

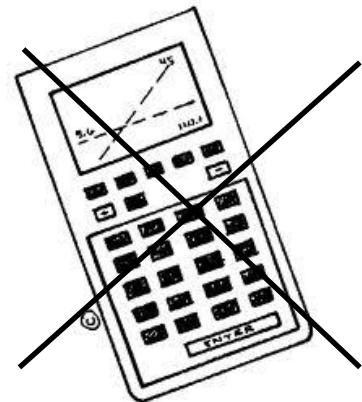
# MATHEMATICS 3 PERIODS

## PART A

**DATE:** 2<sup>nd</sup> June 2025, afternoon

**DURATION OF THE EXAMINATION:**

2 hours (120 minutes)



**AUTHORISED MATERIAL:**

Examination without technological tool

Pencil for the graphs

Formelsammlung / Formula booklet / Recueil de formules

**SPECIFIC INSTRUCTIONS:**

- Answers must be supported by explanations.
- They must show the reasoning behind the results or solutions provided.
- If graphs are used to find a solution, they must be sketched as part of the answer.
- Unless indicated otherwise, full marks will not be awarded if a correct answer is not accompanied by supporting evidence or explanations of how the results or the solutions have been achieved.
- When the answer provided is not the correct one, some marks can be awarded if it is evident that an appropriate method and/or a correct approach has been used.

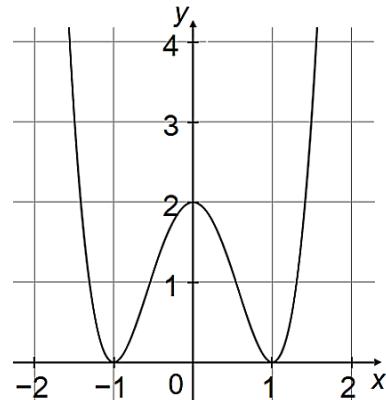
PART A	Page 1/5	Marks
<p>1) Given the functions <math>f, g, h, j</math> and <math>k</math> defined by:</p> $f(x) = e^x, \quad g(x) = -2x + 1, \quad h(x) = x^2 + 1, \quad j(x) = \frac{1}{x}, \quad k(x) = -\frac{1}{2}x^2 + 1$ <p>and their graphs shown in a different order below:</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>a)</p> </div> <div style="text-align: center;"> <p>b)</p> </div> <div style="text-align: center;"> <p>c)</p> </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="text-align: center;"> <p>d)</p> </div> <div style="text-align: center;"> <p>e)</p> </div> </div>		
<p><b>Match</b> each function to its graph. No justification is required.</p>	5 marks	
<p>2) A teacher wants to select a group of 4 students from a class of 10 to help with an event.</p> <p>a) <b>Calculate</b> the number of different groups the teacher can select.</p> <p>b) The class consists of 4 girls and 6 boys.</p> <p><b>Calculate</b> how many different groups of 4 the teacher can select, if the group should have 2 girls and 2 boys.</p>	2 marks	3 marks

PART A	Page 2/5	Marks
3) 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	
4) 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.		

PART A	Page 3/5	Marks
<p>5) A company conducts a survey on the mode of transport used and time taken by employees to get to work.</p> <p>The results of the survey are:</p> <ul style="list-style-type: none"> <li>• <math>\frac{2}{3}</math> of the employees use a bicycle.</li> <li>• The remaining employees use a car.</li> <li>• 10% of employees who use a bicycle take longer than 30 minutes.</li> <li>• 50% of employees who use a car take longer than 30 minutes.</li> </ul> <p>A company employee is selected at random.</p> <p><b>Determine</b> the probability that the employee takes longer than 30 minutes to get to work.</p>		5 marks
<p>6) The height of the tip of a windmill sail is modelled by a periodic function <math>h</math> defined by:</p> $h(t) = a \cdot \sin(b \cdot (t - 4.5)) + d,$ <p>where <math>t</math> is the time in seconds and <math>h(t)</math> is the height of the tip above the ground in metres.</p> <p>The graph of <math>h</math> is shown on the right.</p> <p>a) <b>Determine</b> the height of the tip of the windmill sail at <math>t = 9</math> seconds.</p> <p>b) <b>Determine</b> the values of <math>a</math>, <math>b</math> and <math>d</math>.</p>		

**EUROPEAN BACCALAUREATE 2025: MATHEMATICS 3 PERIODS**

PART A	Page 4/5	Marks
7) 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) <b>Explain</b> why it is appropriate to assume that $X$ follows a binomial distribution.	1 mark	
b) <b>Calculate</b> the probability that exactly 5 of the 6 people are allergic to gluten.	2 marks	
c) <b>Determine</b> , from the group of 6, the expected value of the number of people who are allergic to gluten.	2 marks	
8) The graph of a function $f$ is shown on the right.		
For each of the following statements, <b>state</b> whether it is true or false.		
<b>Justify</b> 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	



# EUROPEAN BACCALAUREATE 2025: MATHEMATICS 3 PERIODS

PART A	Page 5/5	Marks
<p>9) A machine fills bottles with a contact lens cleaning product. From a day's production, a bottle is taken at random. Let <math>V</math> be the random variable which, for each bottle, represents the volume of the product in ml. We assume that <math>V</math> follows the normal distribution with mean <math>\mu = 250</math> ml and standard deviation <math>\sigma = 16</math> ml. <b>Determine</b> the probability that the selected bottle contains between 218 ml and 266 ml of the cleaning product. <b>Illustrate</b> your answer with a sketch of the normal distribution curve.</p>	5 marks	
<p>10) A factory produces computer chips. A sample is taken to check the quality. The proportion of faulty chips in the sample is called <math>p</math>. The sample is used to test the hypothesis <math>H_0 : p = 0.08</math>. The alternative hypothesis is given by <math>H_1 : p &gt; 0.08</math>. 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.</p> <p>a) <b>Describe</b> the type 1 and type 2 errors in this situation.</p> <p>b) The significance level for this test is set at 2.5%. The p-value of the test is 0.034.</p> <p><b>Explain</b> what will happen to the computer chips.</p>	2 marks	3 marks