Part B	Problems 1-11 which only require answers.
Part C	Problems 12-16 which require complete solutions.
Test time	120 minutes for Part B and Part C together.
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 26 E-, 23 C- and 18 A-points.

Level requirements for test grades
E: 19 points
D: 28 points of which 8 points on at least C-level
C: 36 points of which 15 points on at least C-level
B: 46 points of which 6 points on A-level
A: 54 points of which 10 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 answers 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.

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

Name: ______________________________

Date of birth: ______________________________

Educational program: ______________________________

Part B: Digital resources are not allowed. *Only answer is required*. Write your answers in the test booklet.

1. Find *all* antiderivatives of $f(x) = x^2$ _______________________ (1/0/0)

2. Simplify as far as possible

a) $\dfrac{3x+24}{2x+16}$ _______________________ (1/0/0)

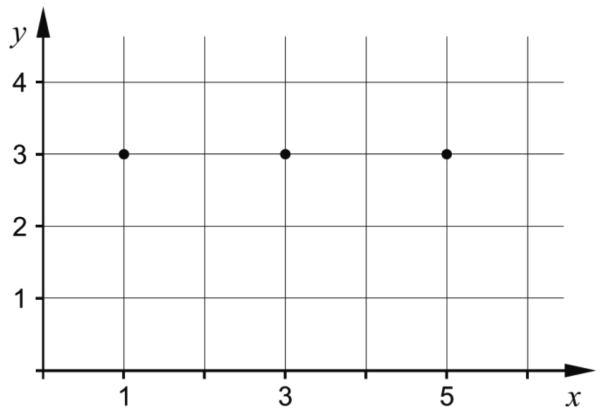
b) $x(x^8+2)+2x^9-2x$ _______________________ (1/0/0)

3. How many terms are there in the geometric sum below?

$2+2\cdot 0.1+2\cdot 0.1^2+2\cdot 0.1^3+\ldots+2\cdot 0.1^{17}$ _______________________ (1/0/0)

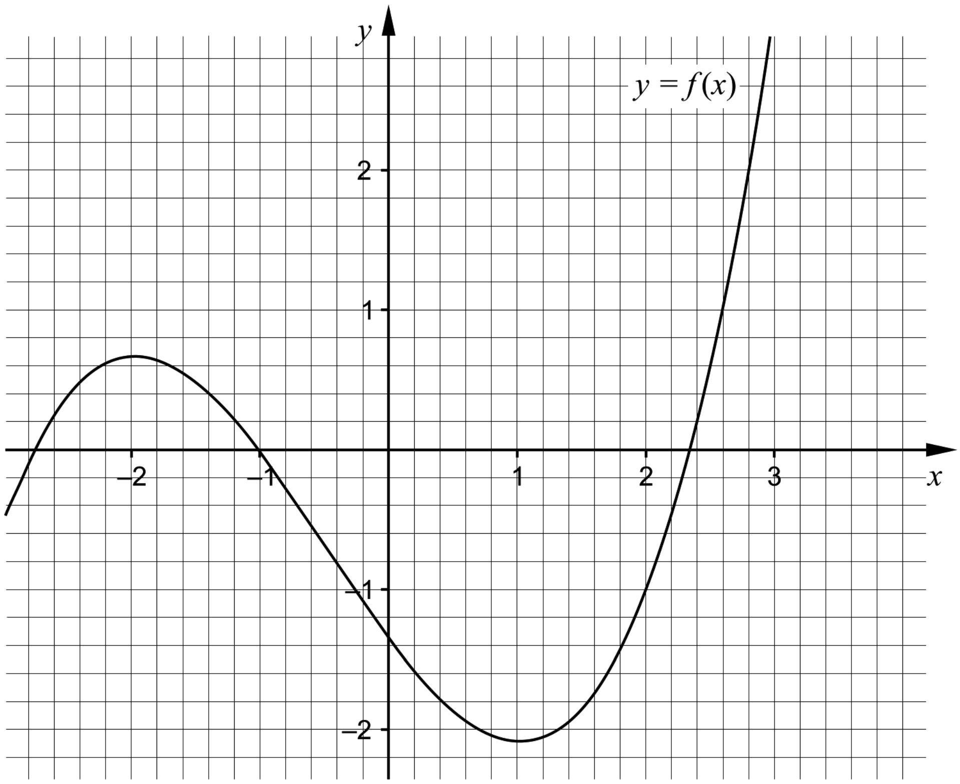
4. The function f is continuous. In the coordinate system below, sketch what the graph of f might look like if it holds that:

- The graph passes through the indicated points $(1, 3)$, $(3, 3)$ and $(5, 3)$
- $f'(1) > 0$
- $f'(3) < 0$
- $f'(5) > 0$



(1/0/0)

5. The figure shows the graph of the cubic function *f*.
Solve the equation $f(x) = 2$ graphically. ______________________ (1/0/0)



6. Determine $f'(x)$

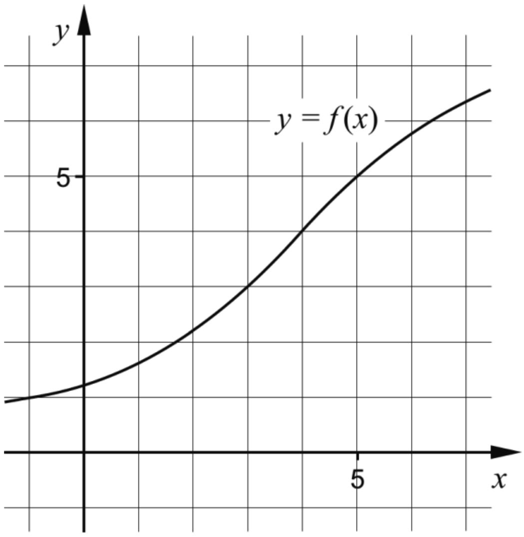
a) $f(x) = 3x^4 - 7x + 5$ ______________________ (1/0/0)

b) $f(x) = x^k + k$ ______________________ (0/1/0)

c) $f(x) = \dfrac{x + 5x^2}{x}$ ______________________ (0/1/0)

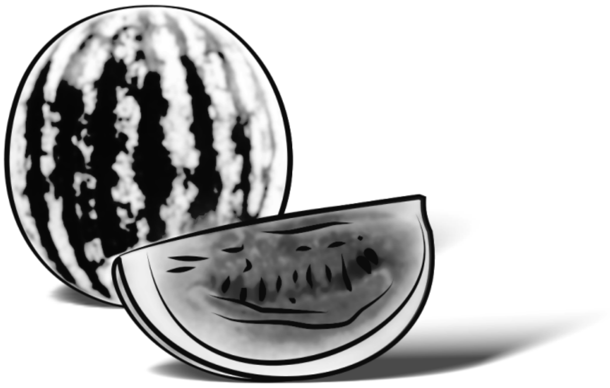
7. The figure shows the graph of the function *f*. Find an approximate value of

$$\int_0^5 f(x)\mathrm{d}x - \int_0^3 f(x)\mathrm{d}x$$



_______________________ (0/1/0)

8. The function f describes how the weight of a growing water melon y depends on the time t, that is $y = f(t)$. The weight y is given in hg (hectograms) and the time t in weeks.



What do you find out by calculating $f'(3)$?
Choose one of the alternatives A-E. _______________________ (0/1/0)

A. The weight in hg that the watermelon has at the time 3 weeks.

B. The increase in weight of the watermelon over 3 weeks.

C. The average increase in weight of the watermelon in hg/week over 3 weeks.

D. The time it takes for the weight of the watermelon to increase to 3 hg.

E. The increase in weight of the watermelon in hg/week at the time 3 weeks.

9. a) Give an example of a polynomial function f of degree four for which it holds that $f(1)=4$

_______________________ (0/1/0)

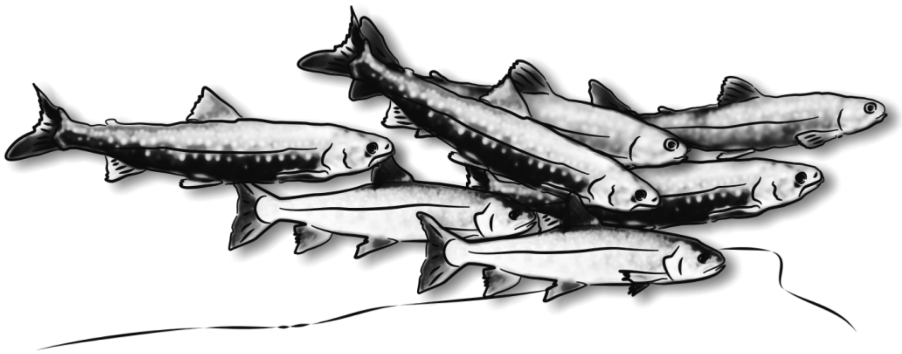
b) There are several rational expressions that satisfy the following conditions:

- The expression has the value 0 when $x=-1$
- The expression is not defined for $x=3$
- The expression is not defined for $x=-4$

Give an example of a rational expression that satisfies all three conditions. _______________________ (0/1/1)

10. A species of fish that was not there previously is planted in a lake. The population of fish can be described by the relation

$N(t)=\dfrac{15000}{3+2e^{-0.5\cdot t}}$ where N is the number of fish and t is the time in years after the planting.



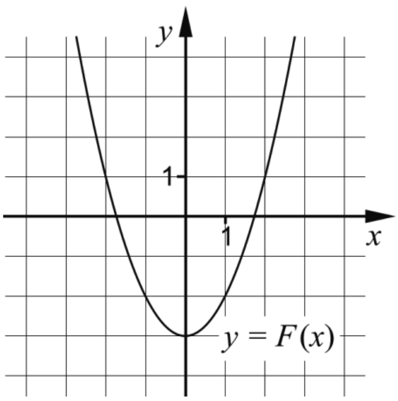
a) How many fish were planted in the lake in the beginning?

_______________________ (0/1/0)

b) Due to different environmental factors, there is a limit to the number of fish. Calculate the upper limit for the number of fish by using the relation.

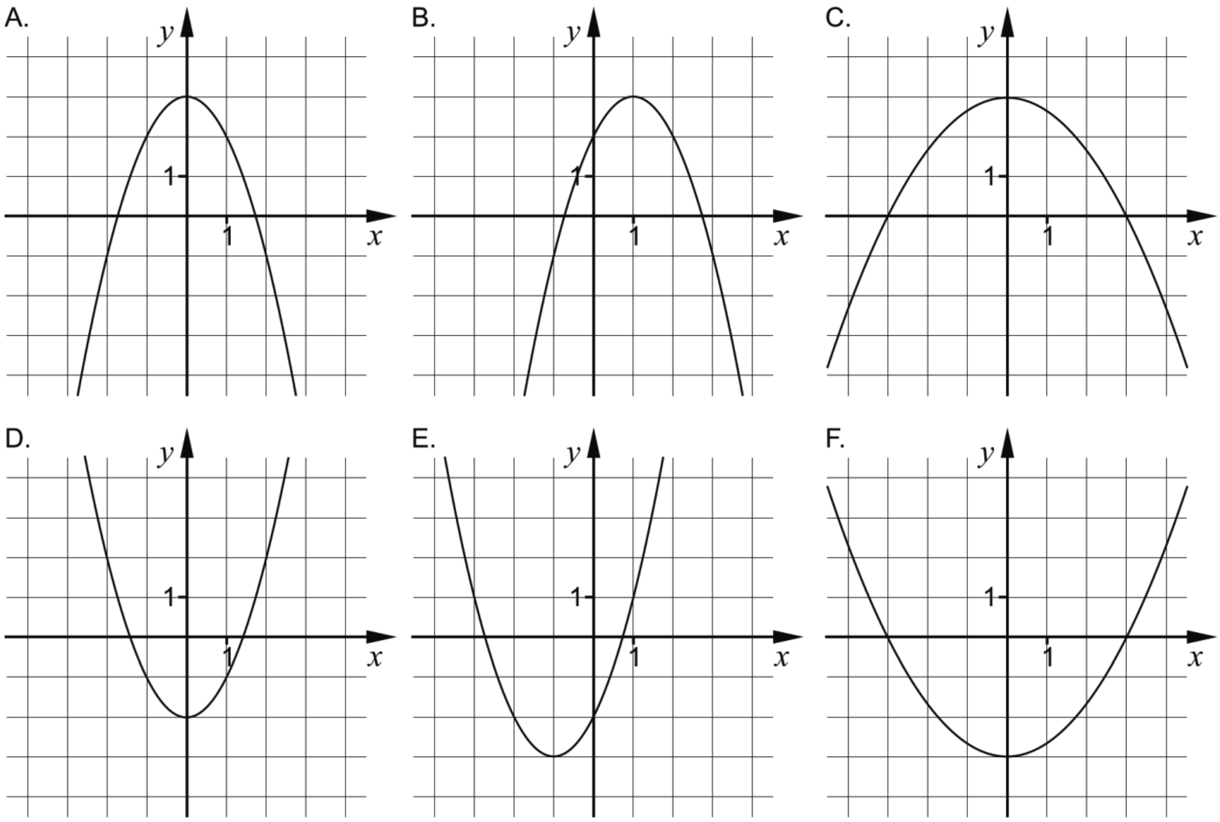
_______________________ (0/0/1)

11. The function f has an antiderivative F. The graph of F can be seen in the figure below.



a) Which of the graphs A-F shows another antiderivative of f ?

_______________________ (0/1/0)



Another function g has an antiderivative G. One of the graphs A-F shows the antiderivative G.

b) Which of the graphs A-F shows G if $\int_0^1 g(x)\mathrm{d}x = 3$?

_______________________ (0/0/1)

Part C: Digital resources are not allowed. Write your solutions on separate sheets of paper.

12. Calculate $\int_1^2 3x^2\,dx$ algebraically. (2/0/0)

13. A gardener is making a flower bed around the corner of a house. Along the sides not bordering the house, she will lay some lawn-edging, see figure 1. She wants to design the flower bed so that the sides BC and CD have the same length, see figure 2.

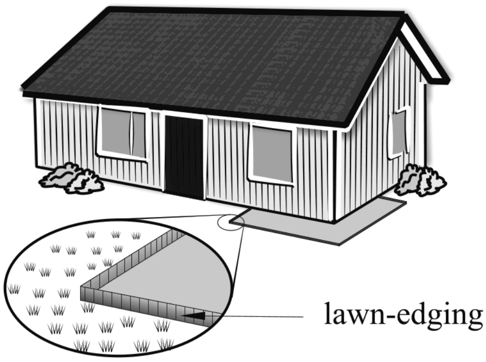


figure 1

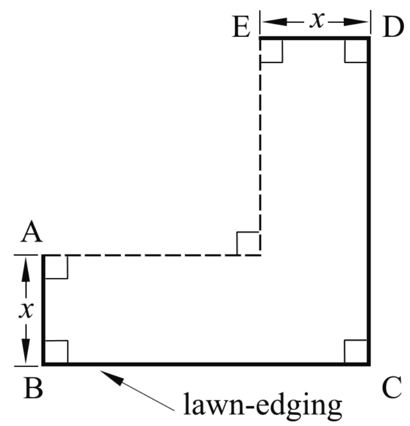


figure 2

In the gardener's shed there is a roll of lawn-edging enough for 6 m and she is planning on using all the lawn-edging. The area of the flower bed is then $A(x) = 6x - 3x^2$
where x is the width of the flower bed in metres, see figure 2.

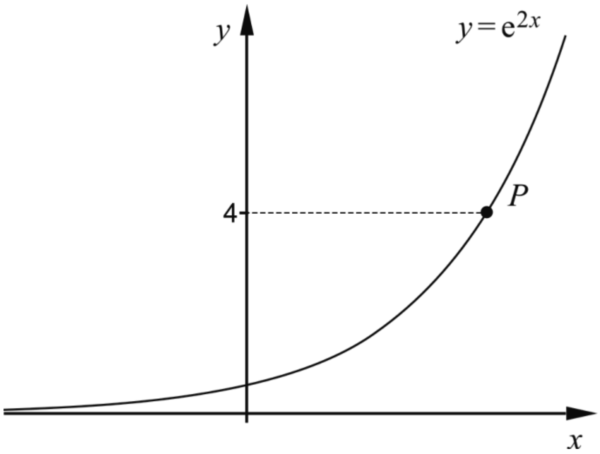
a) The gardener wants the flower bed to have as large area as possible. Use the derivative to calculate the width x that gives the maximum area. (2/0/0)

b) What values can the area A have in this context? (1/2/0)

c) Show that the area of the flower bed in figure 2 can be described by $A(x) = 6x - 3x^2$ if the gardener uses 6 m of lawn-edging. (0/1/2)

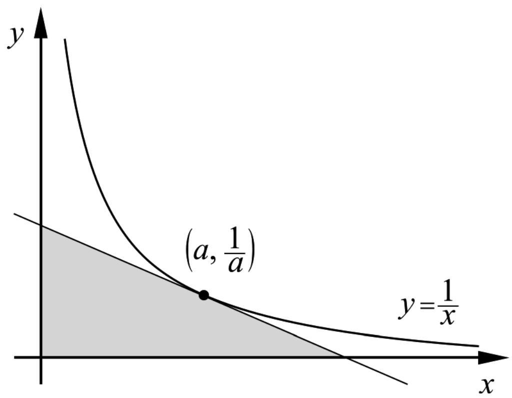
14. Calculate $\dfrac{(x+8)^6 - (x+8)^5}{(x+8)^5}$ when $x = 2.7$
Give an exact answer. (0/2/0)

15. The curve to $y = e^{2x}$ is drawn in the figure below. The point P has the y-coordinate 4



Calculate the gradient of the curve at the point P.
Give an exact answer and simplify it as far as possible. (0/3/0)

16. Prove that the triangle bounded by the positive coordinate axes and a tangent of the curve $y = \frac{1}{x}$ has an area of 2 area units, *regardless* of where the tangent touches the curve.



Assume that the tangential point has coordinates $\left(a, \frac{1}{a}\right)$ (0/1/3)