Part B	Problems 1-7 which only require answers.
Part C	Problems 8-15 which require complete solutions.
Test time	120 minutes for Part B and Part C together.
Resources	Formula sheet and ruler.

Level requirements

The test consists of three written parts (Part B, Part C and Part D). Together they give a total of 58 points consisting of 20 E-, 20 C- and 18 A-points.

Level requirements for test grades
E: 13 points
D: 21 points of which 6 points on at least C-level
C: 28 points of which 11 points on at least C-level
B: 37 points of which 6 points on A-level
A: 44 points of which 10 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.

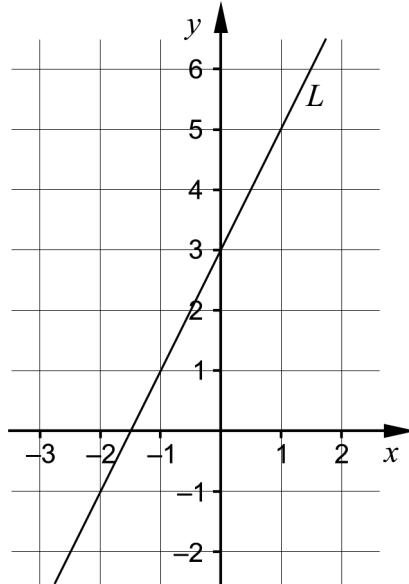**Write your name, date of birth and educational programme on all the sheets you hand in.**

Name: _____

Date of birth: _____

Educational programme: _____

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

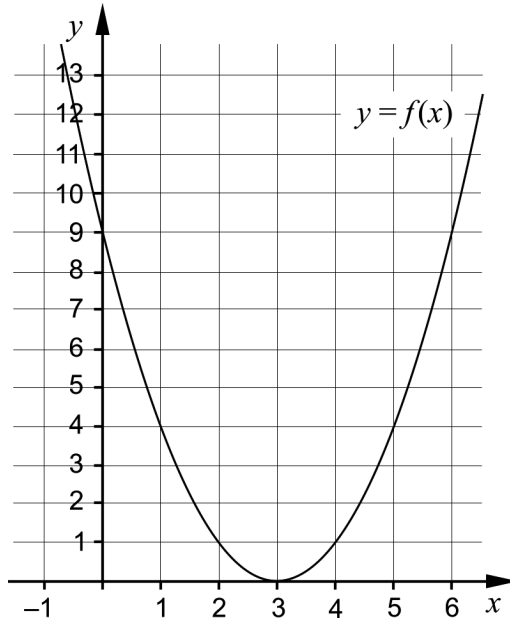1. A straight line L is drawn in the coordinate system.

a) Write down the equation of the line L in the form $y = kx + m$.

    _____ (1/0/0)

b) Write down the equation of another straight line that is parallel to the line L.

    _____ (1/0/0)

2. The figure shows the graph of the function f where $f(x) = ax^2 + bx + c$.

a) Use the graph to determine the constant c. _____ (1/0/0)

Zoltán uses the graph to solve an equation in the form $f(x) = K$ and gets the correct solutions $x_1 = 1$ and $x_2 = 5$

b) Determine the constant K. _____ (1/0/0)

3. Simplify the expressions as far as possible.

a) $(5+x)^2 - x^2$ _____ (1/0/0)

b) $\dfrac{x^{0.5} \cdot x^{\frac{1}{2}} + 2x}{3}$ _____ (1/0/0)

c) $\sqrt[3]{3^6} \cdot x - 3x$ _____ (0/1/0)

4. Factorise $25x^2 - 16y^2$ as far as possible. _____ (0/1/0)

5. Two of the equations A – F have $x = i\sqrt{3}$ as one solution. Which two?
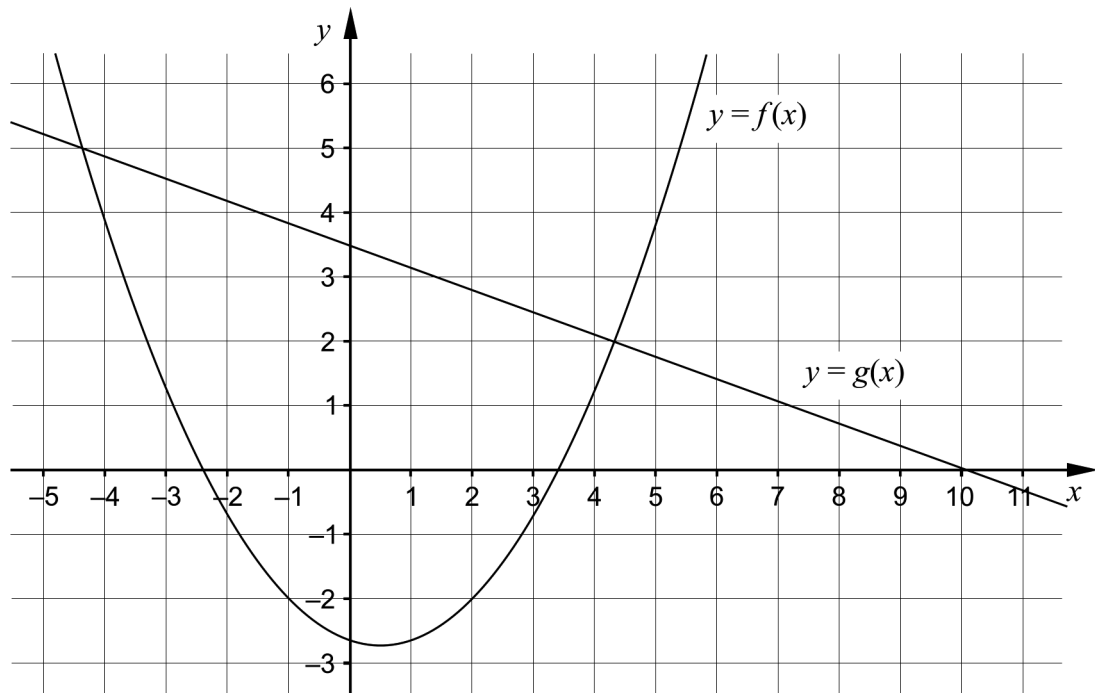
A. $x^2 = -9$

B. $x^2 + 3 = 0$

C. $x^2 = 3$

D. $x(x + \sqrt{3}) = 0$

E. $x^3 = -3x$

F. $(x + 3)(x - 3) = 3$ _____ (0/1/0)

6. The figure shows the graph of a quadratic function f and a straight line g.

Use the figure to solve the problems:

a) For what values of x does it hold that $f(x) < -2$?

_____ (0/2/0)

b) For what values of x does it hold that both $f(x) > 0$ and $g(x) > 0$?

_____ (0/0/1)

7.

a) Solve the equation and give an exact answer.

$$10^{3x+3} = 9$$

_____ (0/1/0)

b) Which of the intervals A – F contains the solution to the equation
$10^{3x+3} = 9$?

A. $-1.5 \le x < -1$

B. $-1 \le x < -0.5$

C. $-0.5 \le x < 0$

D. $0 \le x < 0.5$

E. $0.5 \le x < 1$

F. $1 \le x < 1.5$

_____ (0/0/1)

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

8. Solve the equation $x^2 + 4x - 5 = 0$ algebraically. (2/0/0)

9. The graph of a quadratic function has its maximum point at the point $P(0, 4)$.

Determine whether the graph of the quadratic function can pass through the point $Q(-2, 6)$. Justify your answer. (1/0/0)

10. A company manufactures screws. According to the label on the box, the length of the screws should be 54.0 mm. The length is normally distributed with a mean value of 54.0 mm and a standard deviation of 0.20 mm.

Determine how many per cent of the screws that can be expected to be shorter than 53.6 mm. (2/0/0)

11. It holds for a function f that $f(x) = 2x^2 + 12x + a$

Determine for what values of the constant a the equation $f(x) = 0$ has two different real roots. (0/2/0)

12. Solve the simultaneous equations algebraically.

a) $\begin{cases} 2x - 5y = 22 \\ x + 5y = -4 \end{cases}$ (2/0/0)

b) $\begin{cases} (10^x)^2 \cdot 10^y = 10^{10} \\ (10^y)^x = 10^{12} \end{cases}$ (0/0/3)

13. Juhani is going to make jewellery from metal wire and silver sheet shaped as a rectangle and a square.

Juhani decides that the length of the rectangle should be three times the width. He denotes the width of the rectangle x cm. Juhani will then cover the whole piece of jewellery with silver sheet, see figure.
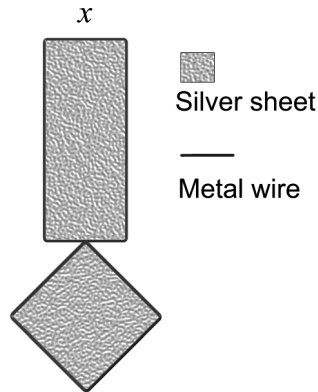
For each piece of jewellery, Juhani will use a wire with a length of 28 cm which should suffice for the circumference for both the rectangle and the square. Since silver sheets are expensive he wants the area of each piece of jewellery A cm^2 to be as small as possible.

a) Write down the area A cm^2 of the silver sheet used for one piece of jewellery, as a function of the width of the rectangle x cm. (0/1/1)

b) Explain why the domain of the area function is $0 < x < \dfrac{7}{2}$. (0/1/1)

c) Determine the width of the rectangle x so that the area A is as small as possible. (0/0/2)

14. Solve the equation $\lg(\lg(8-x)) = 0$ (0/0/2)

15. From two quadratic functions f and g a new function h is formed according to $h(x) = f(x) - 3 \cdot g(x)$. Determine what conditions must always be fulfilled in order for h to also be a quadratic function. Justify your answer. (0/0/2)