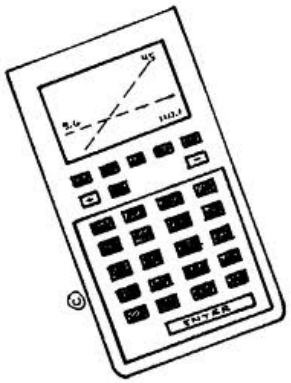
MATHEMATICS 3 PERIODS
PART B

DATE: 11th June 2018, morning

DURATION OF THE EXAMINATION:

2 hours (120 minutes)



AUTHORIZED MATERIAL:

Examination with technological tool:

Calculator TI-Nspire in “Press-to-test” mode

Pencil for the graphs

SPECIFIC INSTRUCTIONS:

- Use a different page for each question.
- Answers must be supported by explanations.
- They must show the reasoning behind the results or solutions provided.
- If graphs are used to find a solution, they must be sketched as part of the answer.
- Unless indicated otherwise, full marks will not be awarded if a correct answer is not accompanied by supporting evidence or explanations of how the results or the solutions have been achieved.
- When the answer provided is not the correct one, some marks can be awarded if it is shown that an appropriate method and/or a correct approach has been used.
- Some of the questions can be answered only with the help of the calculator. The wording of these questions makes this clear. All other questions can be solved with or without the use of the calculator.

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QUESTION B1 ANALYSIS	**Page 1/1**	**Marks**
Use your calculator in b) and c). The function f is defined by $$f(x) = (x^2 - 4) \cdot \ln(x + 4).$$		
a) Determine the domain of definition of f.		2 marks
b) Determine the coordinates of the extrema of f and specify their nature.		4 marks
c) Calculate the area of the region bounded by the graph of f and the x-axis.		4 marks

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QUESTION B2 ANALYSIS	Page 1/1	Marks

Use your calculator in b), c) and d).

In a laboratory, the growth of a bacterial culture is studied.

The number of bacteria present is modelled by

$$f(t) = \frac{32\,000}{1 + 31\mathrm{e}^{-0.753t}}, \quad t \geq 0 ,$$

where t is the time in days from when the study started.

a) Calculate the number of bacteria present when the study started. — 2 marks

b) At what time will the number of bacteria equal 16 000? — 3 marks

c) Determine $f'(3)$, and interpret this result. — 4 marks

d) Determine at what time the growth rate will be at its maximum. — 3 marks

e) According to this model, determine how many bacteria would be present if the study ran for a very long time. — 3 marks

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QUESTION B3 PROBABILITY	**Page 1/1**	**Marks**

Use your calculator in b), c), d) and e).

80 % of the mobile phones manufactured by a company are equipped with touchscreens.

A survey of the production shows that:

7 % of the mobile phones with a touchscreen have a faulty battery,

4 % of the mobile phones without a touchscreen have a faulty battery.

A mobile phone is selected at random from the production.

a) Show that the probability that the mobile phone selected has a faulty battery is 0.064. — 3 marks

10 mobile phones are selected at random from the production.

b) Calculate the probability that exactly one of the mobile phones selected has a faulty battery. — 3 marks

c) Calculate the probability that at least 8 of the mobile phones selected do not have a faulty battery. — 3 marks

A customer is concerned about the lifespan of a mobile phone that he has just bought.

Assume that the lifespan of the mobile phones is normally distributed with mean $\mu = 48$ months and standard deviation $\sigma = 10$ months.

d) Calculate the probability that the mobile phone which was bought by this customer has a lifespan of more than 3 years. — 3 marks

e) Given that the mobile phone has worked for 2 years, calculate the probability that it will work for at least 2 more years. — 3 marks

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QUESTION B4 STATISTICS | **Page 1/1** | **Marks**

Use your calculator in c), d) and f).

A study was conducted of the growth of the leaves on a certain tree.
The table below shows the length of a leaf (in mm) over a period of 70 days.

Day (x)	0	10	20	30	40	50	60	70
Length (y)	4.9	7.2	11.5	18.4	29.4	47	75.1	120

a) Determine an equation of Mayer's line. — 4 marks

b) Draw a scatter plot to represent the data from the table, and use this plot to explain whether a linear model is appropriate. — 4 marks

c) Determine an equation in the form $y = a \cdot b^x$ of the exponential regression of y on x. — 3 marks

Give the numbers a and b correct to four decimal places.

For d), e) and f) use the exponential regression model $y = 4.67 \cdot 1.047^x$.

d) Add this exponential regression curve to your diagram in b). — 2 marks

e) What does the number 1.047 in this model tell about the growth of a leaf? — 3 marks

f) Estimate the length of a leaf after 25 days and after 130 days. — 4 marks

Comment on these results.