

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 66 points of which 25 E-, 24 C- and 17 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 14 points on at least C-level

B: 45 points of which 5 points on A-level

A: 52 points of which 9 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.

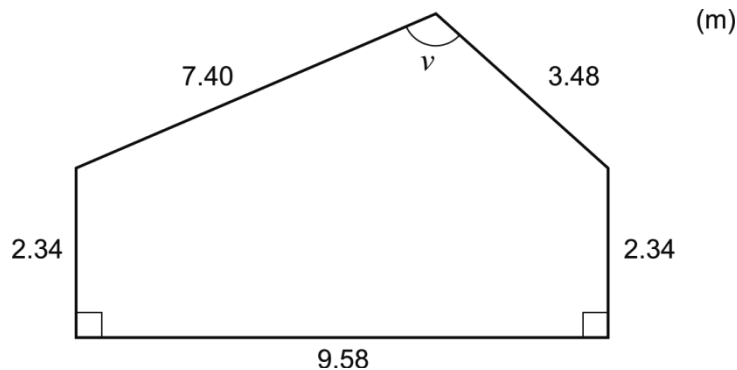
- a) How much does a baby on average decrease in weight during the first three days? (2/0/0)
- b) Evaluate how well the model corresponds to reality when the baby is a few weeks old. (2/0/0)
18. It holds for the function f that $f(x) = x^3 - 3x^2 + 2$ and that f is defined in the interval $0 \leq x \leq 4$. 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. Calculate the angle v in the figure. (2/0/0)



21. The women's world record in the javelin throw is held by Barbora Špotáková from the Czech Republic who threw 72.28 m in Stuttgart in 2008.



The length of the throw is measured to the point where the tip of the javelin lands. There is a rule that states that the landing sector may have a slight inclination (upwards or downwards), but the maximum overall inclination of the landing sector in the running direction shall not be more than 1:1000. This means that on 1000 m the height difference is 1 m.

Assume that Špotáková's world record at 72.28 m was done on a landing sector without inclination and that the javelin formed the angle $\nu = 30,0^\circ$ with the ground at the landing. See figure 1.

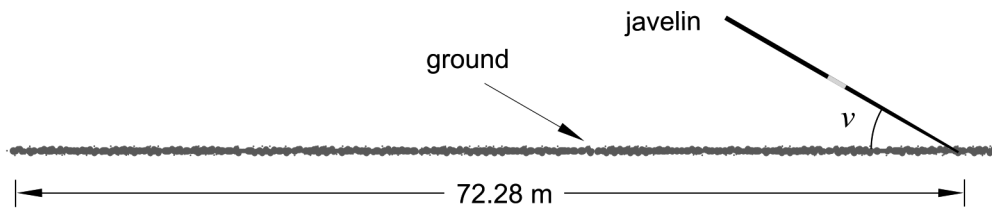


figure 1

When the landing sector has an upwards inclination the length of the throw is slightly shorter. What length of a throw D would Špotáková have had on a landing sector with a maximum upwards inclination? See figure 2.

Give your answer in metres to two decimal places.

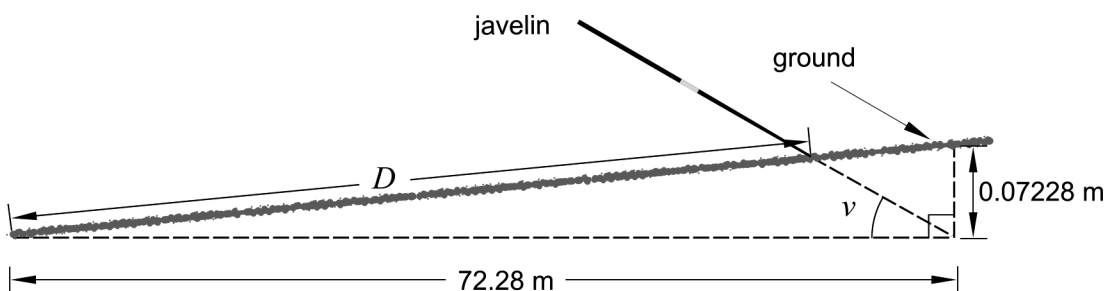
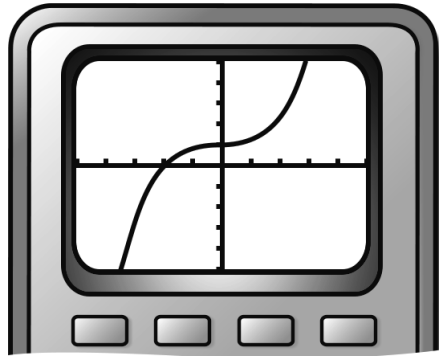


figure 2

(0/4/0)

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

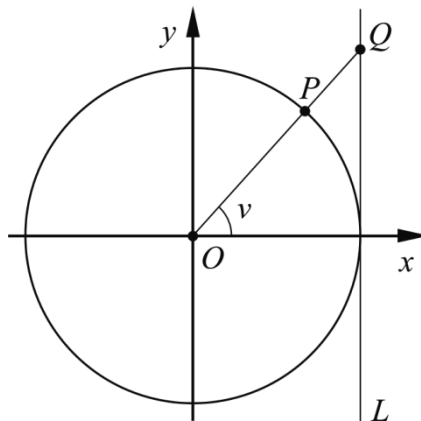
–I see that the graph has a saddle point.



Investigate whether he is right.

(0/2/0)

23. The figure below shows a unit circle that is touched by a line L which is parallel to the y -axis. It holds for the angle v that $0^\circ < v < 90^\circ$. The points O , P and Q lie on the same line. The point Q has the y -coordinate t .



Determine $\cos v$ expressed in t

(0/0/3)

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

(0/0/3)