MATHEMATICS 5 PERIODS
PART A

DATE: DD/MM/YYYY

DURATION OF THE EXAMINATION: 120 minutes

EXAMINATION WITHOUT TECHNOLOGICAL TOOL

AUTHORISED MATERIAL:

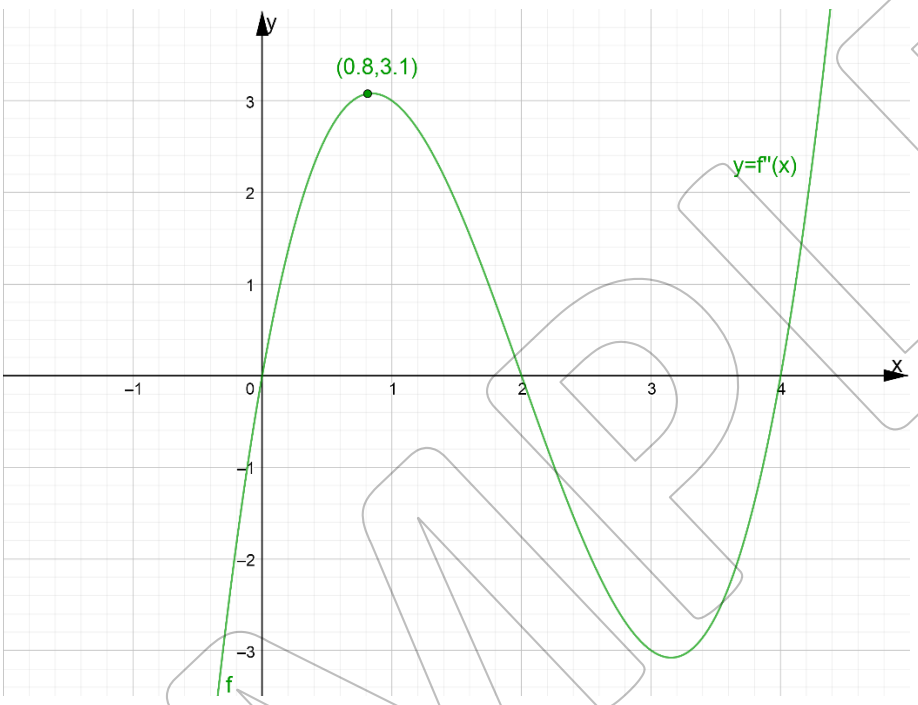
Formula Booklet

Notes:

- As this is a sample paper the cover page is likely to change.
- This sample paper should only be used to see how questions can be created from the syllabus focusing on competences rather than strictly on content.
- The keywords found in the syllabus are highlighted in bold to help the candidate see which competency the question is focusing on and thus helping in answering the question.

PART A		
	Page 1/3	**Marks**
S1	Given the function f, where $f(x) = \ln(3x - 2)$, **determine** the equation of the tangent to the graph of f when $x = 1$.	4
S2	**Determine** the complex solutions to the equation: $z^2 = 3i$. **Give** your answers on the form $z = re^{i\theta}$ where $\theta \in]-\pi, +\pi]$.	5
S3	Given the function $f(x) = \frac{2x-1}{x-1}$. Let f^{-1} be the inverse function of f. **Solve** the equation $f^{-1}(x) = 2$.	3
S4	A strictly increasing arithmetic sequence (a_n) and a geometric sequence (b_n) have the same first term, where $a_1 = b_1 = 2$. Additionally, both (a_n) and (b_n) have the same third term. That is $a_3 = b_3$ The sum of the first three terms of the arithmetic sequence is 4 greater than the sum of the first three terms of the geometric sequence. **Determine** the formula for the nth term of both (a_n) and (b_n).	7
S5	A continuous random variable X has a density function given by a formula: $$f(x) = \begin{cases} 0 & , x < 0 \\ a \cdot e^{-ax} & , x \geq 0 \end{cases}$$ We know that $P(X < 1) = \frac{1}{2}$. **Show** that $a = \ln 2$.	5

PART A		
	Page 2/3	**Marks**
S6	Given is the graph of the second derivative f'' of a function (see figure below). **Decide** which of the following statements are true and which are false. **Justify** your answer. a) The graph of f is concave for $-0{,}5 < x < 2$. b) The graph of f has an inflection point at $x = 0$. c) If $f'(0) = 0$, then the graph of f has an inflection point with a horizontal tangent at $x = 0$.	2 2 2



PART A

		Page 3/3	Marks
E1	A drone manufacturer tests new types of drones at a local athletics field. Drone A moves along the path given by the equation: $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 10 \\ 13 \\ 0 \end{pmatrix} + t \begin{pmatrix} 3 \\ 4 \\ 12 \end{pmatrix}, t \geq 0$ The time t is in seconds and distance is measured in meters.		
	a) **Find** the position of drone A after 6 seconds.		2
	b) **Determine** how long it will take the drone A to reach the point $(25,33,60)$.		2
	c) **Calculate** the speed of the drone A. Give your answer in a simplest surd form.		2
	d) There is an observer watching drone A from the point $(13,53,0)$. **Calculate** the shortest distance between the drone A and the observer, and the time when it occurs.		3
	Drone B takes off from the point $(9,11,0)$ and moves at 7 m/s in the direction $\begin{pmatrix} 1 \\ 1.5 \\ 3 \end{pmatrix}$.		
	e) **Show** that the equation describing the position of the drone B is: $\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 9 \\ 11 \\ 0 \end{pmatrix} + t \begin{pmatrix} 2 \\ 3 \\ 6 \end{pmatrix}, t \geq 0$		2
	f) **Find** the point at which the paths of the drones A and B intersect.		2
	g) **Decide** whether the drones will collide at this point. **Justify** your answer.		2
E2	Two players, A and B alternately and independently flip a fair coin. The first player to get a head wins. Assume player A flips first. a) **Write down** the probability that A wins in a first throw. b) **Calculate** the probability that A wins in a third throw. c) **Determine** the probability that A obtains the first head.		5