

|                  |  |
|------------------|--|
| <b>Part B</b>    | Problems 1–9 which only require answers.         |
| <b>Part C</b>    | Problems 10–15 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 55 points consisting of 23 E-, 19 C- and 13 A-points.

Level requirements for test grades

E: 14 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 4 points on A-level

A: 43 points of which 6 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.**

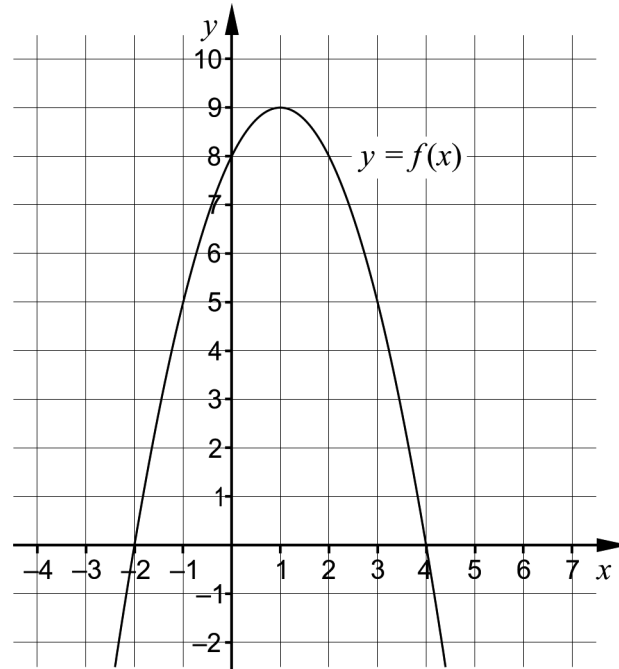
Name: \_\_\_\_\_

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  $f$ .

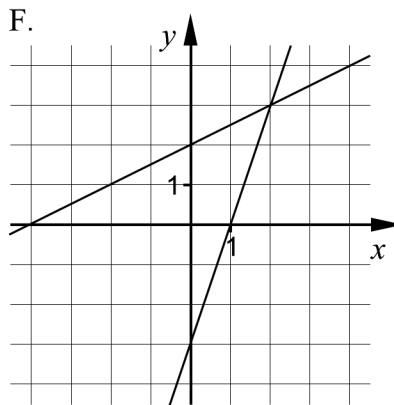
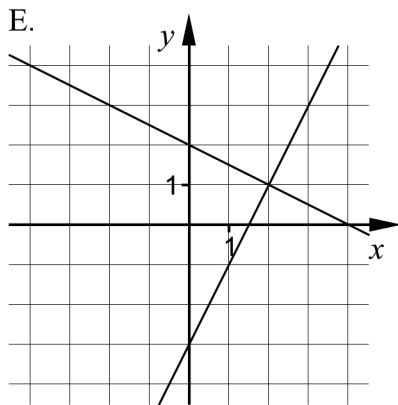
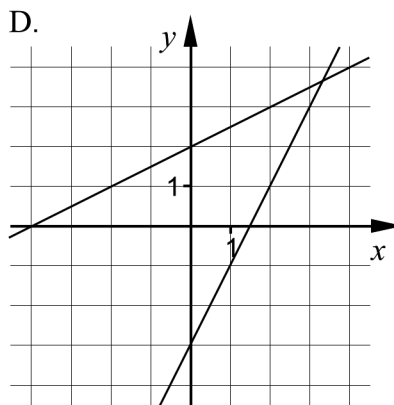
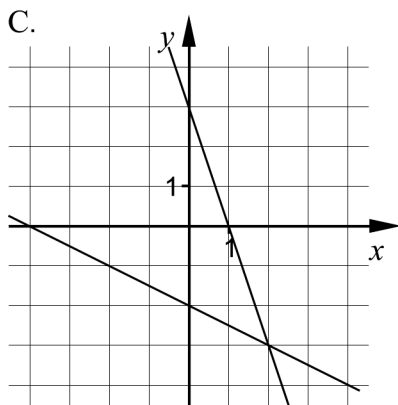
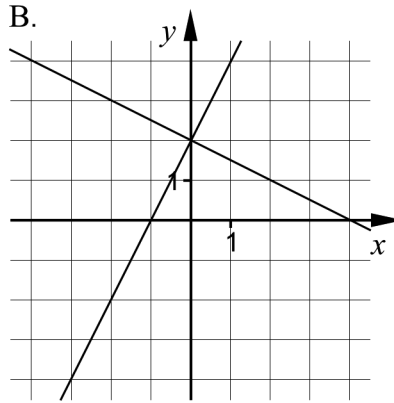
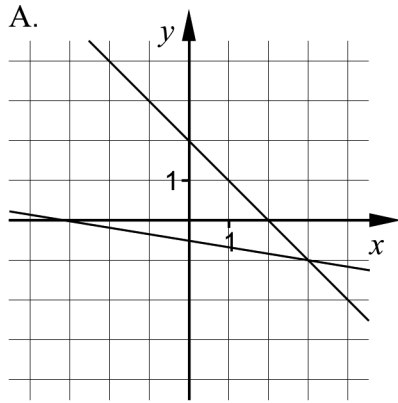


- a) Determine the zeros of the function. \_\_\_\_\_ (1/0/0)
- b) Determine the maximum value of the function. \_\_\_\_\_ (1/0/0)

2. Solve the equations and give an exact answer.

- a)  $x^7 = 21$  \_\_\_\_\_ (1/0/0)
- b)  $x^{\frac{1}{5}} = 10$  \_\_\_\_\_ (1/0/0)

3. 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.

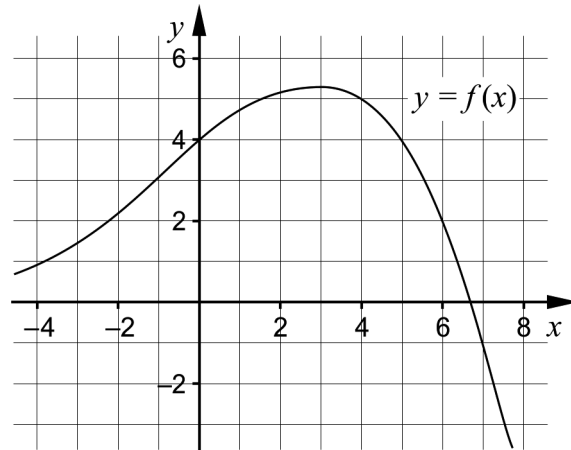
(1/0/0)

4. Fill out the empty brackets so that the equalities hold.

a)  $(7x + 3y)(\quad) = 49x^2 + 42xy + 9y^2$  (0/1/0)

b)  $(\quad)(\quad) = 25 - 4y^2$  (0/1/0)

5. The figure shows the graph of the function  $f$ .

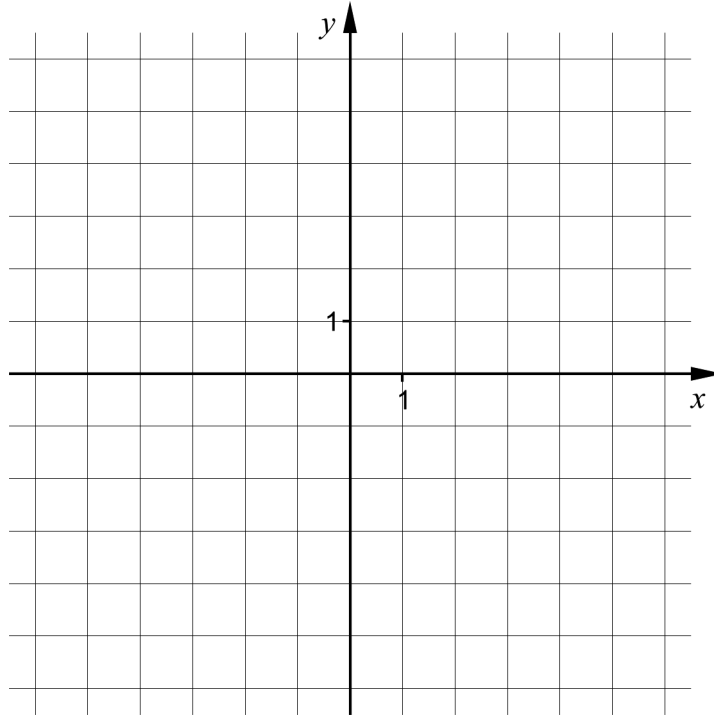


Use the graph to determine  $a$  if  $f(a) = -1$  \_\_\_\_\_ (0/1/0)

6. For a quadratic function  $f$ , where  $y = f(x)$ , it holds that

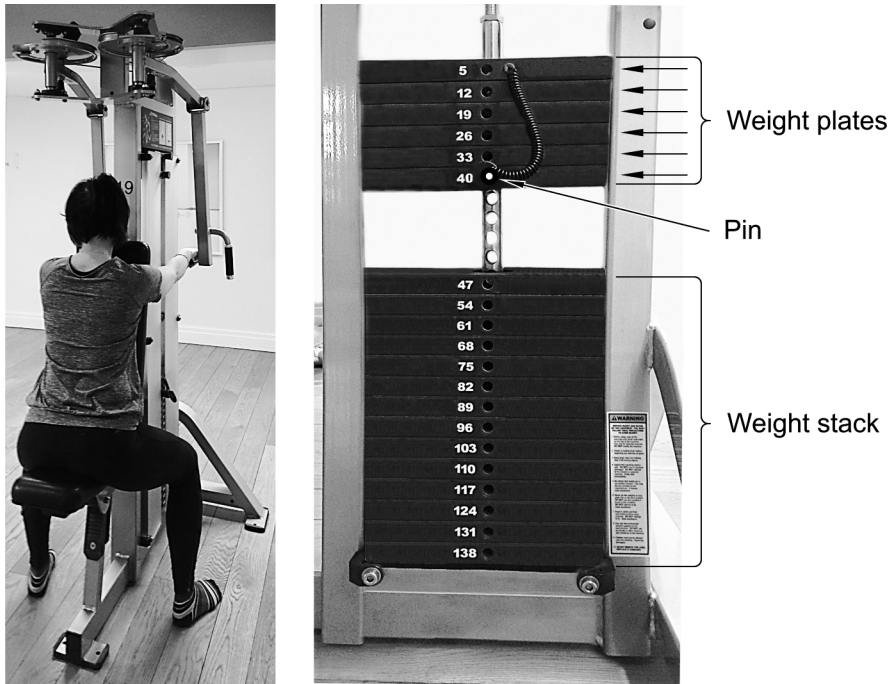
- $f(x) \leq 0$  for all  $x$
- $f(2) = 0$

Sketch an example of what the graph of the quadratic function  $f$  could look like in the coordinate system.



(0/2/0)

7. 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  $x$ .

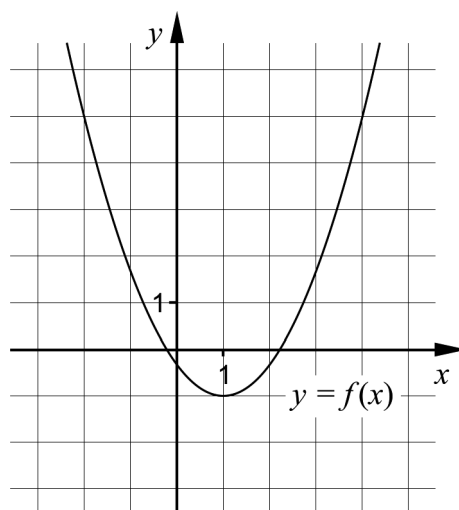
\_\_\_\_\_ (0/1/0)

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

Hint: Can be solved using the conjugate rule.

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

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



- a) Determine a quadratic function  $g$  whose graph does not intersect the graph of the function  $f$  at any point.

$g(x) =$  \_\_\_\_\_ (0/0/1)

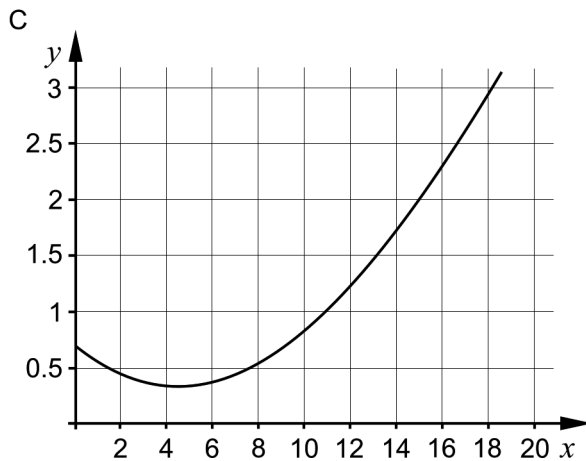
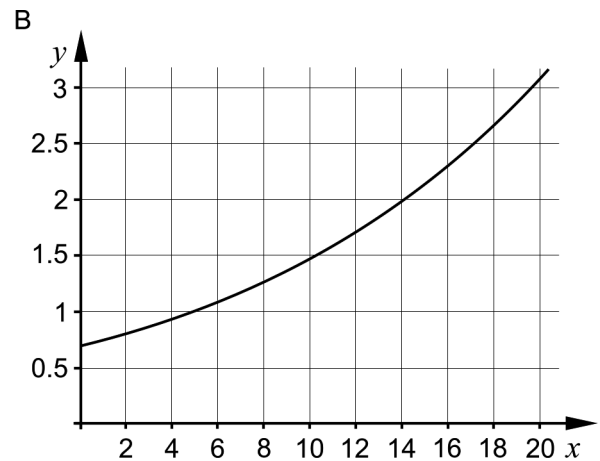
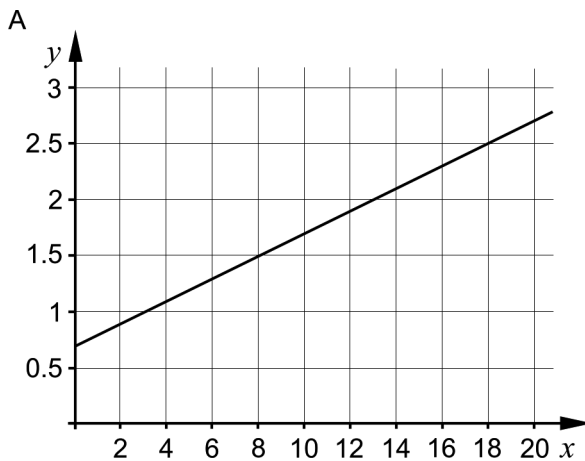
- b) State the range of the quadratic function  $g$ .

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

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

10. 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)

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

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

- 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)
12. Two statements are given below.
- Statement 1: All sides in a quadrilateral  $ABCD$  have the same length.  
Statement 2: The quadrilateral  $ABCD$  is a square.
- Explain why it is not correct to use the equivalence symbol  $\Leftrightarrow$  between statement 1 and statement 2. (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. 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)

15. Solve the equation  $\frac{2^{n-4} \cdot \sqrt{2^{n+1}}}{\sqrt{2^{-2n-2}}} = 2^{15}$  (0/0/2)