Compound Growth and Decay

One more sneaky % type for you... Compound growth shows how a thing increases over time, e.g. money in a savings account. Compound decay shows the opposite, e.g. a shiny new car losing its value with age.

The Formula

This topic is simple if you LEARN THIS FORMULA. If you don't, it's pretty well impossible:

$$N = N_0\left(1 + \frac{r}{100}\right)^n$$

- N: Amount after n days/hours/years
- N_0: Initial amount
- r: Percentage change per day/hour/year
- n: Number of days/hours/years

Percentage Increase and Decrease

The $(1 + \frac{r}{100})$ bit might look a bit confusing in the formula, but in practice it's really easy:

E.g. 5% increase will be 1.05 — 5% decrease will be 0.95 (= 1 – 0.05)
26% increase will be 1.26 — 26% decrease will be 0.74 (= 1 – 0.26)

3 Examples to show you how EASY it is:

The most popular context for these is compound interest. Compound interest means the interest is added on each time, and the next lot of interest is calculated using the new total rather than the original amount.

EXAMPLE: A man invests £1000 in a savings account which pays 8% compound interest per annum. How much will there be after 6 years?

Use the formula: $\text{Amount} = 1000(1.08)^6 = £1586.87$
(initial amount; 8% increase; 6 years)

'Per annum' just means 'each year'.

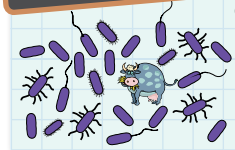
Depreciation questions are about things (e.g. cars) which decrease in value over time.

EXAMPLE: Susan has just bought a car for £6500. If the car depreciates by 9% each year, how much will it be worth in 3 years' time?

Just use the formula again: $\text{Value} = 6500(0.91)^3 = £4898.21$
(initial value; 9% decrease; 3 years)

The compound growth and decay formula isn't just used for money questions.

EXAMPLE: In a sample of bacteria, there are initially 500 cells and they increase in number by 15% each day. Find the formula relating the number of cells, c, and the number of days, d.



Well stone me, it's the same old easy-peasy compound growth formula again:

$c = N_0(1 + 0.15)^d \quad \Rightarrow \quad c = 500 \times (1.15)^d$

Oh man, that last joke has still got me increases...

Bleurgh. What a horrible looking formula. Make sure you learn it... learn it real good. Oh, and try these:

Q1 Josie's savings account pays 5% compound interest.
If she invests £400, how much will she have in the account after 4 years? [3 marks]

Q2 The value of Naveen's favourite painting has been depreciating by 11% per year.
6 years ago, the painting was worth £200 000. What is it worth now? [3 marks]