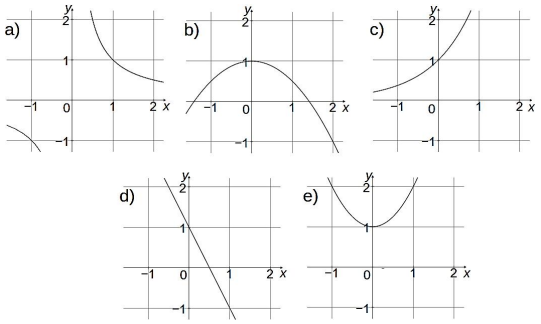
Exercise 1 Calc. : ✗

Given the functions f, g, h, j and k defined by:

$$f(x) = e^x, \quad g(x) = -2x + 1, \quad h(x) = x^2 + 1, \quad j(x) = \frac{1}{x}, \quad k(x) = -\frac{1}{2}x^2 + 1$$

and their graphs shown in a different order below:



Match each function to its graph. No justification is required. 5 marks

Exercise 2 Calc. : ✗

A teacher wants to select a group of 4 students from a class of 10 to help with an event.

a) **Calculate** the number of different groups the teacher can select. 2 marks

b) The class consists of 4 girls and 6 boys.

Calculate how many different groups of 4 the teacher can select, if the group should have 2 girls and 2 boys. 3 marks

Exercise 3 Calc. : ✗

A company produces a new device. The monthly profit from selling these devices is modelled by the function P, defined by:

$$P(x) = -0.5x^2 + 60x - 500,$$

where x is the number of devices sold and $P(x)$ is the monthly profit in euros.

a) **Calculate** the company's monthly profit when they have sold 10 devices in a particular month. 2 marks

b) **Determine** the number of devices to be sold monthly to maximise the monthly profit. 3 marks

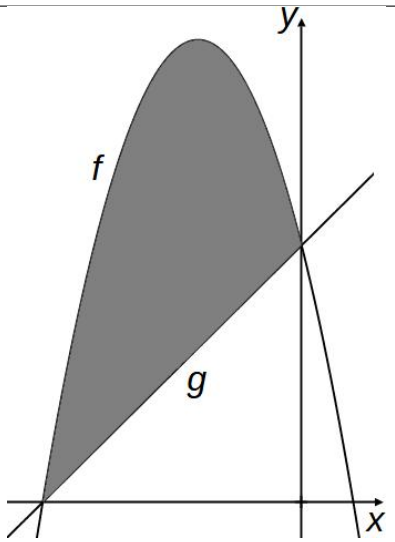
Exercise 4 Calc. : ✗

Consider the functions f and g defined by:

$f(x) = -x^2 - 4x + 5$

$g(x) = x + 5$

The diagram shows the graphs of f and g.



a) **Verify** that the graphs of f and g intersect on the coordinate axes. 2 marks

b) **Write** an integral that gives the area of the shaded region. 3 marks

You do not need to evaluate the integral, only to give an appropriate expression.

Exercise 5 Calc. : ✗

A company conducts a survey on the mode of transport used and time taken by employees to get to work.

The results of the survey are:

- $\frac{2}{3}$ of the employees use a bicycle.
- The remaining employees use a car.
- 10% of employees who use a bicycle take longer than 30 minutes.
- 50% of employees who use a car take longer than 30 minutes.

A company employee is selected at random.

Determine the probability that the employee takes longer than 30 minutes to get to work. 5 marks

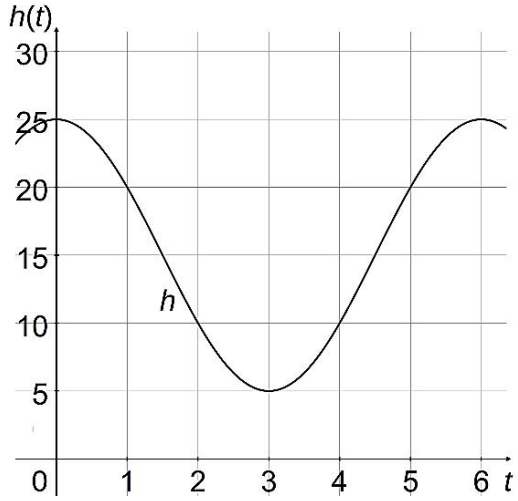
Exercise 6 Calc. : ✗

The height of the tip of a windmill sail is modelled by a periodic function h defined by:

$$h(t) = a \cdot \sin(b \cdot (t - 4.5)) + d,$$

where t is the time in seconds and $h(t)$ is the height of the tip above the ground in metres.

The graph of h is shown on the right.



a) **Determine** the height of the tip of the windmill sail at $t = 9$ seconds. 2 marks

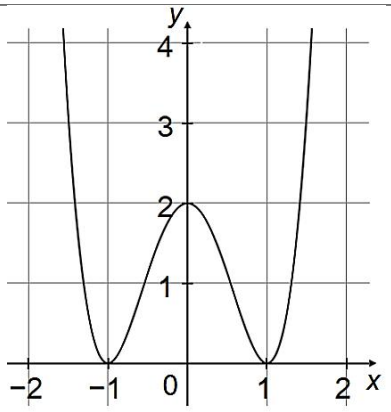
b) **Determine** the values of a, b and d. 3 marks

Exercise 7 Calc. : ✗

In a city it is estimated that 1 in 10 people are allergic to gluten. From the city, 6 people are chosen at random. Let X be the number of them who are allergic to gluten.	
a) **Explain** why it is appropriate to assume that X follows a binomial distribution.	1 mark
b) **Calculate** the probability that exactly 5 of the 6 people are allergic to gluten.	2 marks
c) **Determine**, from the group of 6, the expected value of the number of people who are allergic to gluten.	2 marks

Exercise 8 Calc. : ✗

The graph of a function f is shown on the right.
For each of the following statements, **state** whether it is true or false.
Justify each response.



a) $f'(0) = 0$	1 mark
b) $f'(x)$ changes sign in the interval $(0.5, 1.5)$, i.e. $0.5 < x < 1.5$.	2 marks
c) The equation $f'(x) = 1$ has only two solutions.	2 marks

Exercise 9 Calc. : ✗

A machine fills bottles with a contact lens cleaning product. From a day's production, a bottle is taken at random. Let V be the random variable which, for each bottle, represents the volume of the product in ml. We assume that V follows the normal distribution with mean $\mu = 250$ ml and standard deviation $\sigma = 16$ ml.	
Determine the probability that the selected bottle contains between 218 ml and 266 ml of the cleaning product. Illustrate your answer with a sketch of the normal distribution curve.	5 marks

Exercise 10 Calc. : ✗

A factory produces computer chips. A sample is taken to check the quality. The proportion of faulty chips in the sample is called p. The sample is used to test the hypothesis $H_0 : p = 0.08$. The alternative hypothesis is given by $H_1 : p > 0.08$ If the null hypothesis is rejected, the chips will be sent back to the factory. If the null hypothesis is not rejected, the chips will be used.	
a) **Describe** the type 1 and type 2 errors in this situation.	2 marks
b) The significance level for this test is set at 2.5%. The p-value of the test is 0.034. **Explain** what will happen to the computer chips.	3 marks