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 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 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.

17. Newborn babies normally decrease in weight during the first days, then the weight starts to increase. After three days the weight is at its lowest.


According to a simplified model, the weight of a newborn baby can be described by $V(t) = 5t^3 - 135t + 3500$
where V is the weight in grams and t is the time in days after the birth.

a) How much does a baby on average decrease in weight during the first three days? (2/0/0)

b) Evaluate how well the model corresponds to reality when the baby is a few weeks old. (2/0/0)

18. It holds for the function f that $f(x) = x^3 - 3x^2 + 2$ and that f is defined in the interval $0 \le x \le 4$. Calculate the global minimum and maximum of the function. (2/0/0)

19. It holds for a function f where $y = f(x)$ that $f(3) = 4$ and $f'(3) = 2.4$
Lotta thinks for a while and then says:

− *If it is a straight line, then f(100) must be exactly 244*

Investigate whether Lotta's statement is correct. (2/0/0)

20. A tailor is going to produce lined suits and lined woolen jackets. For each suit he needs 1.5 m of lining and 3 m of wool fabric. For each jacket he needs 2 m of each kind of fabric. The tailor has 90 m of lining and 120 m of wool fabric. Assume that the tailor will manufacture and sell x suits and y jackets. It then holds that:

$$\begin{cases} 1.5x + 2y \leq 90 \\ 3x + 2y \leq 120 \\ x \geq 0 \\ y \geq 0 \end{cases}$$

The figure below shows the graphs of the lines $1.5x + 2y = 90$ and $3x + 2y = 120$ as well as five points plotted.
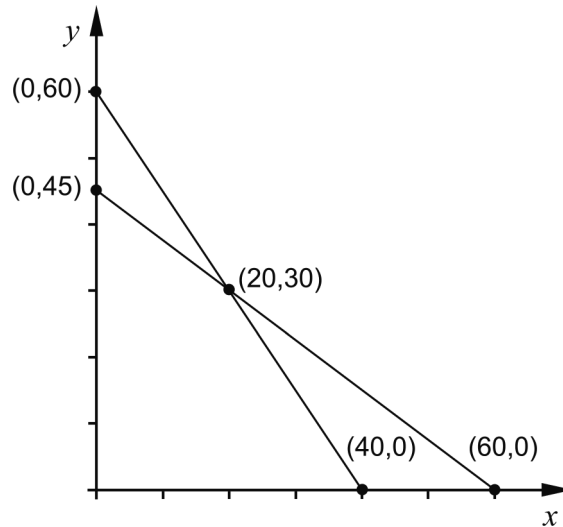

The tailor wants to make as much profit as possible and writes down the profit function $V = 300x + 250y$ where V is the total profit in SEK.

a) Explain what the numbers 300 and 250 in the profit function mean in this context. (1/0/0)

b) Calculate the largest possible profit the tailor can make. (2/1/0)

21. In a geometric sum with 10 terms there is a term 40.5 and after that the following term 121.5
Calculate the value of the first term if the sum is 14762 (0/2/0)

22. Peder draws the graph of $f(x) = x^3 + 0.03x + 1$
    on his graphic calculator and says:

    –I see that the graph has a saddle point.
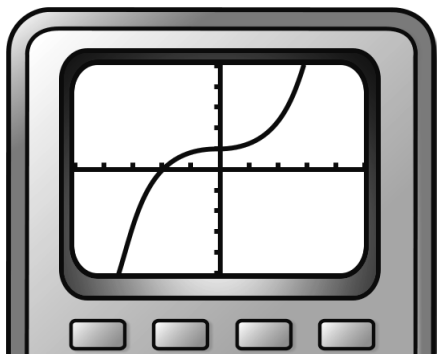

    Investigate whether he is right. (0/2/0)

23. Fredrik and Gustav participate in the same bicycle race. The race is over a distance of 90 km. Fredrik maintains a constant speed throughout the race while Gustav's speed varies. Simplified, the distance (in km) they have cycled can be described by the functions:

    $f(t) = 30t$ and $g(t) = t^3 - 6t^2 + 37.8t$

    where t is the time in hours after the start.

    Fredrik and Gustav start at the same time. Fredrik finishes first. He crosses the finish line exactly 3 hours after the start.
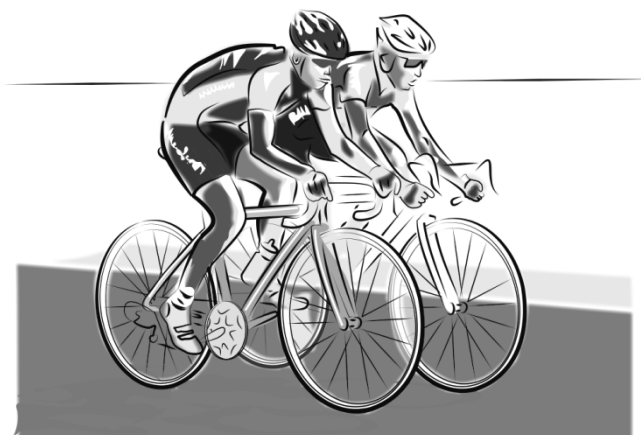
    How long after the start is the distance between Fredrik and Gustav the greatest and how great is the distance between them at that time? (0/0/4)

24. S is a continuous function defined for all x.
    Determine $S'(4)$ when $S(x+h) = S(x) + h$ (0/0/3)