Core Maths

"Learning, in my opinion, is a great treasury"
Saint Teresa of Avila, 1587

The topics in this booklet are on the Higher and Foundation GCSE syllabus (excluding the discussion task) and are **crucial** to success in Core Maths. It is therefore essential that you revise, practise and develop your skills in these areas. Although you may have seen the topics before, to support you and enable you to complete the work there will be:

- Links to the website DrFrostMaths.com – you will receive an email inviting you to register and set up a password.

You should complete the booklet assessing your work as you go using the answers at the back of the booklet. We expect to see **full working out for each question** – naturally any questions where the answer has just been copied down will not be seen as completed.

If you struggle with any of the topic areas you must use MathsWatch to revisit percentages and probability as these are an essential part of the course.

vle.mathswatch.co.uk

Question 1

Categorisation: Determine a percentage of an amount.

[Edexcel GCSE Nov2013-2H Q2b Edited]

Katie has a tin of chocolates.
There are 80 chocolates in the tin.
45% of the chocolates have toffee in the middle.

Work out the number of chocolates that have toffee in the middle.

....

Question 2

Categorisation: Determine a percentage of an amount involving a percentage above 100%.

[Edexcel GCSE June2016-2F Q23c, June2016-2H Q6c]

Tom is a ski jumper.

The maximum length of skis he can use is 145% of his height.
Tom's height is 1.80 m.

(c) Work out the maximum length of skis Tom can use.

.... m

Question 3

Categorisation: Solve wordier multi-step problems involving finding the percentage of an amount.

[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 2F Q16]

In September Sharon paid £565 for some books.
She sold all the books for a total of £780

In October Sharon bought and sold some more books.
The total profit she made in October was 13% greater than the total profit she made in September.

In November Sharon wants to pay a bill of £30
Sharon thinks that the 13% extra profit she made in October will be enough to pay this bill.

Is Sharon correct?
You must show all your working.

[   ] Yes

[   ] No

Question 4

Categorisation: Determine what percentage one amount is of another.

[Edexcel GCSE Nov2005-4I Q7a]

A doctor has 12 000 patients.

4560 of these patients are male.

What percentage of these patients are **female**?

.... %

Question 5

Categorisation: Determine a value after a percentage change.

[Edexcel IGCSE May2014-4H Q4a]

In a sale, all normal prices are reduced by 15%.

The normal price of a washing machine is 270 dollars.

Work out the sale price of the washing machine.

.... dollars

Question 6

Categorisation: Solve wordier multi-step problems involving a value after a percentage change.

[Edexcel IGCSE May2014(R)-4H Q6]

Kim bought 12 boxes of drinks.
He paid $15 for each box.
There were 12 drinks in each box.
Kim sold $\frac{3}{4}$ of the drinks for $1.50 each.
He sold all of the other drinks at a reduced price.

He made an overall profit of 15%.

Work out how much Kim sold each reduced price drink for.

$ ....

Question 7
Categorisation: Determine the percentage change (using numbers in standard form).

[Edexcel GCSE June2007-4I Q23b, June2007-6H Q13b]

In 2003 the population of Great Britain was 6.0×10^7
In 2003 the population of India was 9.9×10^8

In 1933 the population of Great Britain was 4.5×10^7

Calculate the percentage increase in the population of Great Britain from 1933 to 2003.

Give your answer correct to one decimal place.

.... %

Question 8
Categorisation: Determine a value after a compound increase.

[Edexcel GCSE June2007-4I Q18, June2007-6H Q6]

 James invested £2000 for three years in an Internet Savings Account.
He is paid 5.5% per annum compound interest.

Work out the total interest earned after three years.

£ ....

Question 9

Categorisation: Determine a value after a compound decrease.

[Edexcel IGCSE May2015-4H Q12]

The value of a boat depreciates by 16% each year.
At the end of 2012, the value of the boat is £65000.

Work out the value of the boat at the end of 2015.

£ ....

Question 10

Categorisation: Determine a value after different compound increases.

[Edexcel IGCSE Jan2016-3H Q14a]

Liam invests £8000 in a savings account for 4 years.
The savings account pays compound interest at a rate of

4.5 % for the first year
2.75 % for all subsequent years.

Work out the value of Liam's investment at the end of 4 years.

£ ....

Question 11

Categorisation: Determine the number of years before a value increases to some multiple given some known percentage increase. (Note: Calculating the exact answer would require logarithms from A Level! Using some starting amount, keep multiplying by the multiplier, making use of the ANS key on your calculator, until you reach the desired amount)

Helena invests a sum of money into an account that pays 6% compound interest per annum.

Work out after how many years Helena will have trebled his investment.

Give your answer as a whole number of years.

.... years

Question 12

Categorisation: As above, but the amount of time required before a specified amount is reached.

[Edexcel GCSE June2009-4H Q19b]

Jaspir invested £2400 for n years in a savings account.
He was paid 7.5% per annum compound interest.

At the end of the n years he had £3445.51 in the savings account.

Work out the value of n .

$n = $ ....

Question 13

Categorisation: As above, but reaching some fraction of the original amount.

[Edexcel GCSE Nov2006-6H Q17]

Gwen bought a new car.
Each year, the value of her car depreciated by 9%.

Calculate the number of years after which the value of her car was 47% of its value when new.
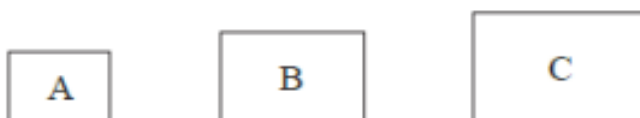
.... years

Question 14

Categorisation: Determine the combined percentage change from two changes.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 1H Q10]

Here are three rectangles.

The area of rectangle **B** is 10% greater than the area of rectangle **A** .
The area of rectangle **C** is 10% greater than the area of rectangle **B** .

By what percentage is the area of rectangle **C** greater than the area of rectangle **A** ?

.... %

Question 15

Categorisation: Use the overall scale factor combined with a given time period to determine each percentage change in a compound change.
(Hint: If after 10 years a value had doubled, then we solve $r^{10} = 2$ where r is the decimal multiplier for each year. $\therefore r = \sqrt[10]{2} = 1.072 \rightarrow 7.2\%$)

I invest £1000 in a bank account which offers a fixed percentage interest per year. After 5 years I have £3000.

Determine the percentage increase each year, giving your answer to 1 decimal place.

.... %

Question 16

Categorisation: As above but with a percentage decrease.

[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 3H Q14]

The number of fish in a lake decreases by x% each year.

Given that the number of fish halves in 8 years, work out the value of x .
Give your answer correct to 1 decimal place.

$x =$ .... %

Question 17

Categorisation: Determine a value before a percentage increase.

[Edexcel IGCSE May2014-3H Q12b]

Joe's savings increased by 4.5%.
His savings are now £125.40.

What were his savings before the increase?

£ ....

Question 18

Categorisation: Determine a value before a percentage decrease.

[Edexcel GCSE June2003-4I Q14c, June2003-6H Q3c Edited]

A garage sells cars.
It offers a discount of 20% off the normal price for cash.

Dave pays £5200 cash for a car.

Calculate the normal price of the car.

£ ....

Question 19

Categorisation: Determine the original value if the percentage change and value change are given.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 3F Q23]

In a sale, normal prices are reduced by 17%.
The normal price of a washing machine is reduced by £42.50

Work out the sale price of the washing machine.

£ ....

Question 1

Categorisation: Calculate probabilities by the number of matching outcomes divided by the number of total outcomes.

[Edexcel IGCSE Jan2014(R)-3H Q8a Edited]

Morse Code uses dots and dashes to represent each letter of the alphabet.
Here are 10 cards.
Each card has the Morse Code for a letter on it.

− − •	• •	− • −	− −	• − − •
• −	− • • •	− • − •	− • •	• • − •

Kelly takes at random one of the cards.
Find the probability that she takes a card with 2 dots or a card with 3 dots.

....

Question 2

Categorisation: Calculate probabilities from an ungrouped frequency table.

[Edexcel IGCSE Jan2014-3H Q13aii]

A box contains 20 nails.
The table shows information about the length of each nail.

Length of nail (mm)	25	30	40	50	60
Number of nails	1	8	4	5	2

Viraj takes at random one nail from the box.

Find the probability that the length of the nail he takes is less than 35 mm.

....

Question 3

Categorisation: Calculate probabilities from a grouped frequency table.

[Edexcel IGCSE May2014-3H Q11b]

The table gives information about the speed, in km/h, of 180 vehicles passing a speed checkpoint.

Speed (v km/h)	Frequency
$40 < v \leqslant 50$	4
$50 < v \leqslant 60$	52
$60 < v \leqslant 70$	60
$70 < v \leqslant 80$	34
$80 < v \leqslant 90$	18
$90 < v \leqslant 100$	12

Work out an estimate for the probability that the next vehicle passing the speed checkpoint will have a speed of 60 km/h or less.

....

Question 4

Categorisation: Calculate probabilities from a two-way table.

[Edexcel GCSE June2010-2F Q14b]

The two-way table gives information about the subjects studied by 50 students.

	Law	Engineering	Medicine	Total
Male	6	15	4	25
Female	5	6	14	25
Total	11	21	18	50

One of these students is chosen at random.

Find the probability that this student is male and studies Law.
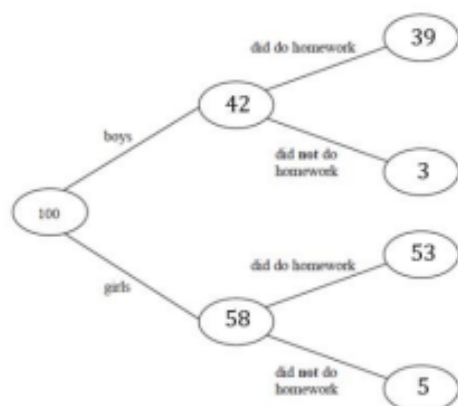
....

Question 5

Categorisation: [Foundation only?] Calculate probabilities from a 'frequency tree'.

[Edexcel New SAMs Paper 1F Q17b]

100 students had some homework. The following **frequency tree** shows which children and boys and girls and who did their homework.

One of the girls is chosen at random.
Work out the probability that this girl did **not** do her homework.
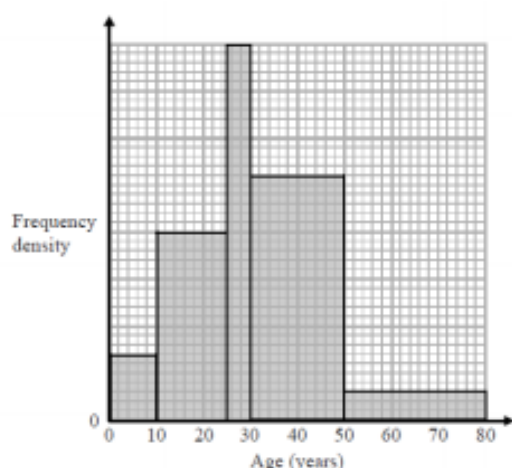
....

Question 6

Categorisation: Determine a probability from a histogram.

[Edexcel GCSE(9-1) Mock Set 1 Autumn 2016 - 1H Q23]

The histogram shows information about the ages of the members of a football supporters club.

There are 20 members aged between 25 and 30.
One member of the club is chosen at random.

What is the probability that this member is more than 30 years old?

....

Question 7

Categorisation: Determine the total number of items or items of a given type using a combination of frequencies and probabilities.

[Edexcel GCSE Nov2013-2F Q16b, Nov2013-2H Q3]

Bill has some counters in a bag.

3 of the counters are red. 7 of the counters are blue.
The rest of the counters are yellow.

Bill takes at random a counter from the bag.

The probability that he takes a yellow counter is $\frac{2}{7}$.

How many yellow counters are in the bag before Bill takes a counter?

....

Question 8

Categorisation: Deal with changes to frequencies (e.g. counters added/removed)

[Edexcel GCSE March2012-1F Q18b, March2012-3H Q5b Edited]

There are only red counters, blue counters and green counters in a bag.
There are 5 red counters. There are 6 blue counters. There is 1 green counter.

Jim puts some more green counters into the bag.

The probability of taking at random a red counter is now $\frac{1}{3}$

Work out the number of green counters that are now in the bag.

....

Question 9

Categorisation: Determine the estimated frequency of an outcome.

[Edexcel IGCSE May2014-4H Q2b]

Sarah has a biased 4-sided spinner.
The spinner can land on 1, 2, 3 or 4.

The probability that the spinner will land on 1, 2 or 4 is given in the table.

Number	1	2	3	4
Probability	0.4	0.35		0.1

Ryan is going to spin the spinner 80 times.

Work out an estimate for the number of times he should expect the spinner to land on 2.

.... times

Question 10

Categorisation: Same as Question 7, but using frequencies to establish and unknown probability.

[Edexcel GCSE(9-1) Mock Set 2 Spring 2017 2F Q21]

There are 300 seeds in a packet of flower seeds.
Each seed will grow into a white flower or a yellow flower or a red flower.

The probability of a seed growing into a white flower is 0.62
45 of the seeds are expected to grow into yellow flowers.

One of the seeds is chosen at random from the packet.

What is the probability that this seed will grow into a red flower?

....

Question 11

Categorisation: Work out an expected value given repeated trials.

[Edexcel GCSE Jan2016(R)-1F Q15bii, Jan2016(R)-3H Q4bii]

Maisie plays a game.

Each time she plays, she can win a prize of $1 or $5 or $10.

When she does not win one of these prizes, she loses.

The table gives the probability of winning each of the prizes.

Prize	Probability
$1	0.50
$5	0.15
$10	0.05

Maisie plays the game 40 times

Work out an estimate for the total value of the prizes she wins.

$ ....

Question 12

Categorisation: As above.

[Edexcel GCSE Jun2015-1H Q11b]

Karl wants to raise money for charity. He designs a game for people to play.

Karl uses a fair 10-sided dice for the game. The dice is numbered from 1 to 10.

Each person will roll the dice once. A person wins the game if the dice lands on a multiple of 4.

Each person pays 30p to play the game once. The prize for a win is £1.
Karl thinks that the game will be played 100 times.

Work out an estimate for how much money Karl will raise for charity.

£ ....

Question 13

Categorisation: Appreciate the probability of mutually exclusive outcomes (the span all possibilities) is equal to 1.

[Edexcel GCSE Nov2005-3I Q13aii]

A school snack bar offers a choice of four snacks.

The four snacks are burgers, pizza, pasta and salad.

Student can choose **one** of these four snacks.

The table shows the probability that a student will choose burger or pizza or salad.

Snack	burger	pizza	pasta	salad
Probability	0.35	0.15		0.2

One student is chosen at random from the students who use the snack bar.

Work out the probability that the student chose pasta.

....

Question 14

Categorisation: Multiply probabilities from independent events.

[Edexcel IGCSE Jan2014-3H Q13bi]

A box contains 20 nails. The table shows information about the length of each nail.

Length of nail (mm)	25	30	40	50	60
Number of nails	1	8	4	5	2

Jamila puts all 20 nails into a bag. She takes at random one of the nails and records its length. She replaces the nail in the bag. She then takes at random a second nail from the bag and records its length.

Calculate the probability that the two nails she takes each have a length of 60 mm.

....

Question 15

Categorisation: Deal with a single sequence of outcomes but involving multiple independent events.

*[Edexcel IGCSE Jan2014(R)-4H Q17b Edited]*

Hugo competes in the high jump at a school athletics competition.
He has up to 3 attempts to clear the bar at each height.
When he clears the bar, he does not have another attempt at that height.

When the bar is set at a height of 1.60 metres, the probability that Hugo will clear the bar on any attempt is 0.4.
The probability tree diagram shows the possible outcomes of Hugo's attempts at 1.60 metres.
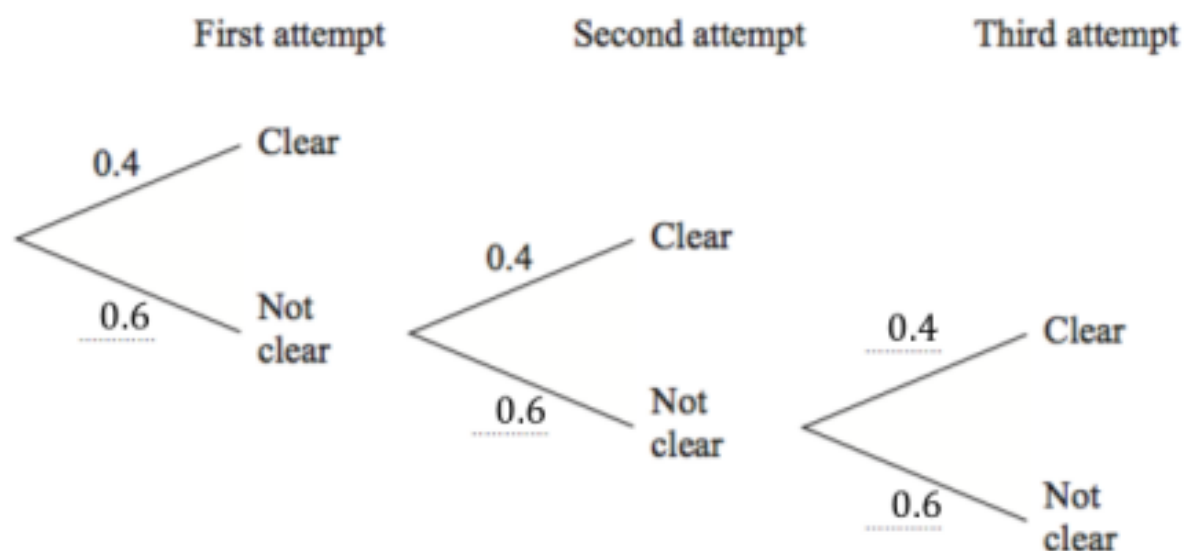
Work out the probability that Hugo does not clear the bar on his first two attempts and then does clear the bar on his third attempt at 1.60 metres.

Question 16

Categorisation: Fill in a probability tree using independent events.
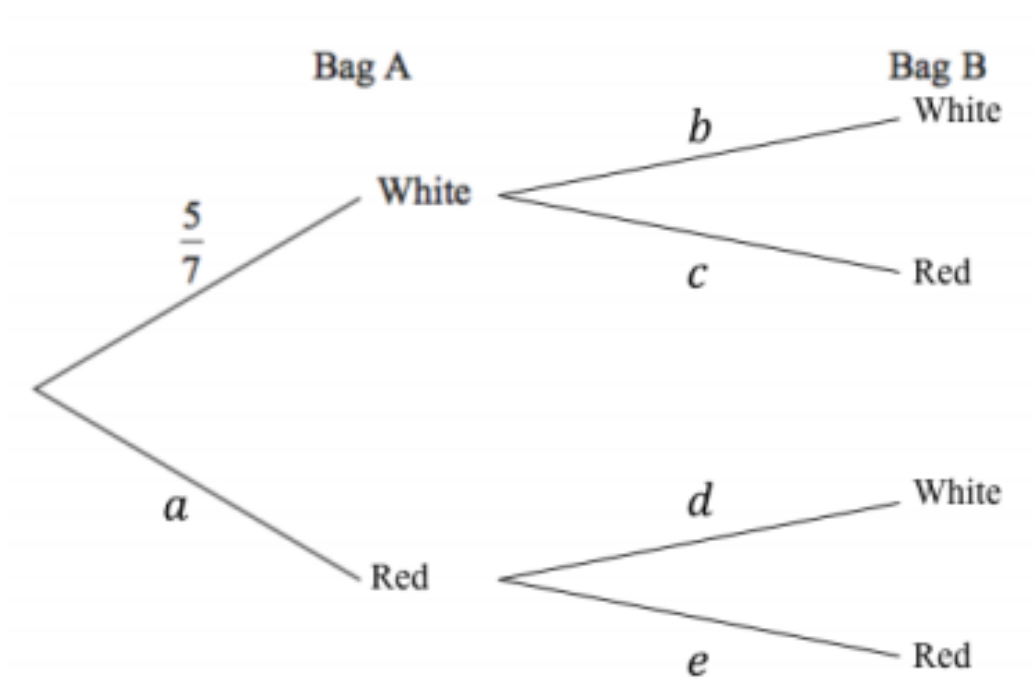
[Edexcel IGCSE May2014(R)-4H Q15a Edited]

Maria has two bags.
In bag A, there are 5 white counters and 2 red counters.
In bag B, there are 3 white counters and 2 red counters.

Maria is going to take at random one counter from bag A and one counter from bag B.

Complete the probability tree diagram.

Below are the graphs of the FTSE 100 index (first graph) and BITCOIN across the same 6-month period. Why do you think both graphs follow the same trend early March and why has BITCOIN managed to recover and thrive in recent weeks?

NOTE: You may need to do some research on both of these.

Answers

Question 1

36

Question 2

2.61 m

Question 3

No

Question 4

62 %

Question 5

229.50 dollars

Question 6

$ 1.25

Question 7

33.3 %

Question 8

£ 348.48

Question 9

any value in the range £ 38525 to £ 38526

Question 10

any value in the range £ 9068.8 to £ 9069

Question 11

19 years

Question 12

$n = 5$

Question 13

8 years

Question 14

21 %

Question 15

24.6 %

Question 16

any value in the range $x = 8.29$ % to $x = 8.3$ %

Question 17

£ 120

Question 18

£ 6500

Question 19

£ 207.50

Answers

Question 1

$\frac{6}{10}$

Question 2

$\frac{9}{20}$

Question 3

$\frac{56}{180}$

Question 4

$\frac{6}{50}$

Question 5

$\frac{5}{58}$

Question 6

$\frac{61}{118}$

Question 7

4

Question 8

4

Question 9

28 times

Question 10

0.23

Question 11

$ 70

Question 12

£ 10

Question 13

0.3

Question 14

$\frac{4}{400}$

Question 15

0.144

Question 16

$a = \frac{2}{7}, b = \frac{3}{5}, c = \frac{2}{5}, d = \frac{3}{5}, e = \frac{2}{5}$