

<b>Part D</b>	Problems 17-25 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 66 points of which 24 E-, 25 C- and 17 A-points.

Level requirements for test grades

E: 17 points

D: 27 points of which 8 points on at least C-level

C: 36 points of which 15 points on at least C-level

B: 45 points of which 6 points on A-level

A: 53 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: _____

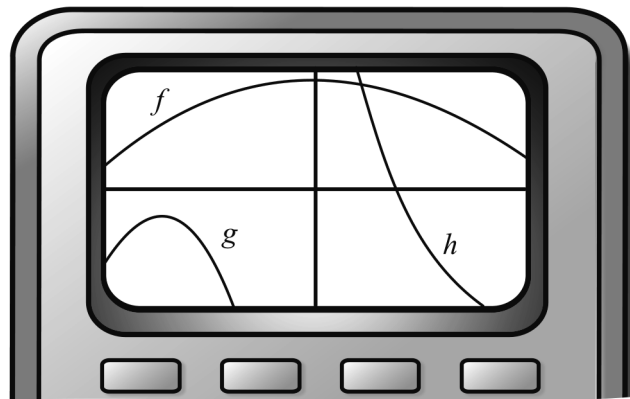
**Part D:** Digital resources are allowed. Do your solutions on separate sheets of paper.

17. Albin and Joakim are having a movie night so they buy soft drinks and sweets. Albin pays SEK 86 for two soft drinks and four bags of sweets. Joakim buys three soft drinks and two bags of sweets and pays SEK 68.

Let the price of one soft drink be SEK  $x$  and the price of one bag of sweets SEK  $y$ . Write down simultaneous equations and calculate the price of a soft drink and a bag of sweets respectively. (2/0/0)

18. Find the equation of a straight line that intersects the  $x$ -axis when  $x = 5$  and has a positive gradient. (2/0/0)

19. Petter is going to determine the number of zeroes of three quadratic functions  $f$ ,  $g$  and  $h$ . He has used a graphic calculator to draw the functions. The picture shows the display of the graphic calculator.



Petter says: “I’ll have to change the settings of the axes so I can see more of the graphs.”

Petter’s teacher John says: “You don’t have to do that, you can already see how many zeroes each of the quadratic functions has.”

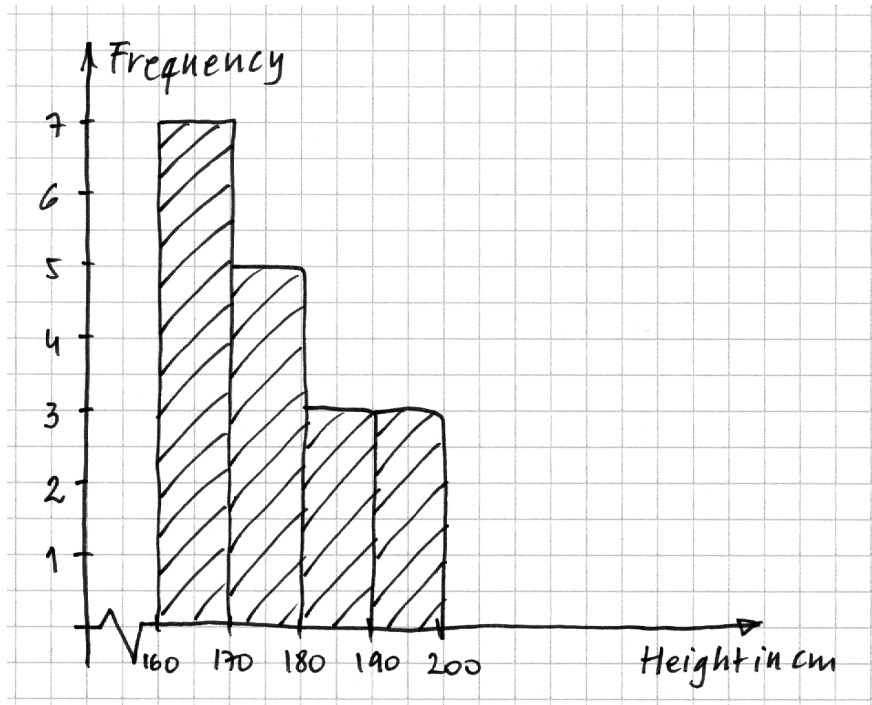
Write down the number of zeroes to each of the functions  $f$ ,  $g$  and  $h$  and explain how you can determine this with help from the given picture. (2/1/0)

- 20.** The concentration of hydrogen ions in nature affects both the water and the land around us. The pH scale describing this concentration is logarithmic. The relation between the pH and the concentration of hydrogen ions can be written as  

$$y = -\lg x$$
where  $y$  is the pH and  $x$  is the concentration of hydrogen ions in  $\text{mol/dm}^3$ .
- a) Calculate the pH when the concentration of hydrogen ions is  $1.2 \cdot 10^{-4} \text{ mol/dm}^3$ . *Only answer required* (1/0/0)
- b) During laboratory work, the pH in a rain water sample was measured to 5.60. Calculate the concentration of hydrogen ions in the rain water sample. (0/1/0)
- 21.** The median of three integers is 34. The mean is 26 and the range 30.
- Which are the three numbers? (0/3/0)
- 22.** One of Sweden's environmental objectives is to reduce its carbon dioxide emission. In 1990 the carbon dioxide emission was  $7.29 \cdot 10^7$  metric tons. In 2011 the emission had decreased to  $6.63 \cdot 10^7$  metric tons. Assume that the carbon dioxide emission has decreased according to the exponential relation  

$$y = C \cdot a^x$$
where  $y$  corresponds to the carbon dioxide emission in metric tons and  $x$  corresponds to the number of years after 1990.
- a) Determine the constant  $C$  in the above relation. *Only answer required* (1/0/0)
- b) Calculate the yearly percentage decrease between 1990 and 2011. (2/0/0)
- The aim is to decrease the carbon dioxide emission by 40% from 1990 to 2020.
- c) Assume that the yearly percentage decrease is 1% starting in 2011 when the emission was  $6.63 \cdot 10^7$  metric tons. Counting from 2011, how many years will it take before the carbon dioxide emission is 40% less than in 1990? (0/2/0)

23. Emelie is carrying out a statistical survey on the height of her 18 class mates. She then calculates the mean of the height to 175.5 cm. Emelie presents her results in a histogram. See below.

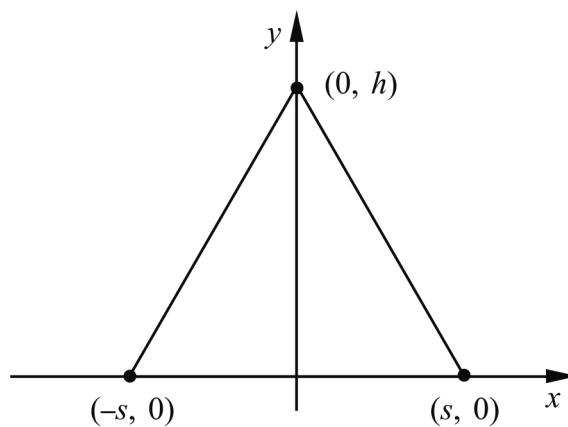


Emelie shows the histogram to Anton. He uses the histogram to calculate the mean to 176.1 cm. Both Emelie and Anton calculate correctly but they get different means.

Explain why the mean becomes different with the two methods.

(0/1/1)

24. An equilateral triangle is drawn in a coordinate system. It has its corners at the points  $(0, h)$ ,  $(-s, 0)$  and  $(s, 0)$



Determine the area  $A$  of the equilateral triangle, expressed only in  $s$ .

(0/0/3)

25. The picture shows a fountain in Seoul, the capital of South Korea.



The distance along the water surface from the start of the jet of water until it hits the water is approximately 2.3 m. The maximum height of the jet of water above the water surface is approximately 3.1 m. Assume that the jet of water has the same shape as the graph of a quadratic function.

Determine a function that describes the trajectory of the water jet.

(0/0/3)