

# Mathematics

Delprov D

1b

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Elevens namn och klass/grupp

## Instructions – part D

**Time for the test** 120 minutes for part D.

**Aids** Allowed aids on part D are digital devices, formula sheet and ruler.

**Tasks** This part consists of several different tasks. The solutions are to be written on separate paper, which is to be submitted together with the test booklet. For most of the tasks in this part it is not enough to only give an answer, you also have to

- show your solutions
- explain/motivate your thinking
- draw figures when required.

For some tasks only the answer needs to be given. They are marked with “*Only answer required*”.

**Grading limits** The test (part A–D) gives a total maximum of 81 points.

Limit for test grade

E: At least 18 points.

D: At least 31 points of which at least 12 points at level C or higher.

C: At least 41 points of which at least 20 points at level C or higher.

B: At least 53 points of which at least 7 points at level A.

A: At least 63 points of which at least 11 points at level A.

Name: \_\_\_\_\_

Date of birth: \_\_\_\_\_

Programme: \_\_\_\_\_ Class: \_\_\_\_\_

**Also write your name, date of birth, programme and class on the sheets you hand in.**

Illustration: Jens Ahlbom

17. Amina has taken out an interest-only mortgage of SEK 800 000. How much does she pay in interest per month if the annual interest rate is 3.6 %? (2/0/0)

18. The peak of Mt. Kilimanjaro, Africa's highest mountain, is 5 892 metres above sea level. Johan is climbing the mountain. When he takes a break to boil some tea water he finds that the water begins boiling at 85 °C. He knows that the boiling point of the water decreases the higher he climbs. The relation between boiling point and height above sea level can be described by the formula

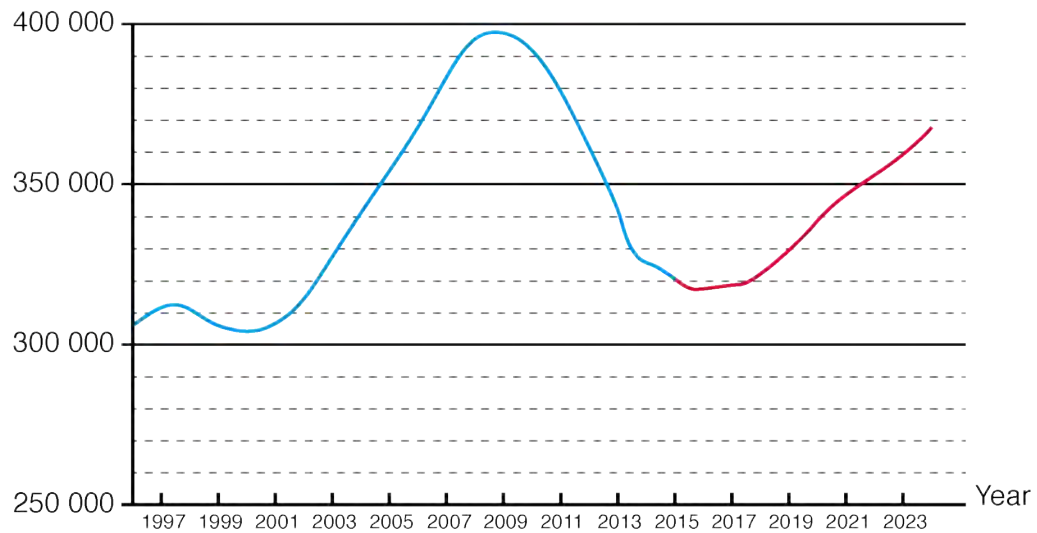
$$t = 100 - \frac{h}{300}$$

where  $t$  is the water's boiling point in degrees Celsius and  $h$  is the height above sea level measured in metres.

- a) At what temperature will water boil at the top of Mt. Kilimanjaro?  
*Only answer required.* (1/0/0)
- b) At what height above sea level is Johan when he boils his tea water? (1/1/0)

19. The diagram shows the number of students in upper-secondary school between 1996 and 2015 (blue line) and a forecast for the years 2016–2024 (red line).

Number of students



Source: The Swedish National Agency for Education

- a) In what year, according to the forecast, is the number of students expected to be equal to that of 2013? *Only answer required.* (1/0/0)
- b) What was the percentage increase in the number of students between 2003 and 2007? (1/1/0)
- c) Assume that the number of students continues to increase according to the forecast between 2019 and 2023. When would the number of students reach 400 000? (0/2/0)

20. Albin is laying a new floor in his apartment and is choosing between two different floors.

Floor A: SEK 345/m<sup>2</sup>

Floor B: SEK 395/m<sup>2</sup>

For floor B there is a SEK 4 000 discount on the total price if you buy 50 m<sup>2</sup> or more.

- a) How much would floor A and floor B each cost if Albin buys 20 m<sup>2</sup>? (1/0/0)
- b) Write a formula for how much floor A costs depending on the number of square metres of floor you buy. (1/0/0)
- c) At what floor area are the floors' costs equal? (0/1/1)

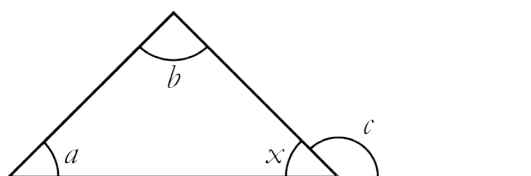
21. Oskar wins SEK  $x$  in a competition.

Ahmed wins 40 % more than Oskar.

Stina wins 20 % less than Oskar.

How many percent bigger is Ahmed's prize compared to Stina's? (1/1/1)

22. Erik, Carina and Sara have been asked to prove the exterior angle theorem.



Exterior angle theorem  $c = a + b$

What solution or solutions are valid proofs and what solution or solutions are not? Motivate.

| CARINA   | ERIK                 | SARA                  |                       |                        |                        |            |            |             |            |            |            |            |             |            |            |            |            |            |             |             |   |   |
|--|----------------------|-----------------------|-----------------------|------------------------|------------------------|------------|------------|-------------|------------|------------|------------|------------|-------------|------------|------------|------------|------------|------------|-------------|-------------|---|---|
| <table><tr><th><math>\frac{a}{10^\circ}</math></th><th><math>\frac{b}{10^\circ}</math></th><th><math>\frac{x}{160^\circ}</math></th><th><math>\frac{c}{20^\circ}</math></th><th><math>\frac{a+b}{20^\circ}</math></th></tr><tr><td><math>10^\circ</math></td><td><math>20^\circ</math></td><td><math>150^\circ</math></td><td><math>30^\circ</math></td><td><math>30^\circ</math></td></tr><tr><td><math>40^\circ</math></td><td><math>40^\circ</math></td><td><math>100^\circ</math></td><td><math>80^\circ</math></td><td><math>80^\circ</math></td></tr><tr><td><math>70^\circ</math></td><td><math>40^\circ</math></td><td><math>70^\circ</math></td><td><math>110^\circ</math></td><td><math>110^\circ</math></td></tr></table> <p style="text-align: center;">↑ ↗</p> <p>C is always as big as a+b</p> <p>Q.E.D.</p> | $\frac{a}{10^\circ}$ | $\frac{b}{10^\circ}$  | $\frac{x}{160^\circ}$ | $\frac{c}{20^\circ}$   | $\frac{a+b}{20^\circ}$ | $10^\circ$ | $20^\circ$ | $150^\circ$ | $30^\circ$ | $30^\circ$ | $40^\circ$ | $40^\circ$ | $100^\circ$ | $80^\circ$ | $80^\circ$ | $70^\circ$ | $40^\circ$ | $70^\circ$ | $110^\circ$ | $110^\circ$ | <p>If a is <math>30^\circ</math><br/>b is <math>60^\circ</math><br/>then <math>x = 180 - 90 = 90^\circ</math><br/>and then is c also <math>90^\circ</math><br/>Now I can see that<br/><math>a + b = c</math><br/>Q.E.D.</p> | <p>THE ANGLE SUM GIVES:<br/><math>a + b + x = 180^\circ</math></p> <p>THE STRAIGHT ANGLE GIVES:<br/><math>x + c = 180^\circ</math><br/><math>a + b + x = x + c</math><br/><math>a + b = c</math> Q.E.D.</p> |
| $\frac{a}{10^\circ}$   | $\frac{b}{10^\circ}$ | $\frac{x}{160^\circ}$ | $\frac{c}{20^\circ}$  | $\frac{a+b}{20^\circ}$ |                        |            |            |             |            |            |            |            |             |            |            |            |            |            |             |             |   |   |
| $10^\circ$   | $20^\circ$           | $150^\circ$           | $30^\circ$            | $30^\circ$             |                        |            |            |             |            |            |            |            |             |            |            |            |            |            |             |             |   |   |
| $40^\circ$   | $40^\circ$           | $100^\circ$           | $80^\circ$            | $80^\circ$             |                        |            |            |             |            |            |            |            |             |            |            |            |            |            |             |             |   |   |
| $70^\circ$   | $40^\circ$           | $70^\circ$            | $110^\circ$           | $110^\circ$            |                        |            |            |             |            |            |            |            |             |            |            |            |            |            |             |             |   |   |

(0/2/0)

23. The music class in a school is having a concert. Adult tickets cost SEK 100 and child tickets cost SEK 50. The pupils devise a formula for the ticket revenue of sold tickets, SEK  $I$ , that depends on the number of adult tickets sold  $x$ .

$$I = 100x + 50(650 - x)$$

How many child tickets were sold if the revenue was SEK 52 500?

(1/1/1)

24. The Social Democrats received 33.4 % of all votes in an opinion poll. This was an increase of 1.7 percentage points compared to the previous poll. The Moderates increased by 1.2 percentage points to 23.6 %. Kalle claims that the increases are equally large. How can Kalle have been reasoning?

(1/1/1)

25. The picture shows a sketch of a sculpture that will be placed in a park. The length of the horizontal sticks is reduced by 20 % for each step and the distance between the sticks is 25 cm. The first stick is 2.0 metres long.



The sketch is not drawn to scale

- a) How long is the 6<sup>th</sup> stick? (0/2/0)
  - b) Investigate how high the sculpture would be if the last stick cannot be shorter than 15 cm. (0/1/2)
26. The population in a city district is increasing. The time it takes the population to double depends on the average percentage increase per year. A rule of thumb is that the doubling time is equal to 70 divided by the percentage increase per year in percent.
- a) Write the rule of thumb as a formula describing how the doubling time  $T$  years, depends on  $p$ , which is the percentage increase per year in percent. (0/1/0)
  - b) Use the rule of thumb to calculate the percentage increase per year required for the population to double in 14 years. (0/2/0)
  - c) Use another method than the rule of thumb and find a more exact value for the percentage increase per year required for the population to double in 14 years. Give your answer to two decimal places. (0/0/2)

