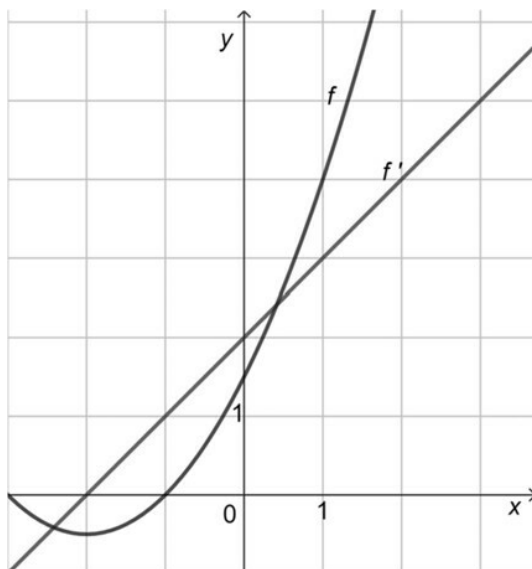


**Exercise 1**

Calc. : ✗

The diagram below shows the graph of a function  $f$  and the graph of its derivative  $f'$ .



**Determine** an equation of the tangent to the graph of  $f$  at the point where  $x = 1$ .

5 marks

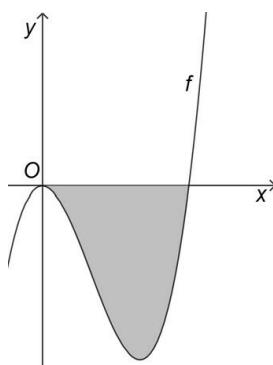
**Exercise 2**

Calc. : ✗

Consider the function  $f$  defined by

$$f(x) = -2x^2 \cdot (2 - x)$$

The diagram below shows the graph of  $f$ .



**Write** an integral that gives the area of the shaded region.

(You do not need to calculate this integral, only give an appropriate expression).

5 marks

**Exercise 3**

Calc. : ✗

The velocity of a moving object is given by a function  $f$ .

A primitive of  $f$  is given by the function  $F$  defined by

$$F(t) = \frac{2}{3}t^3 + 3t$$

where  $t$  is the time expressed in seconds and  $F(t)$  is expressed in metres.

a) **Determine** an expression for  $f(t)$ , the velocity in m/s.

2 marks

b) The displacement, in metres, of the moving object between  $t = a$  and  $t = b$  is given by

$$\int_a^b f(t) dt$$

**Calculate** the displacement of the moving object between  $t = 0$  and  $t = 3$ .

3 marks

**Exercise 4**

Calc. : ✗

|   |         |
|---|---------|
| The height of water in a harbour is modelled by the function $h$ defined by   |         |
| $h(t) = 2 \sin\left(\frac{\pi}{6}t\right) + 3,$   |         |
| where $t$ is the time in hours and $h(t)$ is the height in metres.  |         |
| a) <b>Determine</b> the maximum height of the water in the harbour.   | 1 mark  |
| b) <b>Determine</b> two different values of the time $t$ , when the water is at its highest level.  | 2 marks |
| c) On graph paper, <b>draw</b> the graph of the function $h$ for $t$ between 0 and 16 hours.<br>Use 1 cm for 1 hour on the $x$ -axis and 1 cm for 1 metre on the $y$ -axis. | 2 marks |

**Exercise 5**

Calc. : ✗

|  |  |   |  |  |  |
|--|--|---|--|--|--|
| a) The number of plants of a certain species can be modelled by the function $A$ , given by  |  |   |  |  |  |
| $A(t) = a \cdot b^t$   |  |   |  |  |  |
| where $a$ is the initial number of plants and $t$ is the time in years.  |  |   |  |  |  |
| It is given that $\frac{A(1)}{A(0)} = 0.98$ .  |  |   |  |  |  |
| <b>Determine</b> $b$ and <b>explain</b> its meaning in this context.   | 2 marks                                      |   |  |  |  |
| b) Now consider the population of a second species, which decreases at a constant rate of 10% per year. The initial number of plants of this species is 500.   |  |   |  |  |  |
| <b>Determine</b> which one of the following formulae describes the number $B(t)$ of plants of this species after $t$ years.  | 1 mark                                       |   |  |  |  |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;"><b>Option 1:</b> <math>B(t) = 500 \cdot (-0.10)^t</math></td><td style="padding: 2px;"><b>Option 2:</b> <math>B(t) = 500 \cdot (1.10)^t</math></td></tr> <tr> <td style="padding: 2px;"><b>Option 3:</b> <math>B(t) = 500 \cdot (0.90)^t</math></td><td style="padding: 2px;"><b>Option 4:</b> <math>B(t) = 500 - 0.10 \cdot t</math></td></tr> </table> |  | <b>Option 1:</b> $B(t) = 500 \cdot (-0.10)^t$ | <b>Option 2:</b> $B(t) = 500 \cdot (1.10)^t$ | <b>Option 3:</b> $B(t) = 500 \cdot (0.90)^t$ | <b>Option 4:</b> $B(t) = 500 - 0.10 \cdot t$ |
| <b>Option 1:</b> $B(t) = 500 \cdot (-0.10)^t$  | <b>Option 2:</b> $B(t) = 500 \cdot (1.10)^t$ |   |  |  |  |
| <b>Option 3:</b> $B(t) = 500 \cdot (0.90)^t$   | <b>Option 4:</b> $B(t) = 500 - 0.10 \cdot t$ |   |  |  |  |
| c) The number of plants of a third species can be modelled by the function $C$ defined by $C(t) = 400 \cdot (0.85)^t$ , where $t$ is the time in years.  |  |   |  |  |  |
| Using this model, <b>describe</b> how the number of plants evolve over many years.   | 2 marks                                      |   |  |  |  |

**Exercise 6**

Calc. : ✗

|   |         |
|---|---------|
| A multiple-choice test consists of 4 questions. Each question has three possible answers, with only one answer being correct.<br>One student answers each question at random. |         |
| a) <b>Calculate</b> the probability that the student will answer all 4 questions correctly.   | 1 mark  |
| b) <b>Calculate</b> the probability that the student will get at least one correct answer.  | 2 marks |
| c) <b>Determine</b> the expected value of the number of correct answers obtained by the student.  | 2 marks |

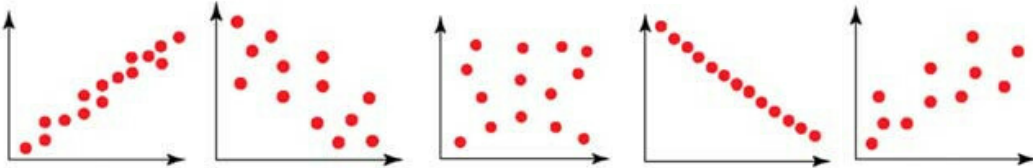
**Exercise 7**

Calc. : ✗

|   |         |
|---|---------|
| 400 patients have volunteered to take part in medical research.<br>153 patients were treated with medicine A, 53 of them were cured.<br>247 patients were treated with medicine B, 117 of them were cured.<br>A patient is chosen at random.<br>Given that the patient is not cured, <b>determine</b> the probability that the patient was treated with medicine B. |         |
|   | 5 marks |

|   |         |           |
|---|---------|-----------|
| <b>Exercise 8</b>   |         | Calc. : ✖ |
| 5 different books are placed on a shelf.  |         |           |
| a) <b>Calculate</b> the number of ways in which these books can be arranged.  | 1 mark  |           |
| b) There are 2 mathematics books and 3 physics books.<br><b>Calculate</b> the number of ways in which the books can be placed on the shelf, if the mathematics books must be together and the physics books must be together. | 2 marks |           |
| c) Claude would like to borrow any 2 of the 5 books.<br><b>Calculate</b> the number of different pairs of books Claude can borrow.  | 2 marks |           |

|   |  |           |
|---|--|-----------|
| <b>Exercise 9</b>   |  | Calc. : ✖ |
| In a marine research study, the length of fins of a certain species of sharks is found to be normally distributed with mean $\mu = 120$ cm and standard deviation $\sigma = 15$ cm.<br>Researchers plan to place a tracking device on a single shark for the study. For the tracking device to fit securely, they should select a shark with a fin length greater than 135 cm.<br>The researchers isolate the sharks with a fin length above the mean and select one of these at random.<br><b>Determine</b> the probability that the device will fit securely. |  | 5 marks   |

|   |  |           |
|---|--|-----------|
| <b>Exercise 10</b>  |  | Calc. : ✖ |
| <b>Match</b> the following correlation coefficients with scatter diagrams below:<br>a) $r = -1$ b) $r = 0.92$ c) $r = 0.74$ d) $r = 0$ e) $r = -0.73$<br>and <b>describe</b> the type of correlation and the strength of the relationship.  |  | 5 marks   |
|  <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>Figure 1</span> <span>Figure 2</span> <span>Figure 3</span> <span>Figure 4</span> <span>Figure 5</span> </div> |  |           |