is about being able to look behind the statistics, graphs and claims made in the media and being able to unpick whether the graph or claim is valid.

“3 Ways To Spot A Bad Statistic”

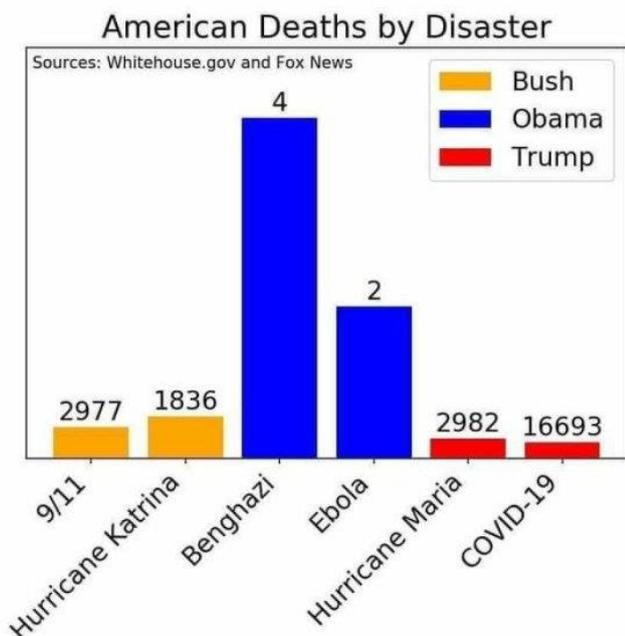
https://www.ted.com/talks/mona_chalabi_3_ways_to_spot_a_bad_statistic/footnotes?c=207625

- The graphs below are actually from News and Media outlets around the world on Coronavirus Covid-19.
- What is wrong with them? What do you think they are trying to convey with these graphs?

a) This graph was projected by channel FOX31 (United States)



b) This bar chart was shown on FOX News and apparently projected by the White House



For your summer work, we will be focusing on skills needed for the Finance section of Core Maths.

There are many parts to Finance: Exchange rates, APR, AER, interest, National Insurance, Tax, Student Loans, mortgages etc. All of the topics mentioned require students to have a solid grounding in using the four operation with Money, use of percentages, ratios and decimal multipliers.

Money is an extremely necessary part of life likewise calculating with money and being financially savvy is just as important, we need to know how to spend wisely, budget, see if a discount is credible, calculate our earnings after tax and there are other many well-known factors why Cash is King!

In the final task, I have attached a video of a typical real-life scenario in regards to a salary that is earned and it will show you how Tax and National Insurance is deducted. It is also the type of question you will be asked in your exam next summer!

Task 1

1. Below are a selection of GCSE videos from Corbett Maths (www.corbettmaths.com) which can help you prepare for Maths in Personal Finance topic in Core Maths. Read your way down the list and look at which topics you will need a refresher
2. I have hyperlinked the video numbers in the table which will take you the relevant video. Likewise, I have hyperlinked the topic names in the table, if you click on the topic, it will take you to the appropriate worksheet where you will be able to test your understanding. If there is no link attached, that means there is no video coinciding with that subject.
3. Alternatively, you can click on the website, click on 'Videos' or 'Worksheets'. Search the video numbers, watch the videos, attempt the practice or textbook exercises to have a solid foundation in your GCSE Maths and begin Maths for Personal Finance in confidence!

Topic	Video - Worksheet
Percentages	233 – Percentage Change 235 – Percentages of an amount (calculator) 236 – Percentages: Compound Interest 238 – Percentages: Increasing/Decreasing 239 – Percentages: Multipliers 240 – Percentages: Reverse
Exchange Rates & Money	214a – Number: Currency (Exchange Rates) 8 – Money Problems
Ratio	210 – Number: Best Buys 270 – Ratio: Sharing the total 271b – Ratio: difference between Ratio: Problem Solving

Task 2

This task is for you to gain an insight and an overview into the world of wages and salaries, click on the following link:

<https://www.bbc.co.uk/bitesize/guides/z8wjh39/revision/2>

Once you have access to the link, you will see 3 tabs, then follow these instructions:

1. Click on the middle tab labelled 'Video'. Watch the video and make notes.
2. Click on the left tab labelled 'Revise'. Have a read of the information, go through all 5 slides, make notes on key pieces of information, attempt the examples at the end of the pages and copy the answers to ensure you have correct notes in your book.
3. Finally, click on the right tab labelled 'Test'. Attempt the 10 questions to the best of your ability, once you have completed the test, click on 'Check Score' and reflect on how well you have done and what you have learnt from this exercise.

Task 3

Attached to this document are 3 worksheets relating to Finance:

1. ***The cost of goods and services***
2. ***Multiplication***
3. ***Going on Holiday***

You should attempt these and mark your work once completed. Answers are attached at the end of the worksheets.

Task 4

If you earn £50,000 a year, how much money would you take home each month after deducting Tax and National Insurance? On the next page you will find the rates of Income Tax and National Insurance you will pay dependant on how much you earn for the Tax Year 2017-18, there are also small pieces of information how to calculate your deductions. Use the tables below to calculate your 'take-home' pay. Once you have calculated your 'take-home' pay, watch the following video and see if your answer is correct!

Video: [Income Tax & NI - £50,000 a year](#)

Income Tax and National Insurance 2017–2018

Income tax 2017–2018

Everyone in the UK has a personal allowance. This is their annual amount of tax-free income. The standard personal allowance for 2017–2018 is £11 500

The rates of income tax you pay depend on how much **taxable income** you have above your personal allowance.

Income tax rates and taxable bands 2017–2018

Rate	Taxable income
Basic: 20%	up to £33 500
Higher: 40%	over £33 500 and up to £150 000
Additional: 45%	over £150 000

Calculating your income tax

Find your taxable income by subtracting your personal tax allowance from your annual gross income.

You pay income tax at 20% on the first £33 500 of your taxable income.

You pay income tax at 40% on your taxable income over £33 500 and up to £150 000

National Insurance (NI) 2017–2018

Percentage NI due	Minimum weekly income	Maximum weekly income	Minimum yearly income	Maximum yearly income
0%		£157		£8164
12%	£157.01	£866	£8164.01	£45 032
2%	above £866		above £45 032	

Examples

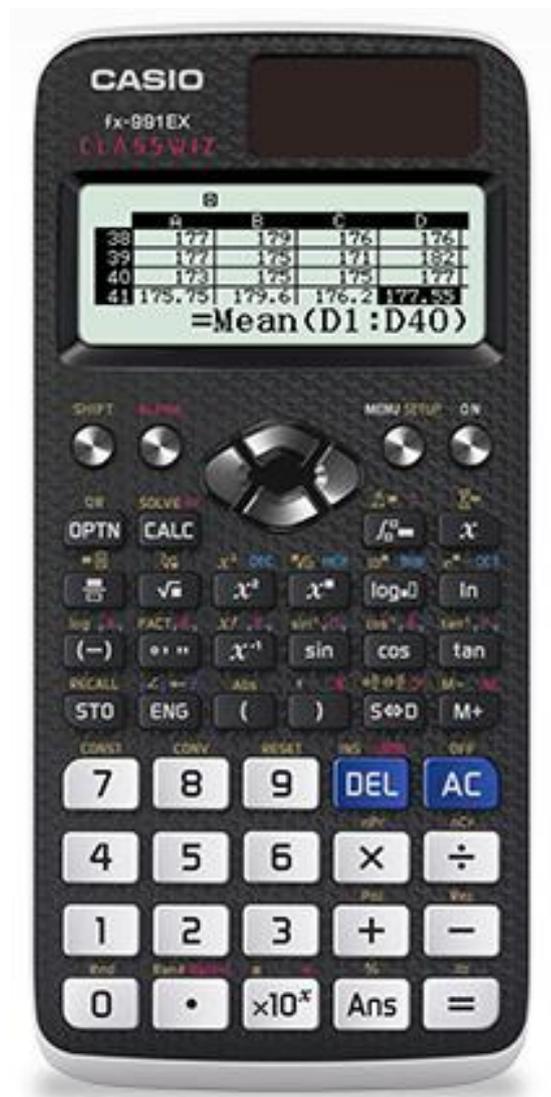
A person who had a weekly income of £350 paid 12% on the amount above £157

A person who had a weekly income of £950 paid 12% on the amount between £157.01 and £866 plus 2% of the amount above £866

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The cost of goods and services

The cost of goods in the shops is made up of several elements:

- the cost of the item to the shopkeeper (the **cost price**)
- a contribution towards the shop expenses and the staff salaries
- **profit** (the amount the shopkeeper 'makes' after all expenses are paid)
- **VAT** (Value Added Tax).

Adding together all the elements above gives you the **selling price** of the item. That is the price on the label in the shop.

Shopkeepers do not always make a profit. If goods do not sell, they may need to set the selling price below the cost price. In this case they will make a **loss**.

VAT

VAT is a sales tax that provides the Government with revenue for public spending. It has already been included in the price of goods and services you buy. The seller has to add it to the price they wish to charge. Sometimes it is shown as a separate line on an invoice or receipt.

QUESTIONS

1 Part of Arif's bank statement is shown below.

Date	Description	Credit	Debit	Balance
24 June				£73.50
26 June	Gas bill		£30.00	
	Cash machine		£50.00	-£6.50
27 June	Salary	£1010.00		£1003.50
1 July	Rent		£350.00	£653.50
4 July	Online payment		£28.35	£625.15
7 July	Mobile phone direct debit		£35.00	
	Retail refund	£20.00		£610.15
8 July	Cash machine		£30.00	£580.15

- a Explain what happened on 26 June.
- b On 9 July Arif had a dentist appointment which cost £35 and a grocery shop of £45.13. What was her final balance on 9 July?
- 2 Jess renovates computers. He sells a laptop for £135 + VAT. The laptop cost him £30. His costs including wages for staff were £73. What profit did he make?
- 3 Erin makes 6 cakes for a charity day. She cuts each cake into 12 slices and sells each slice for 75p. She makes a profit of £36. What was the cost price of each cake?
- 4 Camille organised a local charity fun day. She had to hire some premises and equipment as well as buy prizes and goods to sell. She spent £120 on the premises, £42 on equipment and £94 on prizes and goods to sell. On the day, she took the following money:
- £115 on entrance tickets
 - £165 on activities
 - £53.30 on refreshments
 - £62.40 on sale of other goods
- What profit did she make?
- 5 Jim works 40 hours at £8.50 an hour. Last week he did 5 hours of overtime at time-and-a-half and 6 hours at double-time. What was his total gross pay for the week?

Answers

Questions

- 1 **a** Arif paid his gas bill which was £30 and withdrew £50 from the cash machine. A total of £80. He only had £73.50 in his account, so this took him overdrawn by £6.50.
b £500.02
- 2 £59
- 3 £3
- 4 £139.70
- 5 £505.75

MULTIPLICATION

The following question helps you to develop both your ability to select and apply a method (A02) and your ability to solve problems using your skills of interpretation (A03). Your A03 skills are particularly required as you will need to work through several steps to solve this problem. There are also some functional elements as this is a real-life situation and there is a problem to solve.

Example

Adam runs a coach company. He has 6 small coaches, 4 medium coaches, 3 large coaches and 1 double-decker coach.

The table gives information on how many passengers each coach can seat, the cost of hiring the coach and a driver for a day, and how many of these coaches Adam owns.

Adam's Coach Company			
Coach type	Number of seats	Cost of hire	Number owned
Small	25	£100	6
Medium	38	£110	4
Large	54	£120	3
Double-decker	78	£140	1

Rachel wants to hire some coaches from Adam to take 222 people out for the day.

What is the cheapest way for Rachel to do this?

Solution

$$\begin{array}{r}
 1 \text{ double-decker} \quad \text{£140} \quad 78 \\
 3 \text{ large} \quad \quad \quad + \text{£360} \quad + 162 \\
 \hline
 \text{£500} \quad \quad \quad 240 \text{ seats}
 \end{array}$$

As the number of seats increases, the cost goes down proportionally. Therefore you need to use the largest coach, the double-decker, first.

This leaves 144 people to fit in. This could be done with three large coaches but would leave 12 empty seats.

$$\begin{array}{r}
 1 \text{ double-decker} \quad \text{£140} \quad 78 \\
 2 \text{ large} \quad \quad \quad \text{£240} \quad 108 \\
 1 \text{ medium} \quad \quad \quad + \text{£110} \quad + 38 \\
 \hline
 \text{£490} \quad \quad \quad 224 \text{ seats}
 \end{array}$$

If two large coaches are used then this would leave 36 people to fit in, so a medium coach would be needed as well

The cheapest way costs £490 with two spare seats.

Now try these

- 1** Sam is a salesman. He is paid expenses when he drives his car on company business.
He is paid 45p for each mile he drives.
He is also paid a meal allowance.
Here is Sam's time and mileage sheet for one week.

Meal Allowance	
Lunch	£8.50
Dinner	£22

*Only paid if Sam arrives home after 8 pm

Day	Miles driven	Lunch claimed	Time arrived home
Monday	180	Yes	9 pm
Tuesday	48		5 pm
Wednesday	64	Yes	8.30 pm
Thursday	33		5 pm
Friday	75	Yes	7.30 pm

Work out Sam's total expenses for the week.

- 2** Lynsey took part in a sponsored swim. Her target was to raise £100 for charity. Her nan promised her that she would make up the £100 if Lynsey did not raise enough.
Here is Lynsey's sponsor form.
Lynsey swam 32 lengths in a pool of length 40 m.
Will her nan have to give her any money?
You must explain your answer.

Sponsor	Amount
Ali	£5
Rob	25p for each length
Will	30p for each length
Mum	50p for each length
Jade	2p for each metre

- 3** Here are the rates charged for Mr Pitkin's telephone.
- | | |
|------------------------------|---------------------|
| Line rental | £29.36 |
| Daytime cost | 4p for each minute |
| Evening and weekend | 3p for each minute |
| To mobiles | 11p for each minute |
| International rate (anytime) | 8p for each minute |

Here are the details of calls made by Mr Pitkin in one quarter.

Type of call	Minutes
Daytime	78
Evening	312
To mobiles	42
International rate	25

Calculate Mr Pitkin's telephone bill for that quarter.

Answers

Multiplication

- 1** £249.50
- 2** Yes, her Nan will have to give her £35.80.
- 3** £48.46



GOING ON HOLIDAY

British people take more than 60 million holidays abroad each year. Of these, 75% are taken during the months of July and August, when many people travel to southern Europe and the Mediterranean. Some reward card companies allow people to collect points when they spend money in particular stores. You can use the points to pay for flights abroad.

QUESTION

1. Jared wants to book a return flight from London to Valetta in Malta. The number of points he needs is calculated using the formula:

$$p = \frac{d}{c^2}$$

p = points required
 d = distance of flight (km)
 c = class

Class

First class: $c=1$
Business class: $c=2$
Economy class: $c=3$

The distance of the journey is calculated in a straight line for the purpose of the reward points. Approximately how many points does he need to save up to travel in economy class?



QUESTION

2. The exchange rate is $\text{£}1 = 1.12\text{€}$. Jared has seen a camera in England priced at $\text{£}475$. The shop is offering a 10% discount on this camera. While in Malta, he sees the same camera priced at 420€ , plus VAT at 15%. Will it be cheaper to buy the camera in Malta or back in England?

LINKS

- For **Question 1** you need to be able to use formulae, you learnt how to do this in **Chapter 19**. You will also use your knowledge of scale drawings and maps from **Chapter 12**.
- You need to work out the percentage increase and decrease for **Question 2**, you learnt about them in **Chapter 14**.
- You learnt about speed in **Chapter 7**, you will use this in **Question 3**.

QUESTION

3. The flight from England to Malta takes 3 hours 30 minutes. However, Malta is 2 hours ahead of England because it is further east. Jared's return flight is scheduled for 13:50 local time. He also estimates that it will take 45 minutes to go through customs and leave the airport at Stansted. Fast trains leave for London on the hour and at 15, 30 and 45 minutes past the hour. They take 41 minutes.

What is the earliest time he can expect to be back in London, local time?



Going on holiday

- 1** 155 points
- 2** England (England €478.80, Malta €483)
- 3** 16:56