6E Mathematics – 3 Periods
Part B – With Calculator

DATE: 15th June 2022

DURATION OF THE EXAMINATION:
90 Minutes

AUTHORISED MATERIAL:
Formula Booklet
Scientific Calculator
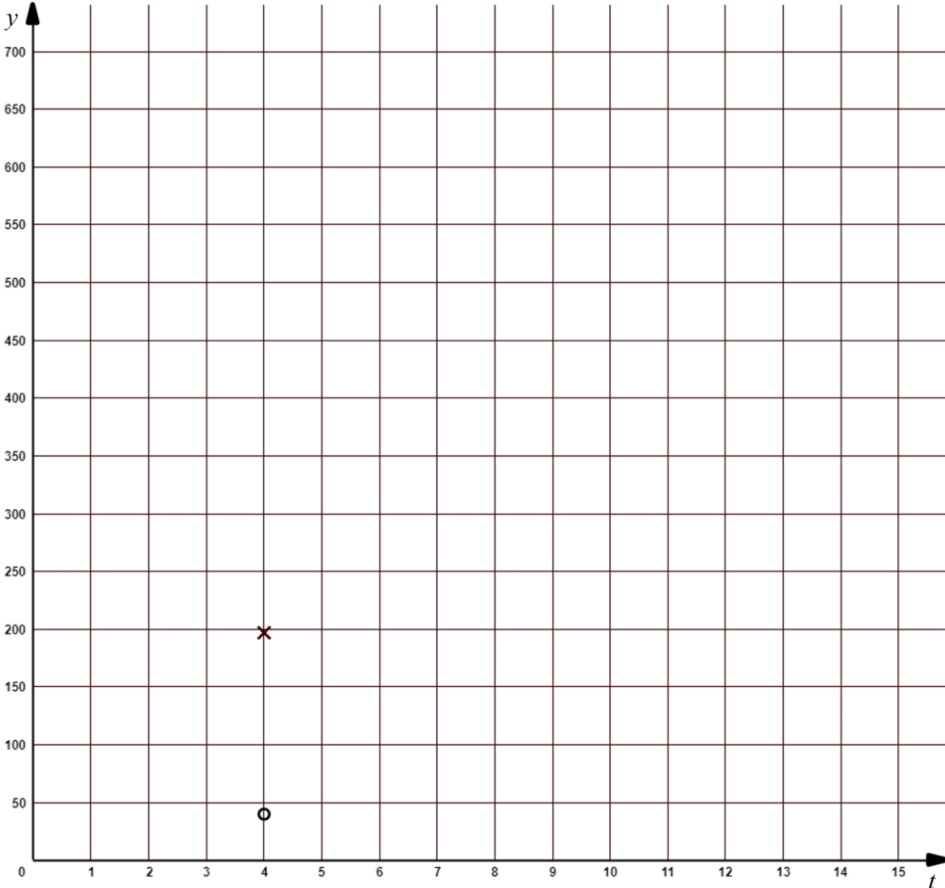
SPECIAL INSTRUCTIONS:

- Answer all questions

- Do not spend too long on one question

- Poorly presented work may result in marks being deducted

- The total mark is 65

- Answers must be supported by explanations, showing the reasoning for the results or solutions given.

- 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

- If the answer provided is incorrect, some marks may still be awarded if it is shown that an appropriate method and/or a correct approach has been used

PART B	
Question 1/4	**Marks**

	(Give your answers to this question accurate to 4 decimal places where appropriate) Many squirrels live in the forest around the ESK in Waldstadt. When a squirrel leaves the forest to go to the trees inside the school grounds, the probability of it being seen by a student is 1/3. One morning, 10 squirrels decide to go to the trees inside the school grounds. Let X represent the number of squirrels which are seen by a student.	
a)	Calculate the probability that exactly 7 squirrels will manage to get to the trees in the school grounds without being seen by a student.	**4**
b)	Calculate the probability that less than two squirrels will be seen by a student.	**4**
c)	Calculate E(X). Interpret this result.	**4**
d)	Calculate the standard deviation of X.	**3**

Question 2/4	**Marks**

	A fair coin is tossed three times in a row and the results obtained are noted. For example, 'Heads, Heads, Tails' is an outcome that may be noted HHT.	
a)	Determine the probability of getting Heads at least twice.	**3**
	For each toss, 20 points are awarded for Heads and 10 points for Tails. Let X represent the sum of the points obtained after the three tosses.	
b)	Calculate $P(X = 40)$.	**3**
c)	Copy and complete the probability distribution table for X shown below. 	x	30			60	 |---|---|---|---|---| 	$P(X = x)$	$\frac{1}{8}$			$\frac{1}{8}$		**4**
d)	Calculate the expected value of X and interpret this result.	**4**

PART B		
Question 3/4		**Marks**
In a village with 700 inhabitants, 14 of them decide to start a rumour at the same time. After 15 hours the rumour has been heard by all of the inhabitants. A linear function is proposed to model this problem.		
a)	Explain why the function $f(t) = 45.73t + 14$ could be used to model this problem, what the variables f & t represent with units, and what the numbers represent.	**5**
b)	Determine the domain of the function.	**2**
c)	Use this function to calculate the time taken for half of the inhabitants to have heard the rumour.	**3**
d)	Copy the graph below onto your 5mm square answer paper using a scale of 1cm for 1 unit on the horizontal axis and 1cm for 50 units on the vertical axis. Draw the line representing the function *f* on your copy of the graph. One of the points has already been marked for you with an X (the point marked O is used later in the question). *(This question continues on the next page)*	**3**

Question 3/4 (continued)		Marks
Another function is now proposed to model this problem $$g(t) = 14 \cdot 1.298^t$$		
e)	Give the name of the type of model represented by function g.	1
f)	Draw the line representing the function g on the same graph as for f above. One of the points has already been marked for you with an O.	3
g)	Using your graph or otherwise, determine also for this function the time taken for half of the inhabitants to have heard the rumour.	3
h)	Compare the two functions f and g and decide, with a reason, which is the better model for this situation.	4

PART B		
Question 4/4		**Marks**
The depth of water at a landing jetty in a small harbour on the North Sea varies according to time due to the tide. There are two tides every day at this harbour. The depth was measured at 3-hour intervals on 15ᵗʰ June and the following figures were recorded. <table><tr><td>Time</td><td>00:00</td><td>03:00</td><td>06:00</td><td>09:00</td><td>12:00</td></tr><tr><td>Depth (m)</td><td>3.6</td><td>5.2</td><td>3.6</td><td>2.0</td><td>3.6</td></tr></table> The depth of water can be modelled by a sine function.		
a)	Show that the function $$h(t) = 1.6 \cdot \sin(0.5236t) + 3.6$$ can be used to model the depth of water h (metres), at time t (hours), explaining how each of the three constants can be found from the data in the table.	6
A large ferry from a nearby island requires a minimum depth of 4m to be able to dock at the jetty.		
b)	Show that the earliest time that the ferry can dock at the jetty on 15ᵗʰ June is 00:29 (rounded to the nearest minute).	3
c)	Find the latest time before midday when the ferry can dock at the jetty.	3

The end