**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 $f(x) = \dfrac{2x-1}{x-1}$. Let $f^{-1}$ be the inverse function of $f$.<br>**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 $a_1 = b_1 = 2$.<br>Additionally, both $(a_n)$ and $(b_n)$ have the same third term. That is $a_3 = b_3$.<br>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.<br>**Determine** the formula for the $n$th term of both $(a_n)$ and $(b_n)$. | 7 marks |

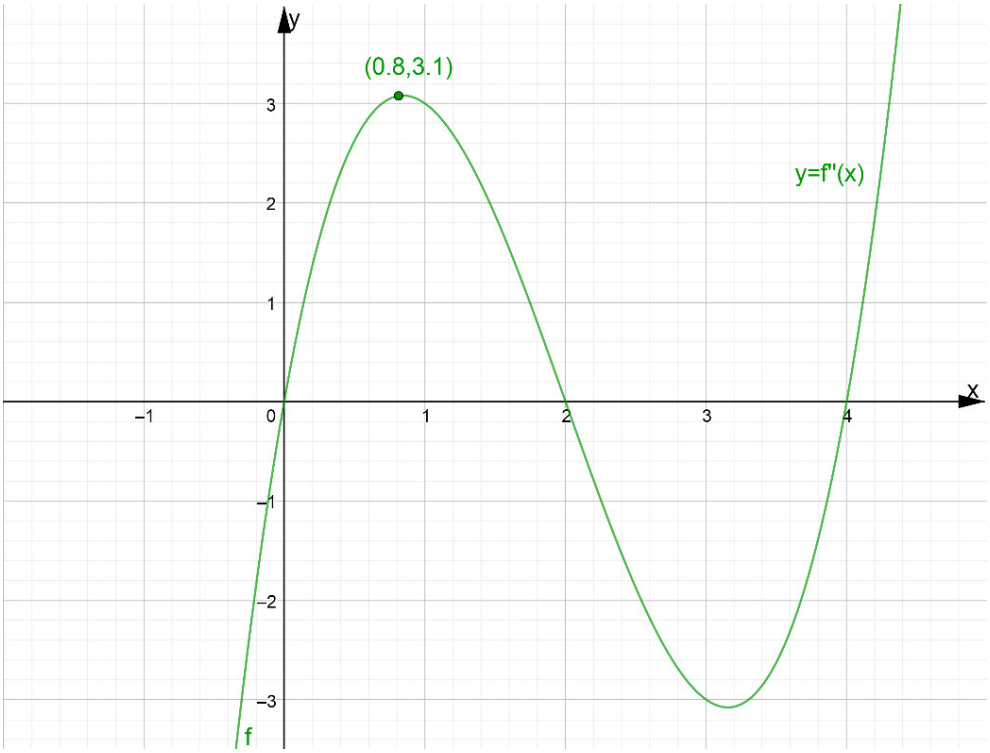
**Exercise 5** Calc. : ✗

| | |
|---|---|
| A continuous random variable $X$ has a density function given by a formula:<br>$$f(x) = \begin{cases} 0 & \text{if } x < 0 \\ a \cdot e^{-ax} & \text{if } x \geq 0 \end{cases}$$<br>We know that $P(X < 1) = \dfrac{1}{2}$.<br>**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.

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 $\begin{pmatrix} 1 \\ 1.5 \\ 3 \end{pmatrix}$.

5. **Show** that the equation describing the position of the drone B is: — 2 marks

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} = \begin{pmatrix} 9 \\ 11 \\ 0 \end{pmatrix} + t \begin{pmatrix} 2 \\ 3 \\ 6 \end{pmatrix}, \quad t \geq 0$$

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. — 2 marks
   **Justify** your answer.

**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.