

Part D	Problems 16-23 which require complete solutions.
Test time	120 minutes.
Resources	Digital resources, formula sheet and ruler.

Level requirements

The test consists of an oral part (Part A) and three written parts (Part B, Part C and Part D). Together they give a total of 67 points of which 23 E-, 24 C- and 20 A-points.

Level requirements for test grades

E: 18 points

D: 27 points of which 8 points on at least C-level

C: 35 points of which 14 points on at least C-level

B: 46 points of which 7 points on A-level

A: 55 points of which 12 points on A-level

The number of points you can have for a complete solution is stated after each problem. You can also see what knowledge level(s) (E, C and A) you can show in each problem. For example (3/2/1) means that a correct solution gives 3 E-, 2 C- and 1 A- point.

For problems labelled “*Only answer required*” you only have to give a short answer. For other problems you are required to present your solutions, explain and justify your train of thoughts and, where necessary, draw figures and show how you use your digital resources.

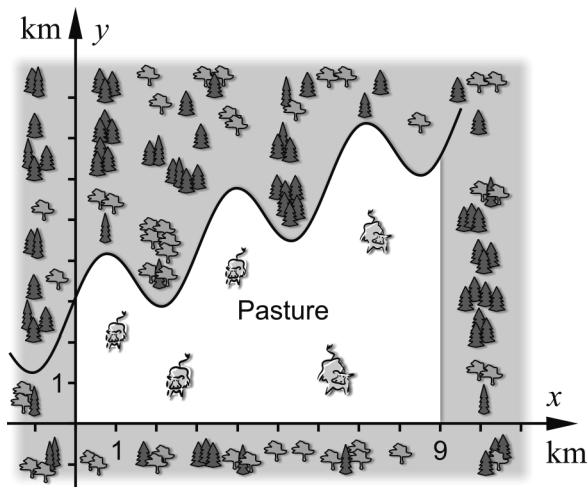
Write your name, date of birth and educational program on all the sheets you hand in.

Name: _____
Date of birth: _____
Educational program: _____

Part D: Digital resources are allowed. Write your solutions on separate sheets of paper.

16. Write the complex number $z = 2 + 2i$ in the polar form. (2/0/0)

17. A pasture for cows is bounded by a forest and a winding creek according to the figure below.



The location of the creek can according to a simplified model be described by the function $f(x) = 0.5x + \sin 2x + 3$

Calculate the area of the pasture. (2/0/0)

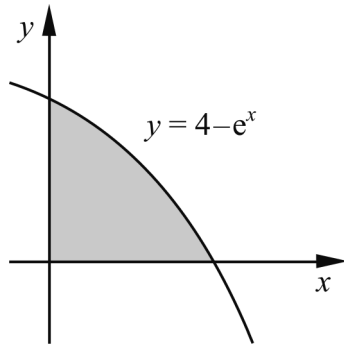
18. The equation $\frac{x}{5} + \cos 2x = 2$ has several solutions.

All solutions lie in the interval $-20 \leq x \leq 20$

a) Calculate the smallest solution to the equation.
Round your answer to at least three significant figures. (1/0/0)

b) Determine the number of solutions to the equation. (1/0/0)

19. The figure below shows the region bounded by the curve $y = 4 - e^x$ and the coordinate axes.



When the area is rotated around the x -axis, a solid of revolution is formed. Write down an expression for the volume of the solid of revolution and calculate its value correct to at least three significant figures.

(0/3/0)

20. A nestling falls from a 8.0 metre high cliff. To describe the falling motion in a simplified way, the following differential equation can be used:

$$\frac{dv}{dt} + 5v = 10$$
 where v is the speed of the falling motion in m/s after time t seconds.

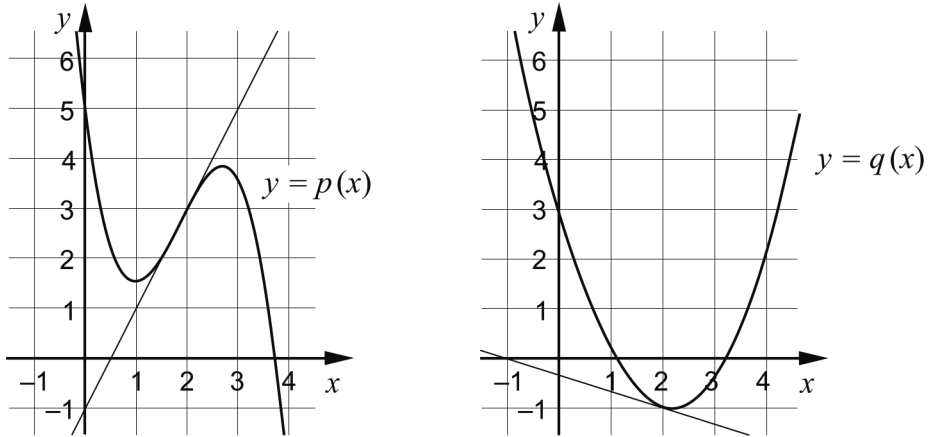
- a) Show that $v(t) = 2 - 2 \cdot e^{-5t}$ is a solution to the differential equation. (1/0/0)
- b) Calculate the time it takes for the nestling to fall 8.0 m. (0/3/0)

21. A company has investigated how long customers calling its customer service must wait before getting an answer. They have found that the waiting time t minutes has a distribution that can be described by the probability density function

$$f(t) = \frac{1}{6} e^{-t/6}, \quad t \geq 0$$

- a) Calculate the probability that a customer has to wait 10 minutes at the most. (0/2/0)
- b) The company wants to inform about the results from the survey with the following statement: "Our customer survey shows that 50 % of our customers have to wait x minutes at the most." Calculate the value of x . (0/2/0)

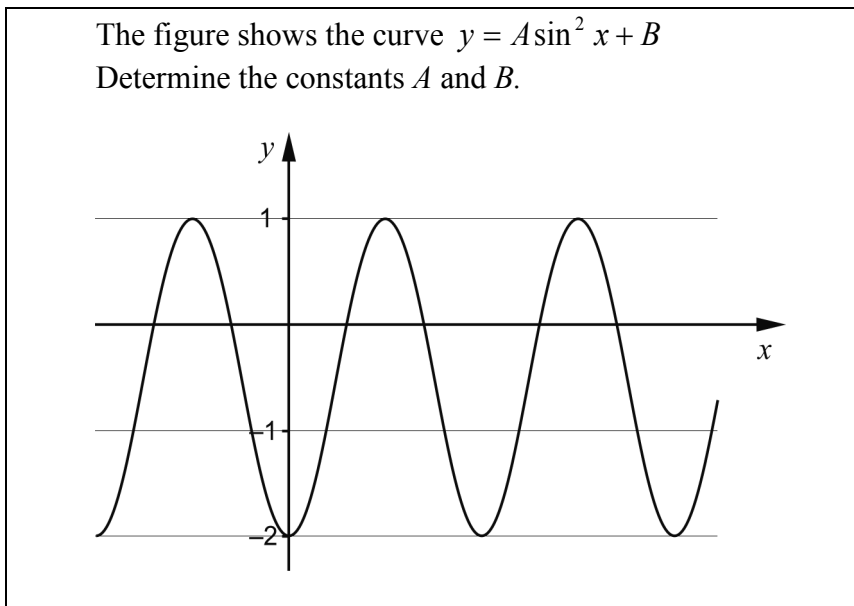
22. The figures show the curves $y = p(x)$ and $y = q(x)$ and also the tangents to these at $x = 2$



Let $r(x) = p(x) \cdot q(x)$ and determine $r'(2)$.

(0/0/2)

23. In Lisa's mathematics book there is the following problem:



This is how Lisa solves the problem:

$$A = \frac{1 - (-2)}{2} = \frac{3}{2} = 1.5$$

$$B = \frac{1 + (-2)}{2} = \frac{-1}{2} = -0.5$$

Answer: $A = 1.5$ and $B = -0.5$

Lisa's solution is not correct. Help Lisa solve the problem correctly.

(0/0/2)