

Exercise 1	Calc. : ✖
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 marks

Exercise 2	Calc. : ✖
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 marks

Exercise 3	Calc. : ✖
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 marks

Exercise 4	Calc. : ✖
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 n th term of both (a_n) and (b_n) .	7 marks

Exercise 5	Calc. : ✖
A continuous random variable X has a density function given by a formula: $f(x) = \begin{cases} 0 & \text{if } x < 0 \\ a \cdot e^{-ax} & \text{if } x \geq 0 \end{cases}$ We know that $P(X < 1) = \frac{1}{2}$. Show that $a = \ln 2$.	5 marks

Exercise 6

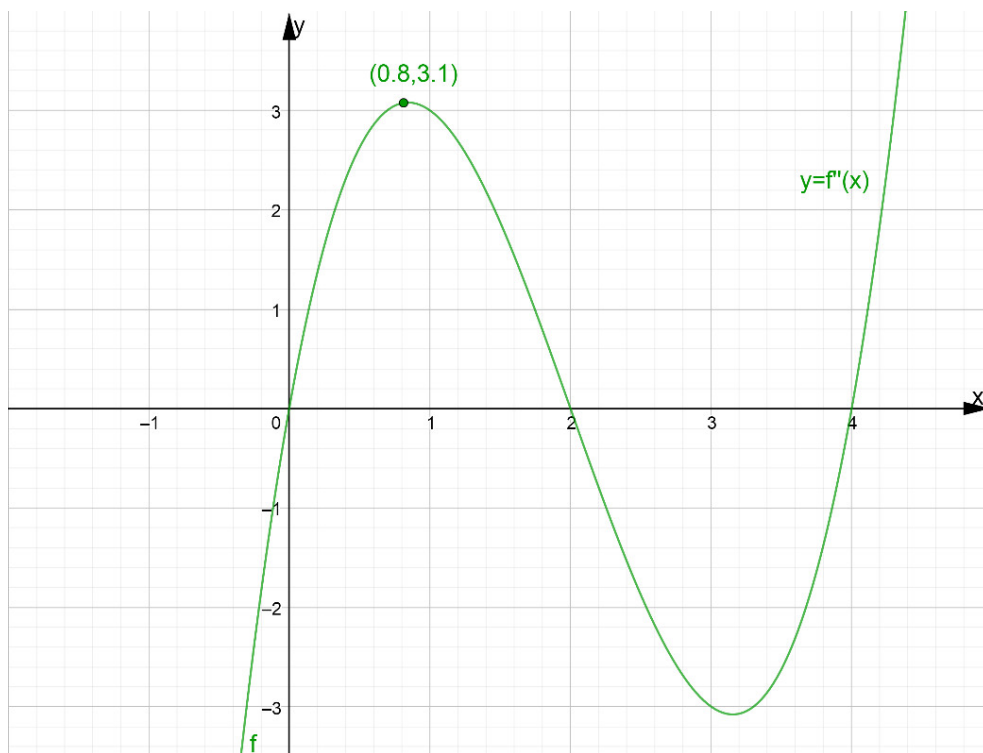
Calc. : ✖

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.

- 1. The graph of f is concave for $-0,5 < x < 2$. 2 marks
- 2. The graph of f has an inflection point at $x = 0$. 2 marks
- 3. If $f'(0) = 0$, then the graph of f has an inflection point with a horizontal tangent at $x = 0$. 2 marks



Exercise 7

Calc. : ✗

A drone manufacturer tests new types of drones at a local athletics field.
Drone A moves along the path given by the equation:

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 10 \\ 13 \\ 0 \end{pmatrix} + t \begin{pmatrix} 3 \\ 4 \\ 12 \end{pmatrix}, \quad t \geq 0$$

The time t is in seconds and distance is measured in meters.

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| 1. Find the position of drone A after 6 seconds. | 2 marks |
| 2. Determine how long it will take the drone A to reach the point (25, 33, 60). | 2 marks |
| 3. Calculate the speed of the drone A. Give your answer in a simplest surd form. | 2 marks |
| 4. 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 marks |

Drone B takes off from the point (9, 11, 0) and moves at 7 m/s in the direction $\begin{pmatrix} 1 \\ 1.5 \\ 3 \end{pmatrix}$.

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| 5. Show that the equation describing the position of the drone B is: | 2 marks |
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$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 9 \\ 11 \\ 0 \end{pmatrix} + t \begin{pmatrix} 2 \\ 3 \\ 6 \end{pmatrix}, \quad t \geq 0$$

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| 6. Find the point at which the paths of the drones A and B intersect. | 2 marks |
| 7. Decide whether the drones will collide at this point.
Justify your answer. | 2 marks |

Exercise 8

Calc. : ✗

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.

5 marks

1. **Write down** the probability that A wins in a first throw.
2. **Calculate** the probability that A wins in a third throw.
3. **Determine** the probability that A obtains the first head.