<table>
<tr><td>Outcome</td><td>NR4</td><td>Student can consistently:</td><td>Calculate repeated percentage increase, including compound interest.</td></tr>
<tr><td>How the topic is examined</td><td colspan="3">

Examined through test paper questions.
Questions very rarely appear on non-calculator papers due to the number and size of calculations that need to take place.
The majority of repeated percentage problems are in the form of word problems. Questions are usually about putting money into a bank account and interest is added etc.…

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<tr><td>Prior knowledge</td><td colspan="3">

Students should be confident:

Working with powers.
Converting from percentages to decimals.
Using a calculator.

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<tr><td>Suggested tuition approaches</td><td colspan="3">

It is important for students to understand that a percentage means parts out of 100.
It is vital that students show all their working out.
Repeated percentage changes are where students have to work out a percentage increase or decrease several times.
Typical questions involve money in a bank account, car depreciation, and repeated pay rise over several years.
Often the percentage change is always the same and therefore Method 2 (outlined below) is the much preferred method, however some students like to use Method 1 (outlined below) as they find it easier to see what they are doing.

There are two approaches to the following question:
Mike invests £10000 in a bank account at 1.5% compound interest.
How much money does Mike have in the bank after 5 years?

<u>Method 1</u>

Find the given percentage of the amount and increase the original amount by this value. This represents one year.
Take the new value and increase this by the same percentage.
Repeat this process the required number of times (in this case 5 times)

<u>Method 2</u>
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	• Find the decimal to multiply by (In this case 1.015 (101.5%) • Because you need to do this calculation 5 times, you would multiply £10000 by 1.015 five times. The easiest way to do this is as a power 10000 x 1.015^5 • Students sometimes use the formula $amount \times decimal^n$ where n is the number of weeks/years//months etc.… • Very rarely students are asked to find the power (e.g. how many years before there will be £12000 in the bank account). The usual way to do this is to use trial an error. You can use either method to do this. • Students should be made aware of the terms compound interest (essentially how interest is paid on most bank accounts now) and the term depreciates.
Common errors and misconceptions	• Students want to use non calculator methods (build up method (NR3)) for all percentage questions, even when they have a calculator to use. It is not efficient for problems like these. • Students should always check their calculations and check if they are reasonable. • The biggest mistake that students make on this question is that they find the required percentage of the amount and then multiply this by the number of years/days etc. and then increase or decrease the original amount by this value. This is not awarded any marks in an exam.
Suggested resources	• Questions o http://www.cimt.plymouth.org.uk/projects/mepres/allgcse/bkb11.pdf (pp 256-258) o https://www.pearsonschoolsandfecolleges.co.uk/Secondary/Mathematics/14-16/AQAGCSEMathematics2010/Samples/TeacherGuidesamples/TeacherGuide81worksheet.pdf o https://www.tes.co.uk/teaching-resource/successive-percentage-change-and-compound-interest-6048279 (free account needed) • Past GCSE Questions o https://keshgcsemaths.files.wordpress.com/2013/11/83_compound-interest-and-depreciation.pdf • Explanation video o https://www.youtube.com/watch?v=dL9E5rjp4CU