Part D	Problems 17-24 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 65 consisting of 23 E-, 23 C- and 19 A-points.

Level requirements for test grades
E: 17 points
D: 26 points of which 8 points on at least C-level
C: 34 points of which 14 points on at least C-level
B: 44 points of which 6 points on A-level
A: 52 points of which 10 points on A-level

The number of points you can get for a complete solution is stated after each problem. You can also see what knowledge levels (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 is 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 thought and, where necessary, draw figures and show how you use your digital resources.

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

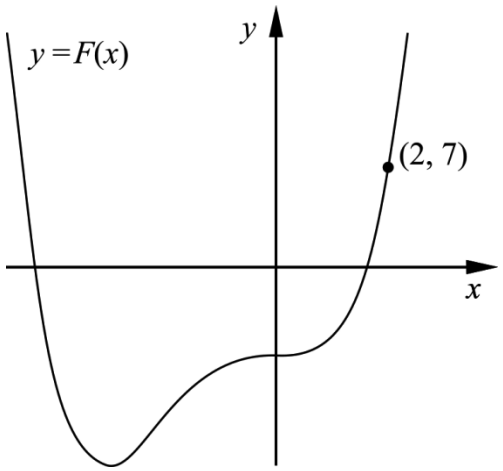
Name: _____

Date of birth: _____

Educational programme: _____

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

17. It holds for the function f that $f(x) = x^3 + 3x^2$
F is an antiderivative of f The graph of F passes through the point $(2, 7)$.
See figure.



Find the antiderivative F. (2/0/0)

18. Lisa considers the solutions of the equation $x^4 + 0.01 = 0$
She then claims that: "There is a negative solution to the equation."

Is Lisa right? Justify your solution. (1/0/0)

19. The temperature of the water in a bottle placed in a fridge can be described by the model $T(x) = 17e^{-0.693x} + 5$
where $T(x)$ is the temperature of the water in °C and x is the time in hours after the bottle was placed in the fridge.

a) Calculate the temperature of the water when the bottle was placed in the fridge. (1/0/0)

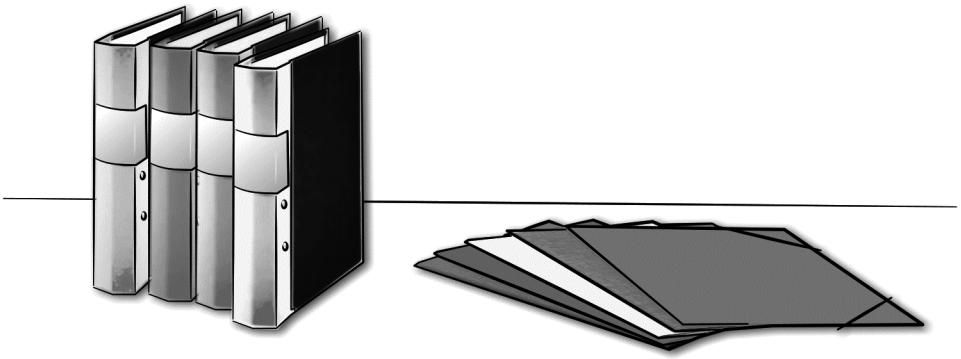
b) Determine how long it takes until the temperature of the water is 10 °C. (2/0/0)

c) Determine how rapidly the temperature of the water is decreasing two hours after the bottle was placed in the fridge. (0/2/0)

d) According to the model, the temperature will, in time, approach a lower limit. Use the model to calculate this lower limit. (0/2/0)

20. The graph of $f(x) = x^4 - 4x$ has a tangent at the point P.
The tangent has the gradient -17.5
Find the x-coordinate of the point P. (0/2/0)

21. The staff at a stationery shop wants to clear the stock of 300 files and 520 folders.



Files Folders

The staff are planning to prepare two different kinds of sets:

- Set 1 costs SEK 40 and contains 1 file and 2 folders.
- Set 2 costs SEK 100 and contains 3 files and 4 folders.

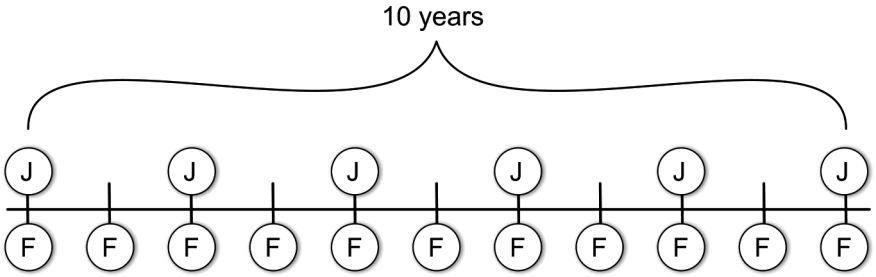
The revenue from the sales can be written $I = 40x + 100y$
where I is the revenue in SEK, x is the number of sold Set 1 and y is the number of sold Set 2.

The information is summed up in the table:

Set 1	**Set 2**	**In stock**
1 file	3 files	300 files
2 folders	4 folders	520 folders
Revenue: SEK 40	Revenue: SEK 100	

Assume that all the prepared sets will be sold.
Calculate how many sets of each kind must be prepared in order for the revenue to be as large as possible. (0/3/0)

22. Frida and John are going to deposit money regularly into their bank accounts which have an annual interest rate of 2 %. Frida is planning to deposit SEK F at the beginning of each year and John is planning to deposit SEK J at the beginning of every second year. They will make their first deposit at the same time and their last deposit at the same time, 10 years later.
This is the plan for their saving:



John wants to have the same amount in his bank account as Frida has in hers immediately after they have made their last deposits.

Show that in that case, John will have to deposit approximately 83 % more than Frida at each deposit, regardless of the amount Frida deposits.

Disregard any possible tax effects. (0/0/3)

23. The bacterium *Clostridium perfringens* may cause serious food poisoning. If food containing this bacterium is left to cool down at room temperature, the number of bacteria increases. Therefore, food should always be cooled as quickly as possible after cooking. It takes approximately 100 000 bacteria per gram of food for a person to get food poisoning.

Assume that immediately after cooking, there are 100 bacteria per gram in a piece of cooked salmon. The cooked salmon is cooled at room temperature.
The number of bacteria increases at a rate of $5.73e^{0.0573 \cdot t}$ bacteria per gram per minute at the time t minutes.

How long does it take before there are so many bacteria per gram in the salmon that a person eating from it will risk getting food poisoning? (0/0/4)

24. Sara sells bilberries at the local market. She has found out that every time she increases the price with SEK 1/kg the amount of bilberries she sells per day decreases by 2 %. If she sets the price at SEK 40/kg, she will sell 30 kg per day.

a) Calculate the daily income SEK D as a function of the price increase x in SEK/kg, where $0 \le x \le 60$

Only answer is required (0/0/2)

b) Use the function in the a) task and draw the graph. Use the graph to determine what price per kilo will yield the largest daily income. (0/0/1)