16. Determine, if it exists, the zero of the following exponential functions.

a) $y = -2(3)^{x-1} + 1$

$\dfrac{1 + \log_3 (0.5)}{} \approx 0.37$

b) $y = 3\left(\dfrac{1}{2}\right)^{x+2} - 10$

$\dfrac{-2 + \log_{\frac{1}{2}}\left(\dfrac{10}{3}\right)}{} - 3.74$

c) $y = -2\left(\dfrac{2}{3}\right)^{2(x+1)} - 1$

No zero.

17. Given $f(x) = 2(5)^x - 1$. Determine, if possible, the value of x for which

a) $f(x) = 2$ $x = \log_5 1.5 \approx 0.25$

b) $f(x) = 0$ $x = \log_5 0.5 \approx -0.43$

c) $f(x) = -2$ *Impossible*

18. The bacterial growth within a culture is given by the rule $y = 10(2)^x$ where y represents the number of bacteria and x represents the elapsed time, in hours, since the beginning of the experiment.

a) What rule enables you to calculate the elapsed time as a function of a given number of bacteria in the culture? $x = \log_2(0.1y)$

b) Determine

1. the number of bacteria in the culture after 5 hours. *320 bacteria*

2. the elapsed time since the beginning of the experiment if we observe 1000 bacteria.
$x = \log_2 100 \approx 6.64$ h $\approx$ 6 h and 38 min.

19. The accumulated value $c(t)$ after t years of an initial capital c_0 invested at an interest rate i compounded n times per year is calculated according to the rule

$$c(t) = c_0\left(1 + \frac{i}{n}\right)^{nt}$$

a) What is the accumulated value of a $1000 capital invested at an interest rate of 10% after 7 years if the interest is compounded

1. annually. *$1948.72*

2. every 3 months. *$1996.50*

3. every month. *$2007.92*

4. every day. *$2013.56*

b) After how many years will the accumulated value of a $1000 capital, invested at an interest rate of 8%, be worth $2000 if the interest is compounded

1. annually. $\log_{1.08} 2 = 9$ yrs

2. every 3 months. $\frac{1}{2} \log_{1.02} 2 = 8.75$ yrs

20. One litre of water evaporates by losing 1% of its volume each hour. After how long will the volume be 950 ml? $950 = 1000(0.99)^t \Leftrightarrow t = \log_{0.99} 0.95 \approx 5.10$ h $\approx$ 5 h and 6 min

21. A grocery basket for 4 people cost $150 in the year 2000. The inflation rate remained at 3% for the following years.

a) How much did this same basket cost in 2005? *$173.89*

b) In what year will this basket cost $185? $\log_{1.03}\left(\dfrac{185}{150}\right) = 7.09$. In 2007.

22. A village of 1000 inhabitants increases at a rate of 10% per year. A neighbouring village of 2000 inhabitants decreases at a rate of 5% per year. After how many years will these two villages have the same population?
$1000(1.1)^t = 2000(0.95)^t$; $t = 4.73$ yrs. After 4 years and approximately 9 months.

23. A car loses 15% of its value for the first 3 years and 10% of its value for the following years. After how many years will a car purchased for $30 000 be worth $10 778? *After 8 years.*