Part B	Problems 1-8 which only require answers.
Part C	Problems 9-15 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 62 points consisting of 24 E-, 22 C- and 16 A-points.

Level requirements for test grades
E: 14 points
D: 24 points of which 7 points on at least C-level
C: 32 points of which 12 points on at least C-level
B: 42 points of which 5 points on A-level
A: 50 points of which 9 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 thought and, where necessary, draw figures.

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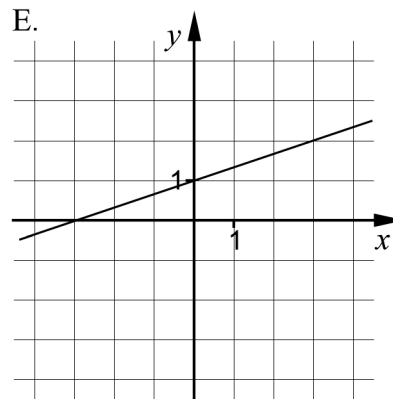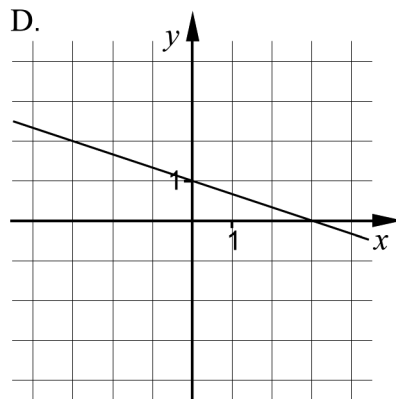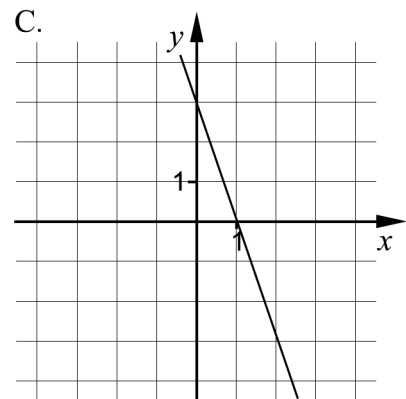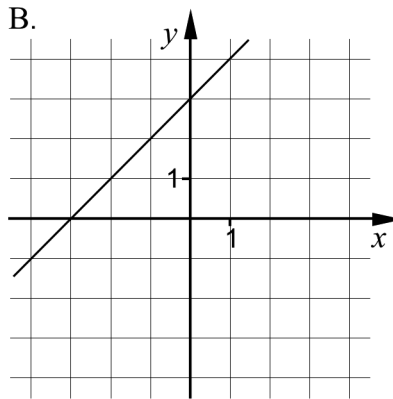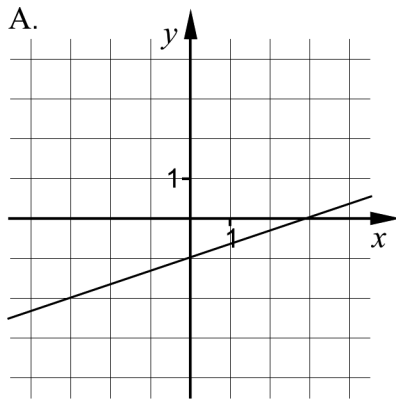
Name: _____

Date of birth: _____

Educational programme: _____

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

1. Which of the figures A-E below shows the graph of

    a) $y = x + 3$ _____ (1/0/0)

    b) $y = -\dfrac{1}{3}x + 1$ _____ (1/0/0)
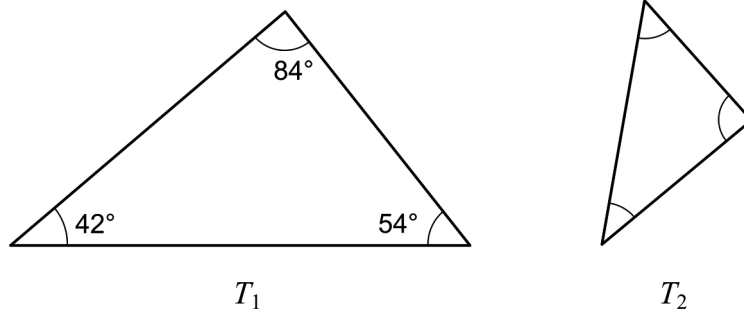
A.

B.

C.

D.

E.

2. Solve the equations and give exact answers.

    a) $x^5 = 10$ _____ (1/0/0)

    b) $3^x = 12$ _____ (1/0/0)

3. The triangles T_1 and T_2 are similar.

T_1 T_2

What is the size of the smallest angle in triangle T_2?

_____ (1/0/0)

4. It holds for a quadratic function $y = f(x)$ that

- the function has zeroes $x = -3$ and $x = 7$
- the largest value of the function is 10

a) What are the coordinates of the maximum point of the function?

_____ (1/0/0)

b) The same function $y = f(x)$ also passes through the point $(-8, -30)$.

Write down the coordinates for yet another point through which the function passes. This point should not be the maximum point or a zero.

_____ (0/1/0)

5. The weight of a certain brand of jam sugar is normally distributed with an average weight of 1000 g and a standard deviation of 10 g. Peder buys one such pack of jam sugar.

Assume that the weight of the pack Peder bought is x grams. Which of the options A-F below is/are correct?

The probability is 84% that:

A. $x \geq 1010$

B. $x \leq 1010$

C. $x \geq 990$

D. $x \leq 990$

E. $990 \leq x \leq 1010$

F. $1000 \leq x \leq 1020$

_____ (0/2/0)

6. It holds for the function f that $f(x) = 2x - a$

For what values of a does it hold that $(f(1))^2 = 4$? _____ (0/2/0)

7. Solve the equations

a) $x^2 - i^2 = -3$ _____ (0/1/0)

b) $\sqrt[3]{x \cdot \sqrt{x}} = 8$ _____ (0/0/1)

c) $\lg 5 + 2 \lg x = \lg 80$ _____ (0/0/1)

8. The value of $\lg 2$ is approximately 0.301
Determine a value of $\lg 8$ to three decimal places. _____ (0/0/1)

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

9. It holds for the functions f and g that $f(x) = 6 + 6x$ and $g(x) = (x-3)^2$

Simplify the expression $f(x) + g(x)$ as far as possible. (2/0/0)

10. Solve the equations algebraically.

a) $x^2 - 6x - 16 = 0$ (2/0/0)

b) $\sqrt{2x+3} = x$ (0/3/0)

11. An association wants to order T-shirts with its logo printed on the pocket. The dimensions of the pocket can be seen in figure 1. Figure 2 shows a picture of the association's logo.
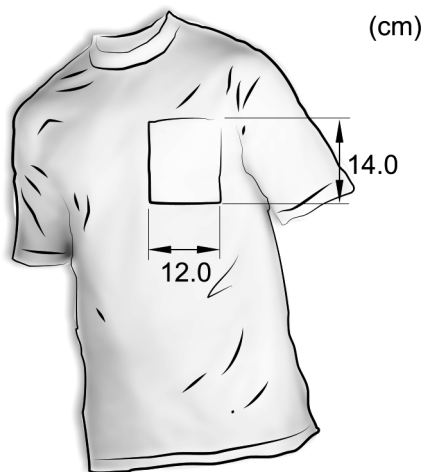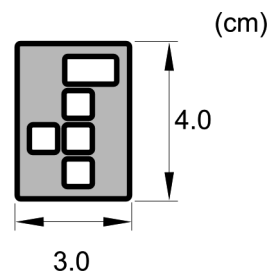

Figure 1   Figure 2

The association wants the logo printed on the pocket to be as large as possible. Relationship between the logo's height and width should remain unchanged.

Determine what dimensions the logo should have. (2/0/0)

12. The figure below shows a straight line that passes through the point $P(3, 4)$. The line intersects the positive y-axis at a point A. The distance between the origin and point A is equal to the distance between the origin and point P.
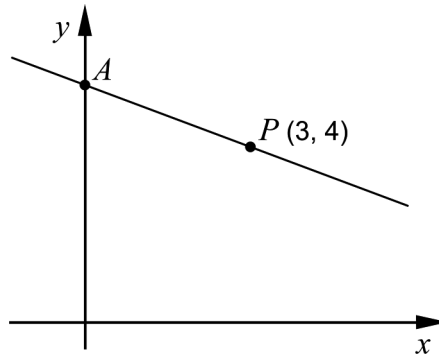
Find the equation of the straight line that passes through points A and P.   (0/3/0)

13. It holds for the function f that $f(x) = x^2$

Simplify the expression $\dfrac{f(a+h) - f(a)}{h}$ as far as possible.   (0/2/0)

14. A and B are constants in the simultaneous equations below.

$$\begin{cases} 15x - 6 = -By \\ Ax - 3y = 4 \end{cases}$$

Determine the constants A and B so that there are an infinite number of solutions to the simultaneous equations.   (0/0/2)

15. Archimedes is regarded as one of the greatest mathematicians of all time and he lived two thousand years ago. In an Arabic collection of Thabit ibn Currah there are geometric theorems which very likely have been proven by Archimedes. The figures below illustrate one such mathematical theorem.
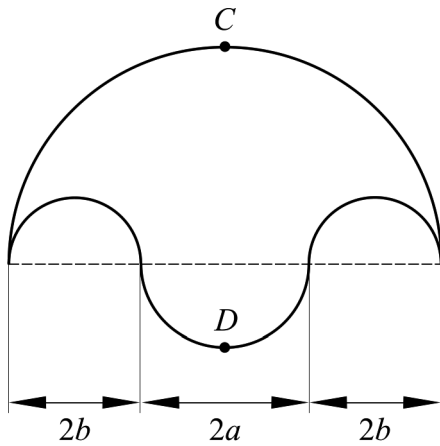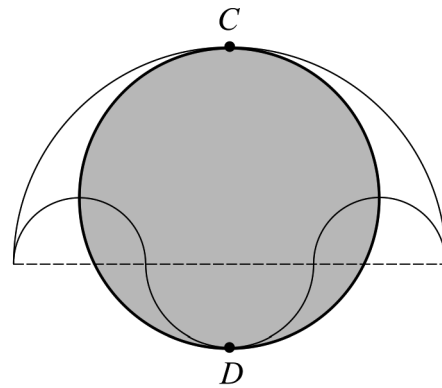

Figure 1   Figure 2

Figure 1 shows a region bounded by four semi-circles. The grey circle in figure 2 has the diameter *CD*.

Show that the area of the grey circle in figure 2 has the same size as the area in figure 1. (0/0/4)