EXPONENTIAL GROWTH-DECAY -POPULATION-FINANCE PROBLEM

One general formula that is always true for all kinds of exponential growth and decay problems is :

$A = Pe^{rt}$,

- **where "A" is the ending amount of whatever you're dealing with (money, bacteria growing in a petri dish, radioactive decay of an element highlighting your X-ray).**
- **"P" is the beginning amount of that same "whatever",**
- **"r" is the growth or decay rate, and**
- **"t" is time.**

Note: The formula $A = Pe^{rt}$, is related to the compound-interest formula, and represents the case of the interest being compounded "continuously".

Example:

- **A certain type of bacteria, given a favourable growth medium, doubles in population every 8.5 hours. Given that there were approximately 500 bacteria to start with, how many bacteria will there be in a day and a half?**
  $A = Pe^{kt}$
  $1000 = 500e^{8.5k}$
  $2 = e^{8.5k}$
  This is the final equation.[Logs is not for the current IGCSE Syllabus]

IGCSE PAST PAPER QUESTIONS

1 **(a)** The price of a book increases from \$2.50 to \$2.65 .

Calculate the percentage increase.

.... % [3]

(b) Scott invests \$500 for 7 years at a rate of 1.5% per year simple interest.

Calculate the value of his investment at the end of the 7 years.

\$.. [3]

(c) In a city the population is increasing exponentially at a rate of 1.6% per year.

Find the overall percentage increase at the end of 20 years.

.... % [2]

(d) The population of a village is 6400.
The population is decreasing exponentially at a rate of r% per year.
After 22 years, the population will be 2607.

Find the value of r.

$r =$ .... [3]

MARKING SCHEME:

(a)	6 nfww	3	**M2** for $\frac{2.65-2.50}{2.50}[\times 100]$ or for $\frac{2.65}{2.50}\times 100$ or **M1** for $\frac{2.65}{2.50}$
(b)	552.5[0]	3	**B2** for 52.5[0] or **M2** for $500\times\frac{1.5}{100}\times 7+500$ oe or **M1** for $500\times\frac{1.5}{100}$ $[\times 7]$ oe
(c)	37.4 or 37.36…	2	**M1** for $\left(1+\frac{1.6}{100}\right)^{20}$ oe soi 1.37…
(d)	4[.00...]	3	**M2** for $\sqrt[22]{\frac{2607}{6400}}$ or **M1** for $6400\times x^{22}=2607$ oe or better