

<b>Part B</b>	Problems 1–10 which only require answers.
<b>Part C</b>	Problems 11–17 which require complete solutions.
<b>Test time</b>	120 minutes for part B and part C together.
<b>Resources</b>	Formula sheet and ruler.

The test consists of three written parts (part B, part C and part D). Together they give a total of 57 points consisting of 21 E-, 20 C- and 16 A-points.

Level requirements for test grades

E: 13 points

D: 22 points of which 6 points on at least C-level

C: 29 points of which 11 points on at least C-level

B: 37 points of which 5 points on A-level

A: 44 points of which 8 points on A-level

The number of points you can get for a complete solution is stated after each problem. You can also see what knowledge levels (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 answer is 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.

**Write your name, date of birth and educational programme on all the sheets you hand in.**

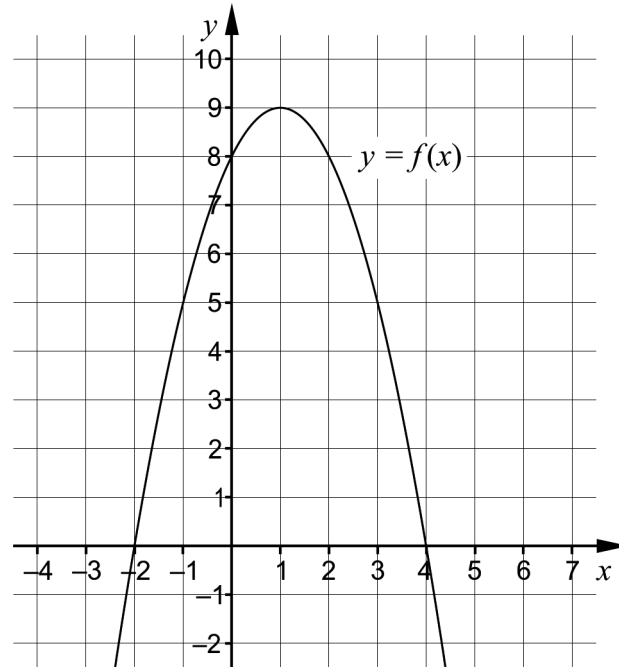
Name: \_\_\_\_\_

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

Educational programme: \_\_\_\_\_

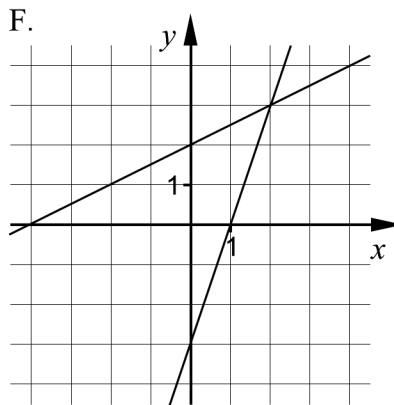
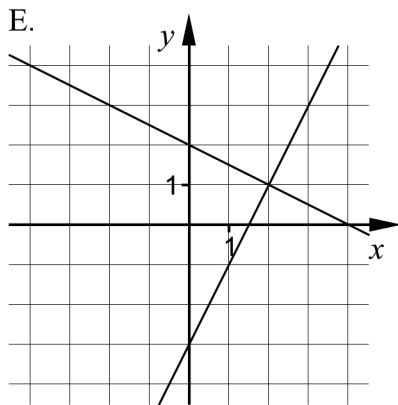
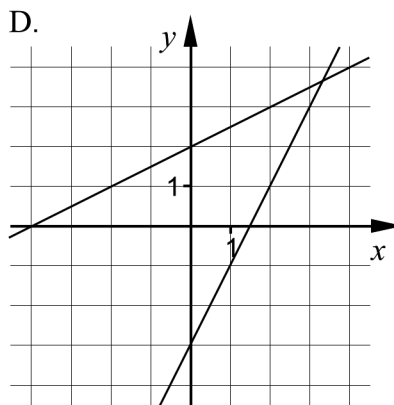
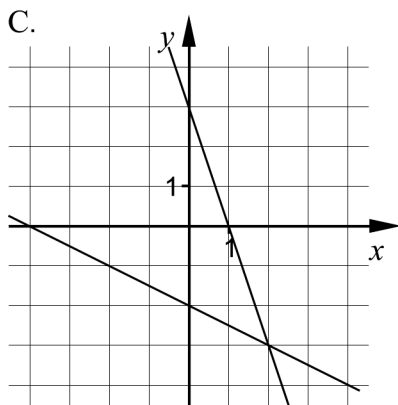
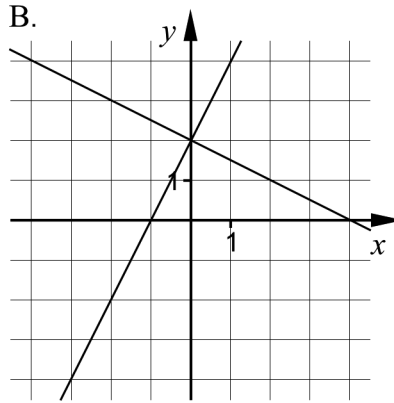
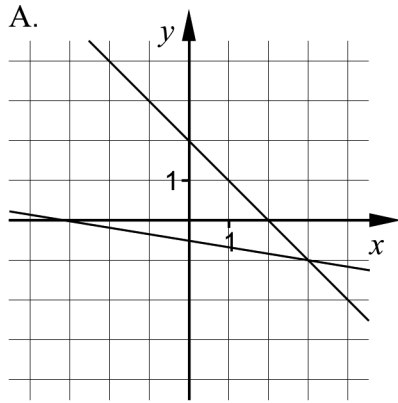
**Part B:** Digital resources are not allowed. *Only answer is required.* Write your answers in the test booklet.

1. The figure shows the graph of the quadratic function  $f$ .



- a) Determine the zeros of the function. \_\_\_\_\_ (1/0/0)
- b) Determine the maximum value of the function. \_\_\_\_\_ (1/0/0)

2. The coordinate systems A–F show graphical representations of systems of linear equations.



a) One of the coordinate systems A–F shows the system of equations

$$\begin{cases} y = -\frac{1}{2}x + 2 \\ y = 2x - 3 \end{cases}$$

Which one?

\_\_\_\_\_ (1/0/0)

b) Mark the solution of the system of equations  $\begin{cases} y = -\frac{1}{2}x + 2 \\ y = 2x - 3 \end{cases}$

in the chosen coordinate system.

(1/0/0)

3. Simplify the expressions as far as possible.

a)  $(y+3)^2 + y^2 - 9$  \_\_\_\_\_ (1/0/0)

b)  $(3b-2)^2 - (b+4)$  \_\_\_\_\_ (0/1/0)

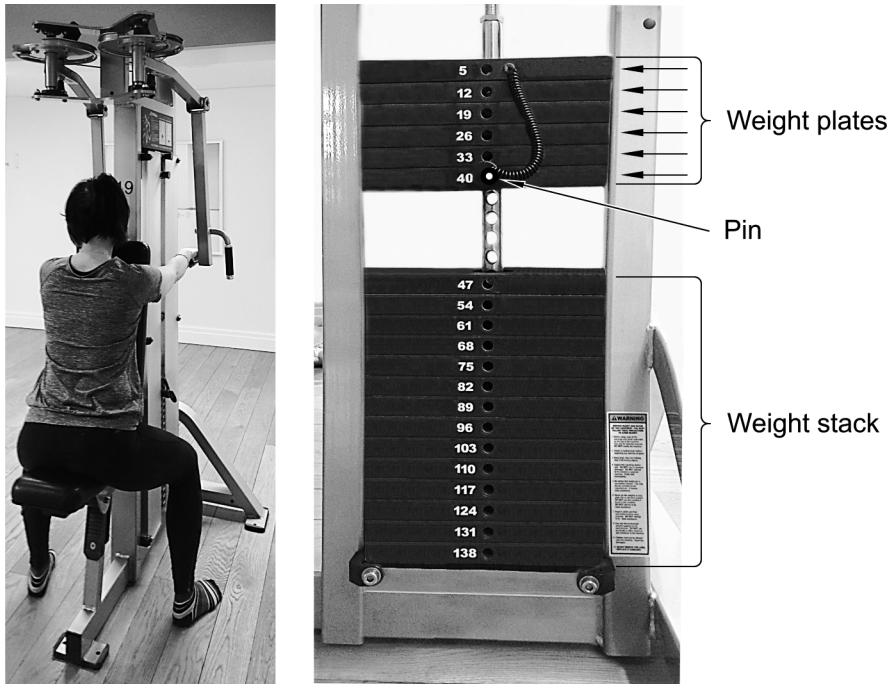
4. Solve the equations and give an exact answer.

a)  $5^x = 20$  \_\_\_\_\_ (1/0/0)

b)  $x^{\frac{1}{5}} = 10$  \_\_\_\_\_ (1/0/0)

c)  $3^{2x} = 2 \cdot 3^x$  \_\_\_\_\_ (0/1/0)

5. Lena works out in a gym and uses a machine to exercise her back. By inserting a pin in a weight plate in the weight stack of the machine, she can choose which total weight she wants to use. See pictures.



The smallest weight the machine can be set to is 5 kg and the weight plate is then marked 5. After this, the weight plates are marked 12, 19, 26, ..., 138 according to the table.

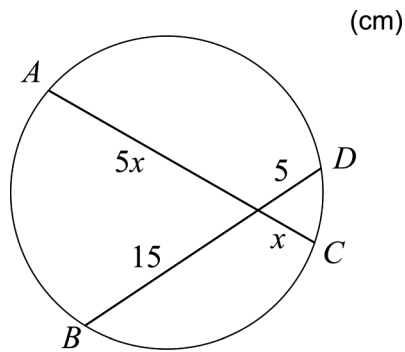
Number of weights	Total weight in kg
1	5
2	12
3	19
4	26
...	...
20	138

Let  $y$  be the total weight in kg that Lena uses and let  $x$  be the number of weight plates she chooses in the weight stack.

Write down a function describing how the total weight,  $y$  kg, depends on the number of chosen weight plates  $x$ .

\_\_\_\_\_ (0/1/0)

6. The figure shows a circle with two chords  $AC$  and  $BD$  passing through a common point, with the lengths of the segments given.



Calculate the length of the chord  $AC$ . Give an exact answer.

\_\_\_\_\_ (0/1/0)

7. Two of the alternatives A–F give a solution to the equation  $x^2 + 3 = 0$   
Which two?

A.  $x = -\sqrt{3}$

B.  $x = i\sqrt{3}$

C.  $x = 3\sqrt{i}$

D.  $x = -i\sqrt{3}$

E.  $x = -3\sqrt{i}$

F.  $x = \sqrt{3}$

\_\_\_\_\_ (0/1/0)

8. Calculate the value of the expression  $4444^2 - 4443^2$

Hint: Can be solved using the conjugate rule.

\_\_\_\_\_ (0/1/0)

9. To check that all cinnamon rolls baked at a bakery have approximately the same weight, the cinnamon rolls are weighed. It turns out that the weight is normally distributed, with mean weight 80 g.



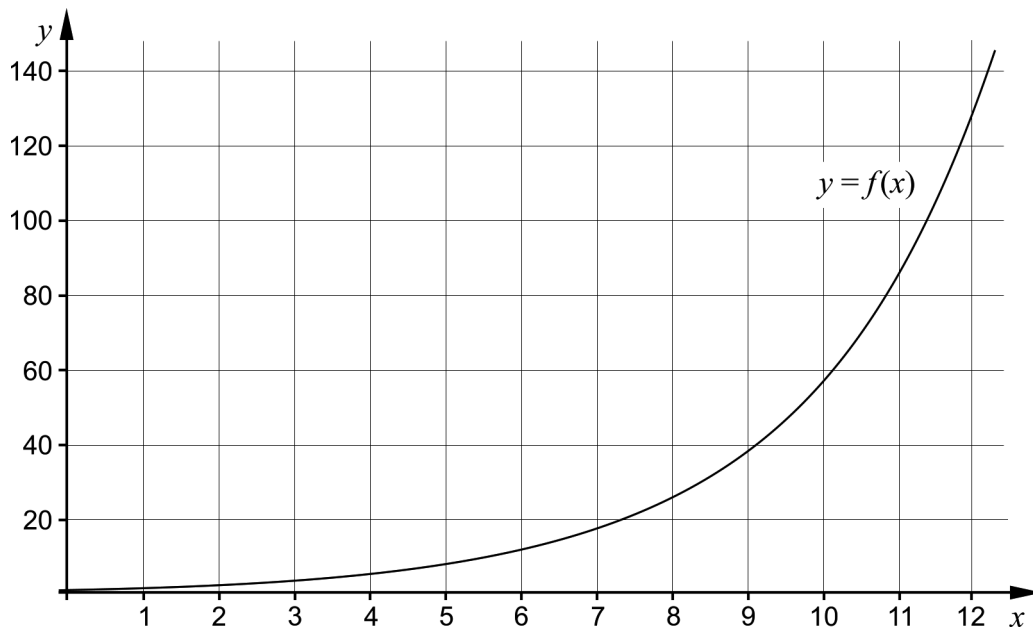
Of all the cinnamon rolls, 81.8% are expected to weigh between 77 and 86 g.

- a) Write down the standard deviation. \_\_\_\_\_ (0/1/0)

As a rule, the bakery doesn't sell the cinnamon rolls that deviate two standard deviations or more from the mean weight 80 g.

- b) Write down the weights,  $v$  gram, of the cinnamon rolls that the bakery doesn't sell. \_\_\_\_\_ (0/0/2)

10. The figure shows the graph of an exponential function  $f$ .

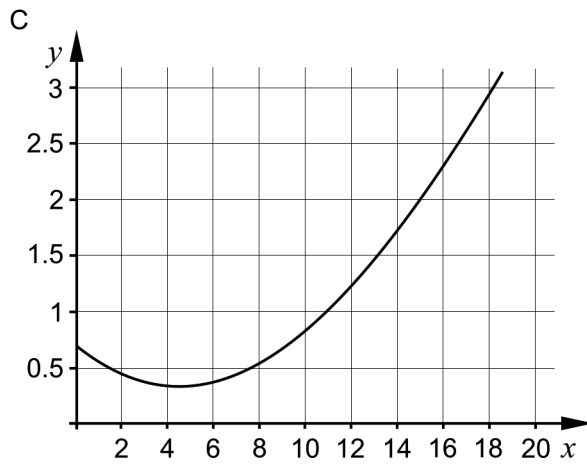
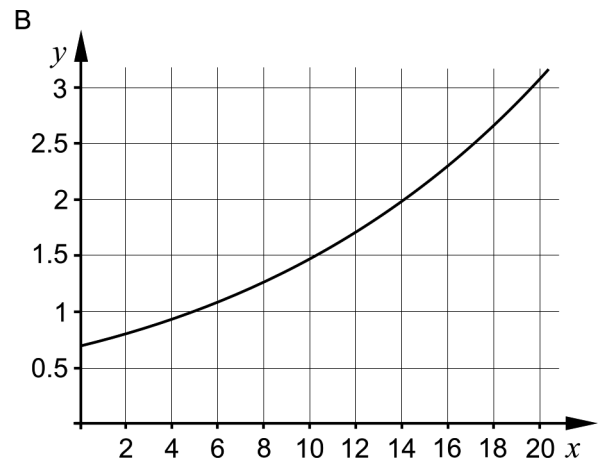
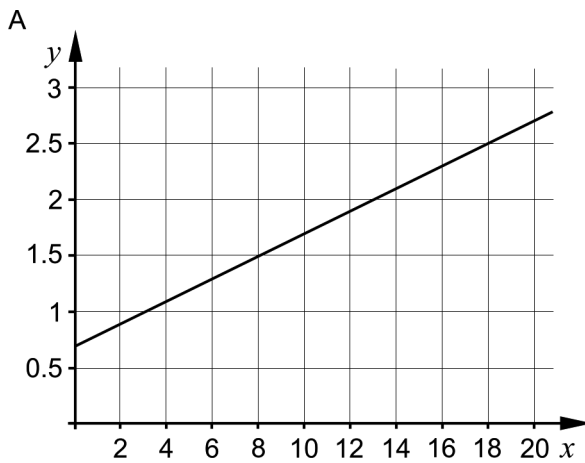


- Use the graph to determine  $x$  when  $\lg f(x) = 2$  \_\_\_\_\_ (0/0/1)

**Part C:** Digital resources are not allowed. Write down your solutions on separate sheets of paper.

11. A cooperative apartment was bought in January in the year 2000 for 700 000 SEK and sold in January in the year 2016 for 2.3 million SEK.

The graphs A, B and C show three different possible models for the value change for the cooperative apartment where  $y$  is the value of the cooperative apartment in millions of SEK and  $x$  is the time in years from January in the year 2000.



- a) One of the graphs shows that the yearly change in percent of the value of the cooperative apartment has been the same between the years 2000 and 2016. State which of the graphs this is, and justify your answer. (1/0/0)
- b) Assume that the change in value continues with the same yearly change in percent after the year 2016. Use the graph to determine how much the cooperative apartment would be worth in January in the year 2018. (1/0/0)

*Only answer is required* (1/0/0)

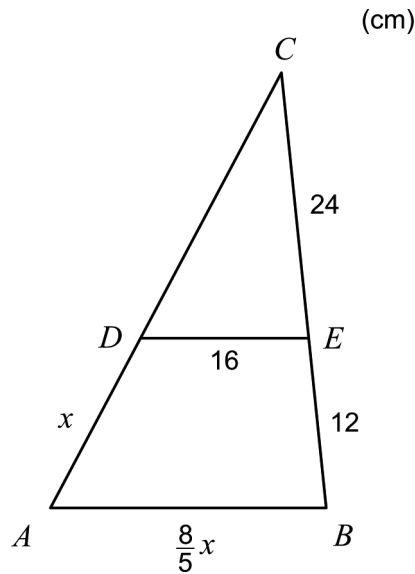
12. The figure shows the initial steps of three algebraic solutions of the equation  $x^2 + 4x - 5 = 0$

Method A:	$x^2 + 4x - 5 = 0$ $x = -\frac{4}{2} \pm \sqrt{\left(\frac{4}{2}\right)^2 - (-5)}$
Method B:	$x^2 + 4x - 5 = 0$ $x = -\frac{4}{2 \cdot 1} \pm \frac{\sqrt{4^2 - 4 \cdot 1 \cdot (-5)}}{2 \cdot 1}$
Method C:	$x^2 + 4x - 5 = 0$ $(x+2)^2 - 4 - 5 = 0$

- a) Choose one of the methods A, B or C and explain briefly what has been done in the initial steps of the solution. (1/0/0)
- b) Continue solving the equation  $x^2 + 4x - 5 = 0$  according to the chosen algebraic method. (1/0/0)
13. The graph of a quadratic function  $f$  has one of its zeros in  $x = 3$  and its maximum in the point  $(0, 18)$ .

For the quadratic function  $f$  it holds that  $f(x) = Ax^2 + Bx + C$ . Determine the function  $f$ . (1/2/0)

14. In the triangle  $ABC$ , the line segment  $DE$  is parallel to the side  $AB$ . See figure.

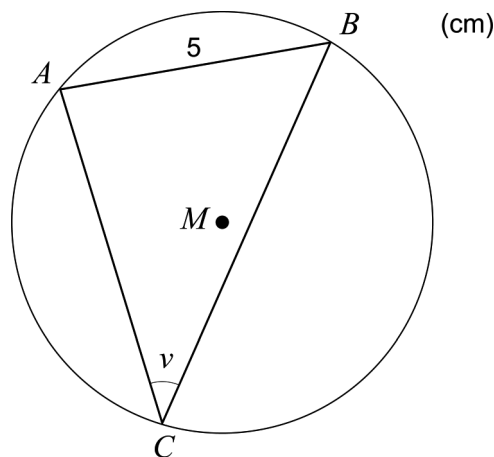


Calculate the length of the line segment  $AD$ . (0/3/0)

15. Assume that  $a, b$  and  $c$  are three consecutive integers, where  $a < b < c$ .

Investigate whether the expression  $\frac{a^2 + b^2 + c^2 - 2}{3}$  is always an integer for all such consecutive integers  $a, b$  and  $c$ . (0/0/3)

16. In a circle with diameter 10 cm and centre  $M$ , a triangle  $ABC$  is inscribed so that all the vertices of the triangle lie on the perimeter of the circle.



Calculate the angle  $v$ . (0/0/2)

17. Solve the equation  $\frac{2^{n-4} \cdot \sqrt{2^{n+1}}}{\sqrt{2^{-2n-2}}} = 2^{15}$

(0/0/2)