Maths 10 | **Test 8** | 12 March 2019

`subject:` *Logarithms*

Name: _____

Question 1 [7 marks]

Solve :

1) $\log_3(x-4)+\log_3(x-6)=1$

2) $\log_3(x-4)-\log_3(x-6)=\log_2(22)-\log_2(11)$

Question 2 [4 marks]

Find x such that $\log_2^2(x-1)-5\log_2(x-1)+6=0$

Notice : $\log_2^2(x-1)$ is a notation for $\big(\log_2(x-1)\big)^2$

Idea : Taking $y=\log(x-1)$ we get a second degree equation for y.

Then you can find first y, and then x.

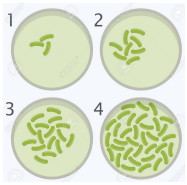
Question 3 [8 marks]

Two populations of bacteria ($\mathcal{B}_1$ and $\mathcal{B}_2$) are growing at different rates.

Their populations at time t are given by:

$n_1(t)=2^{(t+6)}$ for $\mathcal{B}_1$

$n_2(t)=3^{(2t+1)}$ for $\mathcal{B}_2$ (where t is in days).



1) Which population is *initially* (at time zero) the greatest ?

Let N be $\mathcal{B}_2(3)$, that is the number of bacteria in population $\mathcal{B}_2$ exactly 3 days after time zero.

2) What is the value of N ?

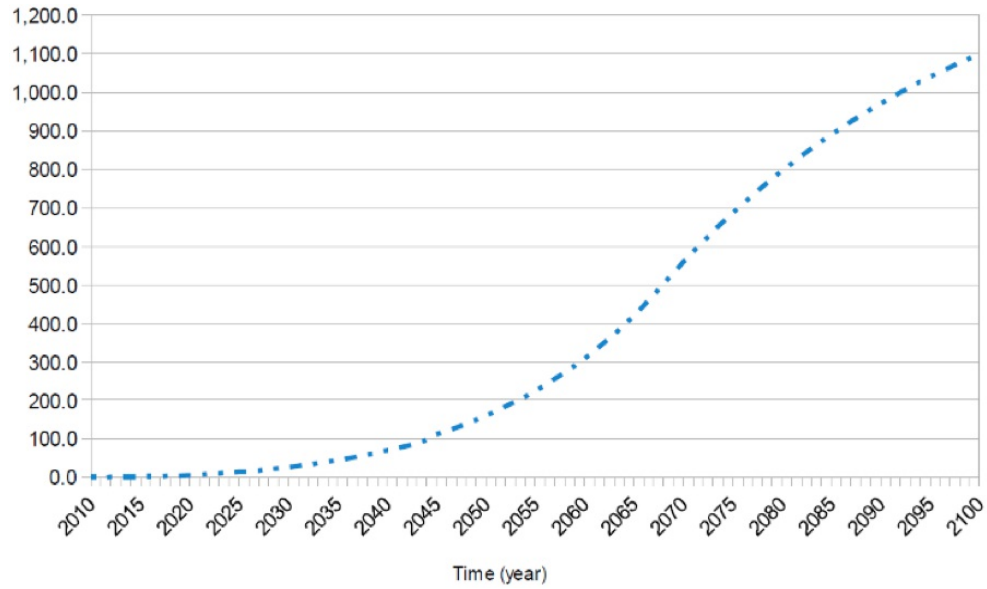
3) Show that it takes 5 days + 2 h, 16 min and 25.32 s. for the population $\mathcal{B}_1$ to also contain N bacteria.

4) At what time do $\mathcal{B}_1$ and $\mathcal{B}_2$ have equal number of bacteria ?

Question 4 [5 marks]

The figure below shows the sea leve rise prevision according to a study published in November 2012 by two Climate scientist James Hansen and Makiko Sato.

Fig.1



« Negative feedbacks kick in after 1 meter of sea level rise is reached in 2045, and by 2067 rates of sea level rise slow significantly - but still continue at a devastating rate....

Just on sea level rise some countries are only starting to adapt coastline infrastructure in expectation of 1 metre of sea level rise. If Hansen-Sato theory is correct, Ice Sheet mass loss does proceed on an exponential basis. Any multi-metre sea level rise will be extremely costly and disastrous, let alone 4 or 5 metres towards the end of the century.»

Let be $\boldsymbol{n}$ the number of year after 2000 (for exemple for the year 2019, n is 19)
and assume that the elevation is given by : $h(n) = 3.6 \times 1.077^n$.

1) Complete the following table :

year	$\boldsymbol{n}$	see level $\boldsymbol{h}$ (cm)
2045	45	
2055	55	
2060		

2) Using the formula, find in which year h will be 400 cm ?

Bonus 1 (complement to question 4) [+ 3]

What would be $\boldsymbol{h}$ in 2090 according to the formula ?
Compare this last result with the value provided by the curve above (fig.1).
Can you find an explanation for the reason why the values are so different ?

Bonus 2 [+ 4]

Solve: $\log_2(x) - \log_x(2) = 1$