

<b>Part D</b>	Problems 16-24 which require complete solutions.
<b>Test time</b>	120 minutes.
<b>Resources</b>	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 64 consisting of 23 E-, 22 C- and 19 A-points.

Level requirements for test grades

E: 16 points

D: 25 points of which 7 points on at least C-level

C: 33 points of which 13 points on at least C-level

B: 43 points of which 6 points on A-level

A: 52 points of which 11 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 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.**

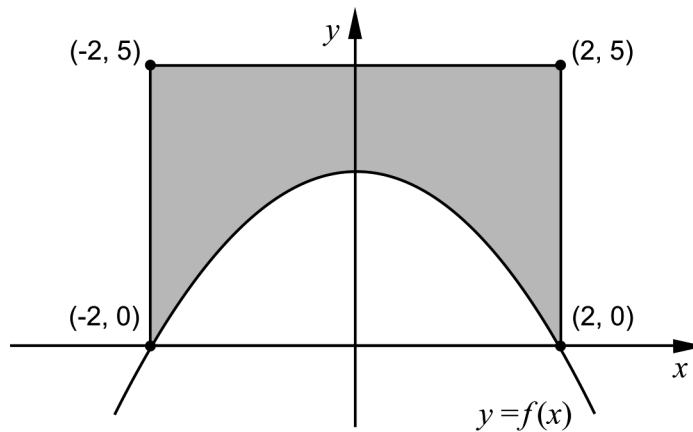
Name: _____
Date of birth: _____
Educational programme: _____

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

16. Determine the values of  $x$  for which it holds that the graph of  $f(x) = x^3 - 0.88x$  has the gradient 5 (2/0/0)

17. Solve the equation  $x(x^2 - 5) = 5(2 - x)$  (2/0/0)

18. The figure below shows the graph of  $f(x) = -0.75x^2 + 3$  and a rectangle. The rectangle has its corners at the points  $(-2, 0)$ ,  $(-2, 5)$ ,  $(2, 0)$  and  $(2, 5)$ .



- a) Use the figure and explain, in words, why  $\int_{-2}^0 f(x) dx = \int_0^2 f(x) dx$  (1/1/0)
- b) Calculate the area of the shaded region. (2/1/0)
19. Andrea is going to start saving money by depositing a certain amount of money into a bank account at the beginning of each year. She wants to save up SEK 50 000 for a trip. She plans to make her first deposit at the beginning of the year 2014 and the last one at the beginning of the year 2020. She counts on the yearly interest rate being 2% for the whole period of time.
- What amount should she deposit every time if she wants there to be SEK 50 000 in her account immediately after the last deposit? (0/2/0)

20. Today there are approximately 7 billion people on Earth. A model that describes the number of people on Earth as a function of time is

$$N(t) = \frac{11}{1 + 3.4e^{-0.03 \cdot t}}$$

where  $N$  is the number of people in billions and  $t$  is the time in years after 1950.




- a) Calculate the number of people on Earth in 1950. (1/0/0)
- b) According to the model, the number of people on Earth will in time reach an upper limit. Use the model and determine this upper limit for the number of people. (0/3/0)
21. It holds for a function  $f$  that  $f(x) = (x - a)(x - b)$  where  $a$  and  $b$  are constants. Find the relation that must be true for  $a$  and  $b$  in order for the graph of  $f$  to have a tangent with gradient 2 when  $x = 4$  (0/3/0)
22. It holds for the polynomial function  $f$  that  $f'(x) > 0$  for all  $x$ . Investigate how many real solutions there are to the equation  $f(x) = 0$  (0/0/2)
23. Albin's weight can be described by the function
- $$V(t) = 0.10t^3 - 1.23t^2 + 6.51t + 3.72$$
- where the weight  $V$  kg is a function of the time  $t$  years after his birth. The function is true for his first eight years in life.



The rate of increase of Albin's weight varies. Calculate what values the rate of increase can have during the first eight years of Albin's life. (0/0/2)

24. Anton and Amanda have been given the task of baking buns and biscuits which they then will sell in order to get money for a school trip. They write down the two recipes on a piece of paper and decide that the profit should be SEK 4 per bun and SEK 2 per biscuit.




**Recipe for 100 Buns**

2400 grams flour  
500 grams butter

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180 grams sugar  
2.5 packets yeast  
1.5 litres milk  
1 teaspoon salt

**Profit: SEK 4 per bun**



**Recipe for 100 Biscuits**

600 grams flour  
500 grams butter

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170 grams sugar  
4 teaspoons baking powder  
6 teaspoons vanilla sugar

**Profit: SEK 2 per biscuit**

Anton and Amanda want to make as large a profit as possible. At the same time, they think about whether they should bake both buns and biscuits or if it will be enough to bake just one of them. They count on selling everything they bake.

In order to know how much they can bake, they find out how much butter and flour they have at home. Together they have 4800 grams of flour and 1750 grams of butter.

Calculate the maximum profit Anton and Amanda can make on their baking. You only need to take into consideration how much flour and butter they will use.

(0/0/4)