Paper 1 - CALCULATOR INACTIVE

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written work. You are advised to show all working.

SECTION A

Answer all questions in the spaces provided.

1. Evaluate the following expressions:

    (4 marks)

    a. $27^{\frac{2}{3}}$

    b. $25^{-\frac{1}{2}}$

2. Evaluate the following expressions:

    (3 marks)

    a. $\log_4 16$

    b. $\log_8 2$

    c. $\log_2\left(\dfrac{1}{32}\right)$

3. Evaluate $f(-3)$ if $f(x) = 6(2)^{x+2} + 3$.

    (3 marks)

4. Give an exact solution to the equation $e^{x+2} = 5$.

    (2 marks)

5. Solve the equation $f(x) = 18$ for x if $f(x) = 2 + 4(2)^{3-x}$.

(3 marks)

6. Solve the equation $g(x) = 2$ for x if $g(x) = \log_3(2 - x)$.

(3 marks)

7. Mr. D has written a population word problem and the equation he used was $P(t) = 500(0.94)^{2t}$. From the options provided, select the appropriate description of the word problem: (explain the reasoning behind your choice)

(2 marks)

   a. The population was growing at a rate of 6%.

   b. The population was decreasing at a rate of 94%.

   c. The population was growing at a rate of 94%.

   d. The population was decreasing at a rate of 6%.

   e. We cannot determine the rate of change of population as there is not enough information provided.

Section B

Do NOT write solutions on this page. Answer all questions on the answer sheets provided.

1. You have been provided a graph of the function $f(x) = ab^x$. Use the graph to answer the following questions.
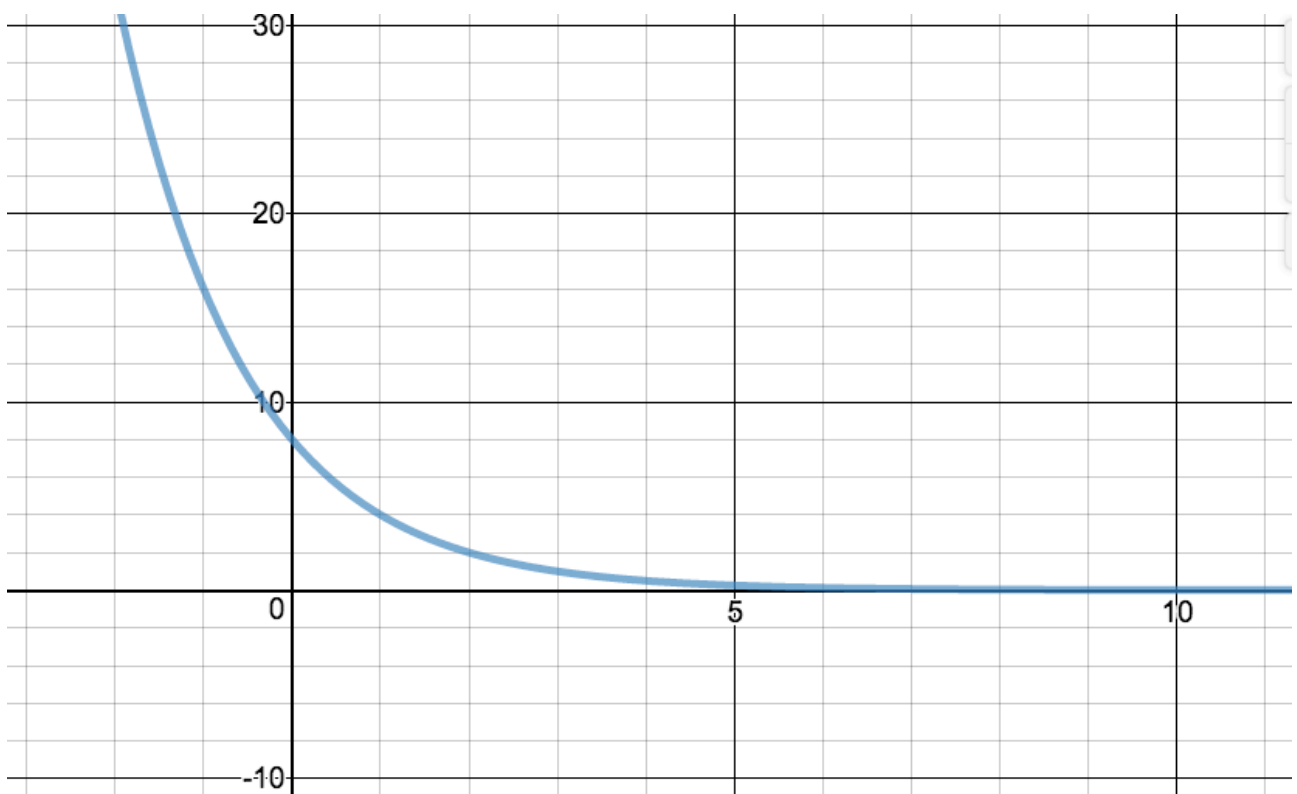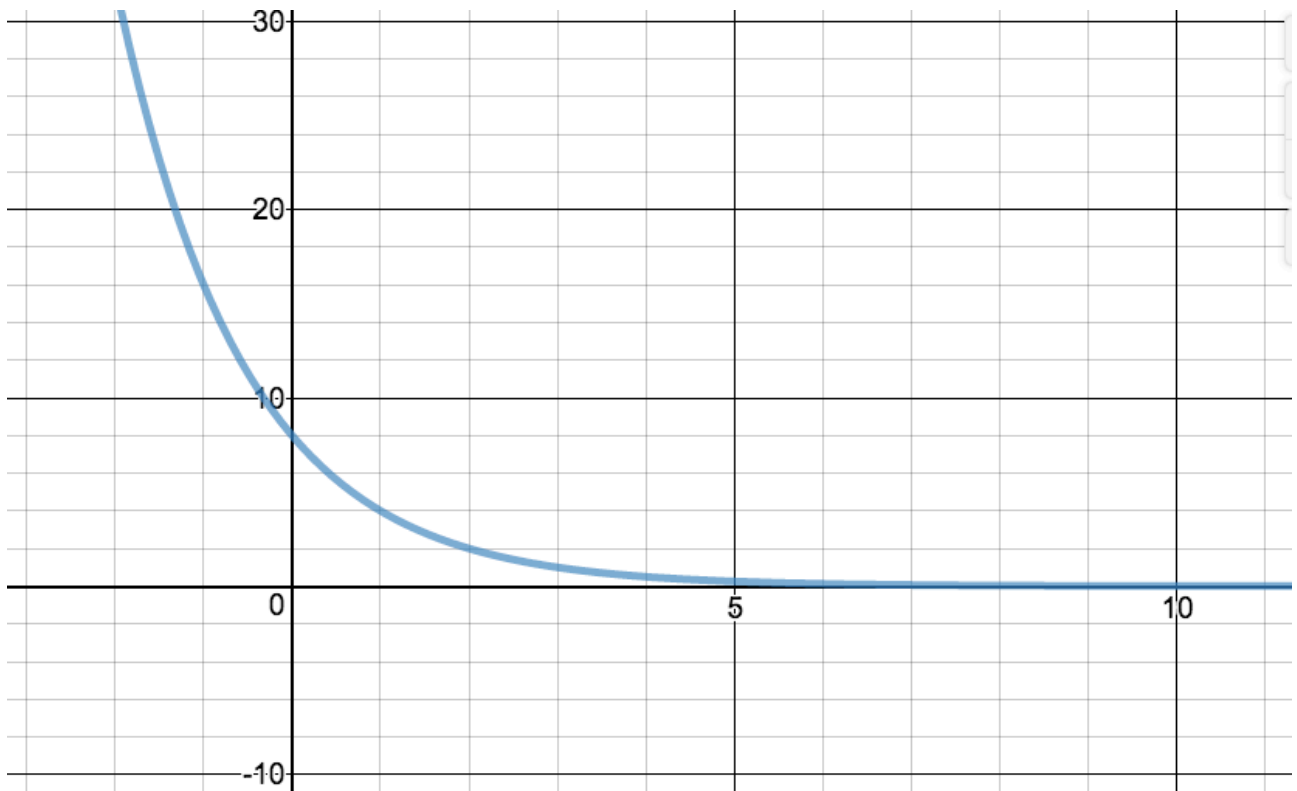
(18 marks)
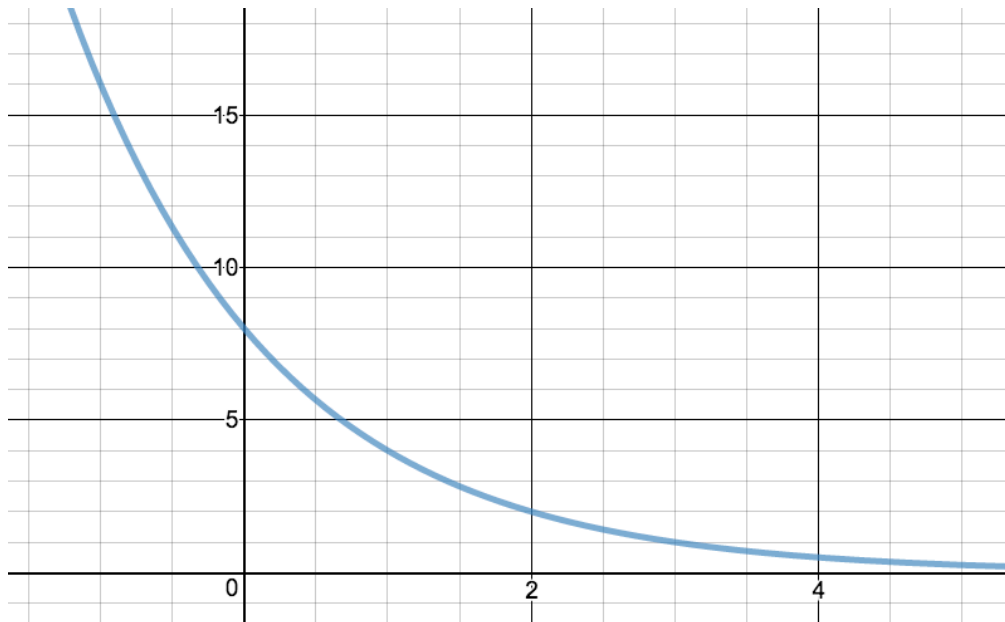
a. Explain how you know from the graph that $a = 8$. (1)

b. Explain how you know from the graph that $b = \frac{1}{2}$. (2)

c. State the domain and range of this function. (2)

d. State the equation of the asymptote of this function. (1)

e. Sketch the inverse of this function and determine its equation. (4)

Mr. S now wants to make a few transformations of the function $f(x) = 8\left(\dfrac{1}{2}\right)^x$. So he writes a new equation as $f(x) = 10 - 8\left(\dfrac{1}{2}\right)^{x+2}$.

f. List the transformations that Mr. S. made. (3)

g. Sketch the new function. (3)

h. Write the equation of inverse of this transformed function. (2)

Graph(s) and Grid(s) for Q1, Section B

Paper 2 – CALCULATOR ACTIVE

Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. In particular, solutions found from a graphic display calculator should be supported by suitable working, e.g. if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for correct method, provided this is shown by written working. You are therefore advised to show all working.

SECTION A

Answer all questions in the spaces provided. Show/explain the key steps of your solution.

1. Mahmoud has an investment for college of $30,000 that is earning 5% per year.

    a. If this interest of 5% is compounded quarterly for 6 years, determine how much **interest** was earned in those 6 years. (3)

    b. How much time does it take to triple the value of this investment? (3)

2. Provide an exact and an approximate solution to the equation $\ln(3x - 8) = 2$. (4)

Section B

Do NOT write solutions on this page. Answer all questions on the answer sheets provided.

1. The population of Cornwall in 1995 was 35,600 and in 2006, the population had grown to 42,000. Assume that population growth happens **continuously** and let t represent time in years since 1995.

(Total 16 marks)

   a. Explain why Hoda will use the equation $A(t) = 35,600e^{kt}$ to model this situation. (2)

   b. Use the information given in this question to show that $k = 0.0150$ (3)

   c. What does k represent in this model? (1)

   d. According to the model, what was the population of Cornwall in 1980? (2)

The population of Pembrook is modeled with the equation $P(t) = \dfrac{80,000}{1 + e^{-.05t}}$, where t is in years since 1995.

   e. What is the predicted population of Pembrook in 2070? (2)

   f. Sketch a graph, showing the graphs of the population models of both towns. Label each curve in your sketch. (4)

   g. In what year does the population of Cornwall first exceed that of Pembrook? (2)

2. The following graph shows the temperature in degrees Celsius of Robert's cup of coffee, t minutes after pouring it out. The equation of the cooling graph is $f(t) = 16 + 74(2.8)^{-0.2t}$ where $f(t)$ is the temperature and t is the time in minutes after pouring the coffee out.

(Total 11 marks)
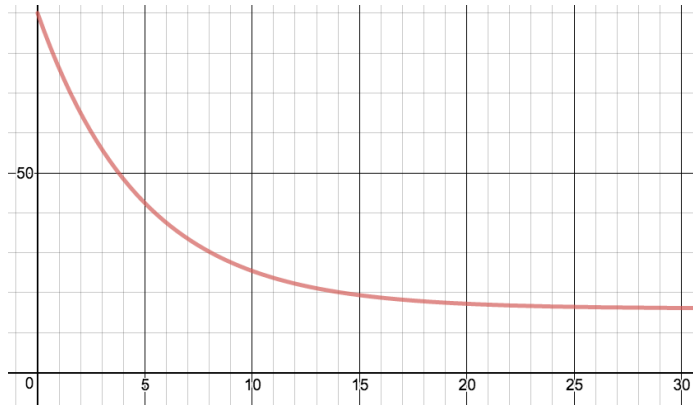
a. Find the initial temperature of the coffee. (2)

b. Write down the equation of the horizontal asymptote and explain what it means in the context of this problem. (2)

c. Find the temperature of the coffee after 10 minutes. (1)

If the coffee is not hot enough it is reheated in a microwave oven. The liquid increases in temperature according to the formula $T = A_o(2)^{1.5t}$ where T is the final temperature of the liquid, A_o is the initial temperature of coffee in the microwave and t is the time in minutes after switching on the microwave.

d. Given the final temperature of the coffee from part (c), find the temperature of Robert's coffee after being heated in the microwave for 30 seconds. (3)

e. Calculate the length of time it would take a similar cup of coffee, initially at 20° C. heated in the microwave to reach 100° C. (3)