Exercise 1 Calc. : ✗

Consider the function $f(x) = x^3 + 3x^2$.
Determine the equation of the tangent to the curve at $x = -1$. 5 marks

Exercise 2 Calc. : ✗

The population of a small town increases linearly. In 2012 the population was 5 000. Five years later it was found to be 6 250.

a) **Determine** a model for the population P as a function of t where t is the time in years after 2012. 3 marks

b) **Investigate** in which year the population exceeds 7 000. 2 marks

Exercise 3 Calc. : ✗

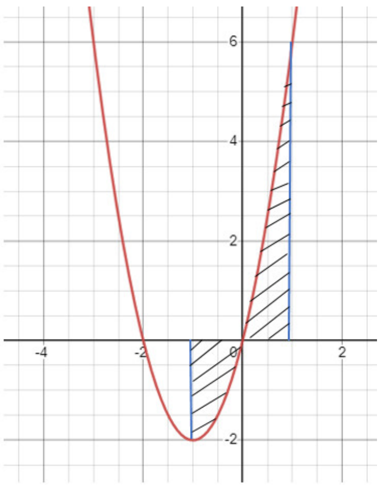
A student kicks a ball up into the air. The height of the ball, h, in metres, can be modelled by the function

$$h(t) = -5t^2 + 15t$$

where $h(t)$ is the height in metres and t is the time in seconds after it is kicked.
Determine the maximum height reached by the ball. 5 marks

Exercise 4 Calc. : ✗

The function $F(x) = \frac{2}{3}x^3 + 2x^2 + 2$ is a primitive function of $f(x)$.
Consider the graph of the function $f(x)$ shown below.
Show that the shaded area bounded by the graph of $f(x)$, the lines $x = -1$ and $x = 1$, and the x-axis is equal to 4 square units. 5 marks



Exercise 5 Calc. : ✗

Scientists observe the population of ladybirds in a field. The population can be modelled by the function $P(t) = 200 \cdot e^{\ln(1.015)t}$ where $P(t)$ is the number of ladybirds and t is the time in weeks after the observation starts.

a) How many ladybirds are there at the start of the observation? 1 mark

b) **Calculate** the number of ladybirds after one week. 2 marks

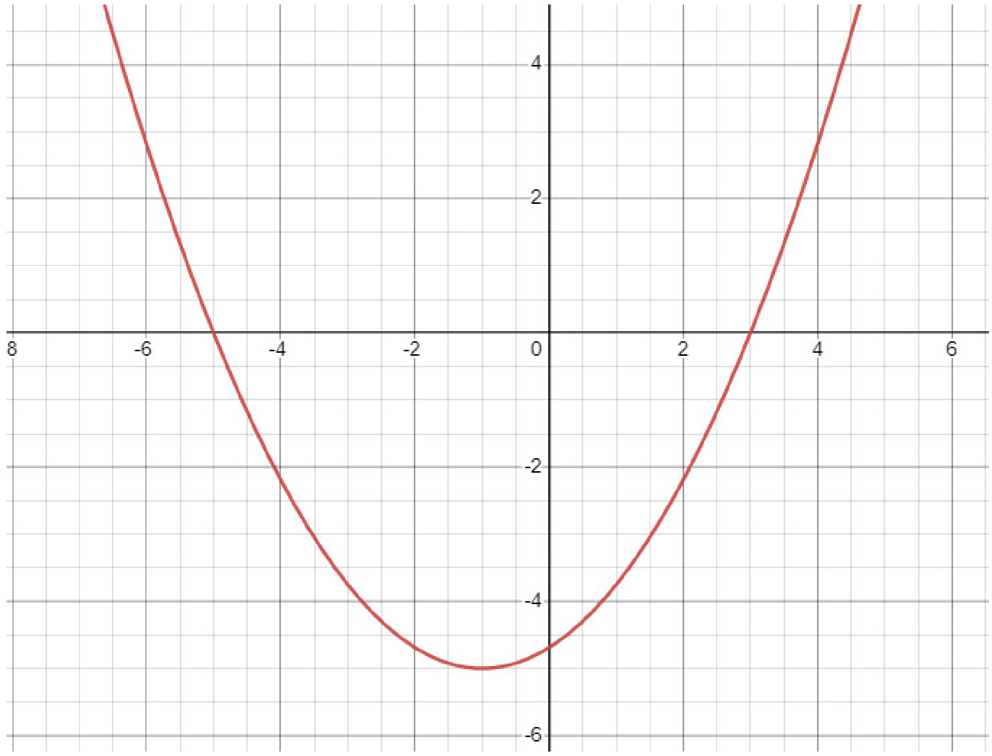
c) **Determine** the weekly percentage increase. 2 marks

Exercise 6 Calc. : ✗

An exponential function is of the form $f(x) = e^{a \cdot x + b}$. The graph of $f(x)$ passes through the co-ordinates $(0, e)$ and $\left(1, \frac{1}{e}\right)$.
Determine the parameters a and b, and give the function $f(x)$. 5 marks

Exercise 7 Calc. : ✗

The graph below is the graph of the derivative $f'(x)$.



For each of the statements below indicate if it is true or false and give a reason for your answer. Marks will only be given if both the answer and the reason are correct. 5 marks

a) The function $f(x)$ has a minimum at $x = -1$.

b) The function $f(x)$ is decreasing over the interval $-5 < x < 3$.

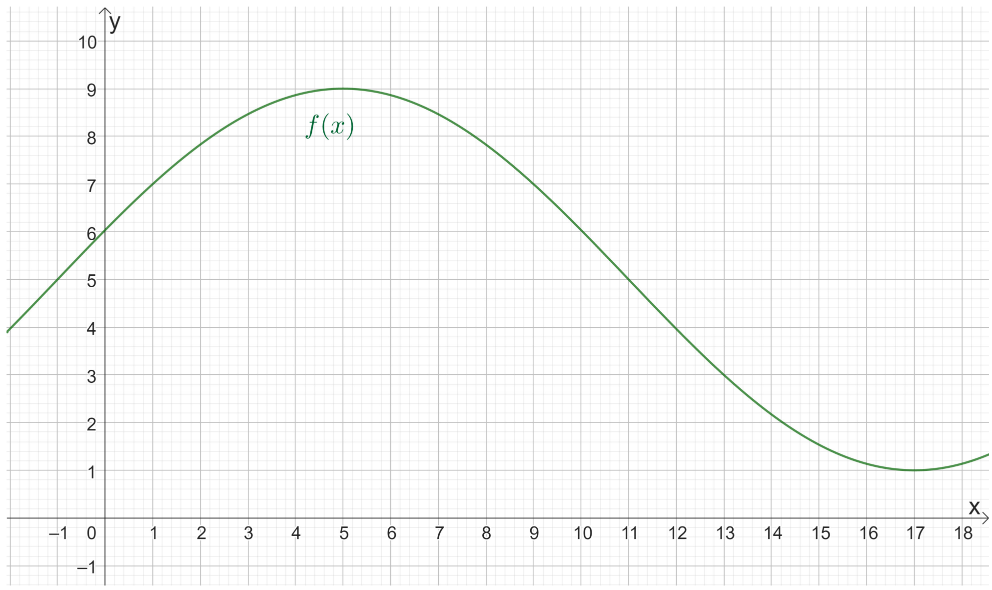
c) The function $f(x)$ has two turning points.

d) The y-intercept of the graph of $f(x)$ cannot be determined from the graph of $f'(x)$.

e) The graph of $f(x)$ must have two x-intercepts.

Exercise 8 Calc. : ✗

The graph of a sine function $f(x)$ is shown below.



a) **Determine** the period. 1 mark

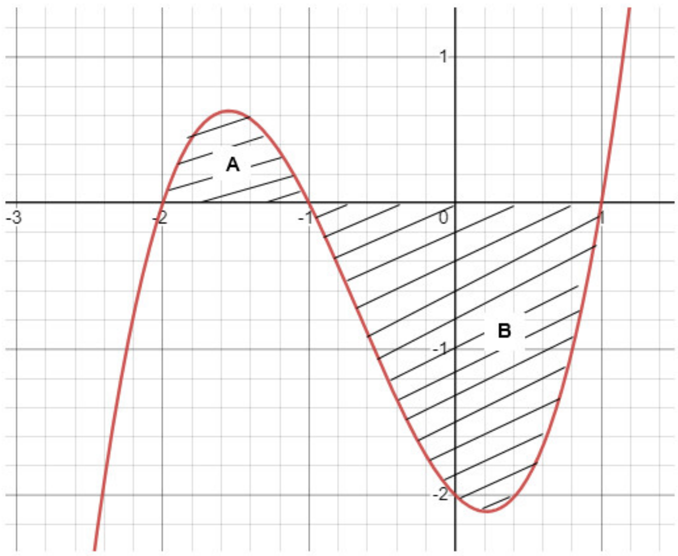
b) **Determine** the parameters a, b, c and d in the function 4 marks

$$f(x) = a\sin(b(x-c)) + d$$

Exercise 9 Calc. : ✗

Consider the graph of $f(x)$ shown below.

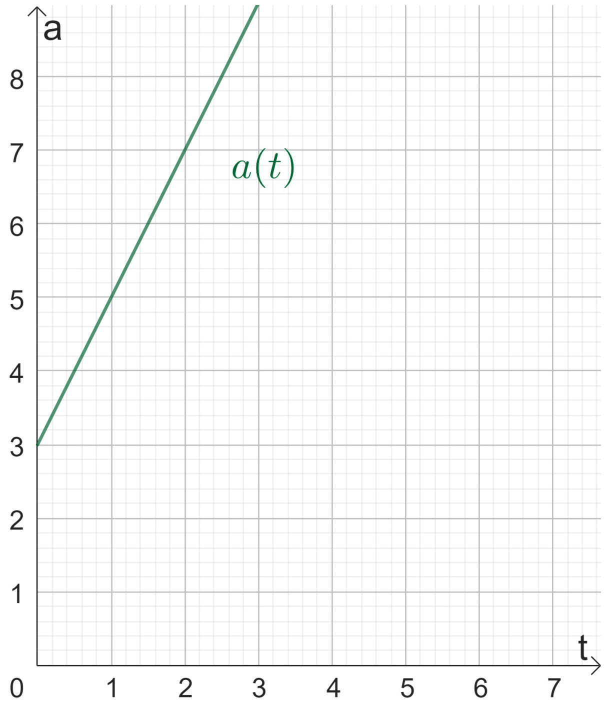
Given that $A = 1.37$ and $B = 4.50$, **find** $\int_{-2}^{1} f(x)\,\mathrm{d}x$. 5 marks



Exercise 10 Calc. : ✗

The acceleration function $a(t)$ is defined as $a(t) = v'(t)$, where $v(t)$ is the velocity function.

The acceleration a (in m/s^2) of an object at a time t (in seconds) can be modelled by the function $a(t)$. The graph of $a(t)$ is shown below.



The velocity of the object at $t = 0$ is equal to 7 m/s.
Calculate the velocity after 2 seconds.

5 marks