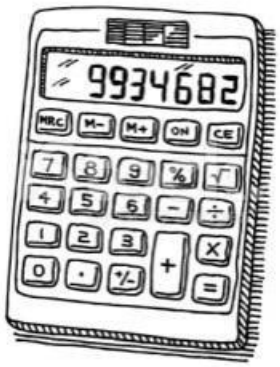
S6MA3ENA – Semestre 1

MATHEMATICS 3
Part B

Date: Wednesday 15th December 2021

DURATION OF EXAMINATION:
45 minutes

Answer ALL questions



SPECIFIC INSTRUCTIONS:

- 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 evident that an appropriate method and/or a correct approach has been used.

K. Osborne

PART A	Marks
1) Consider the function $f(x) = x^3 - 4x^2 + x + 2$.	
(a) Determine the coordinates of the turning points of $f(x)$, giving your answer to 2 decimal places.	4
(b) Draw a table of signs.	2
(c) Use the table of signs to determine the nature of the turning points.	2
2) Consider the function $f(x) = \frac{6x+5}{3x-4}$.	
(a) Explain why the function is undefined when $x = 1\frac{1}{3}$.	1
(b) State the domain of the function.	2
(c) Give the coordinates of the y-intercept of $f(x)$.	2
3) Karen plays volleyball and throws a ball vertically. The height $h(t)$ (in meters) as a function of the time t (in second) of the ball is given by the formula: $h(t) = 6t - 5t^2 + 2$.	
(a) From what height does Karen throw the ball?	2
(b) Show that the ball reaches its highest point at $t = 0.6$ s.	3
(c) Calculate the ball`s maximum height.	3
(d) For how long is the ball in the air?	3

4) A group of scientists decides to investigate a population of insects in a large field. It is found that the starting population 100 and that the population increases exponentially by 20% every week.

Two students each write down a formula to model the population P at a time t , where t is the number of days since the start of the investigation:

Formula A: $P(t) = 100t + 1.2$
Formula B: $P(t) = 100 \cdot (1.2)^t$

(a) Explain why formula B is the correct formula and why formula A is incorrect. 2

(b) Calculate the number of insects after 2 weeks, to the nearest whole number. 2

(c) Copy and complete the table of values below, giving your answers to the nearest whole number: 2

Number of days	**5**	**10**	**15**	**20**
Population				

(d) After how many days will the population exceed 4600? 2

Another group of scientists investigates a population of insects in a different large field. They record their results in the table below:

Number of days	**0**	**5**	**10**	**15**	**20**
Population	**100**	**340**	**580**	**820**	**1060**

(e) Explain why the results follow a **linear** model. 1

(f) Use the information in the table of values to write down a formula to model the population P at a time t , where t is the number of days since the start of the investigation. 2