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-, 23 C- and 15 A-points.

Level requirements for test grades
E: 14 points
D: 24 points of which 7 points on at least C-level
C: 33 points of which 13 points on at least C-level
B: 43 points of which 5 points on A-level
A: 51 points of which 8 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: __________________________________

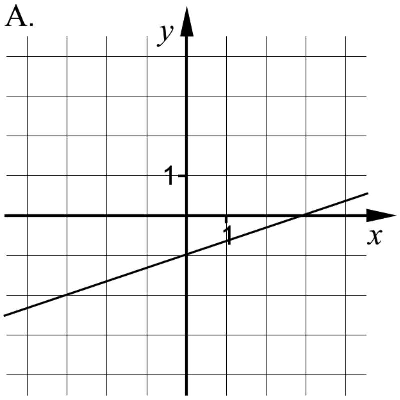
Part B: Digital resources are not allowed. *Only answer is required*. Write your answers in the test booklet.

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

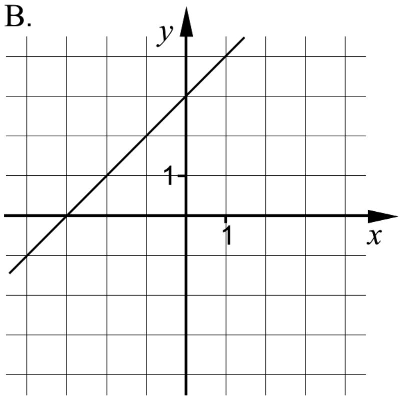
a) $y = x + 3$ ____________________ (1/0/0)

b) $y = -\frac{1}{3}x + 1$ ____________________ (1/0/0)

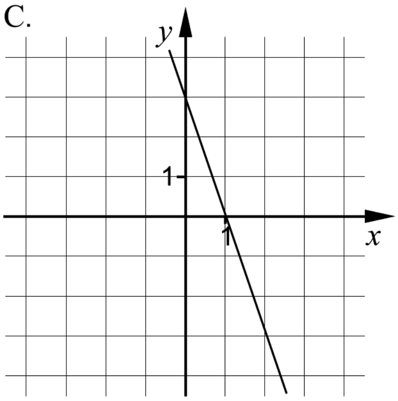
A.



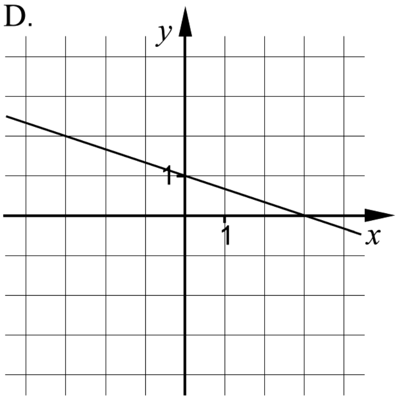
B.



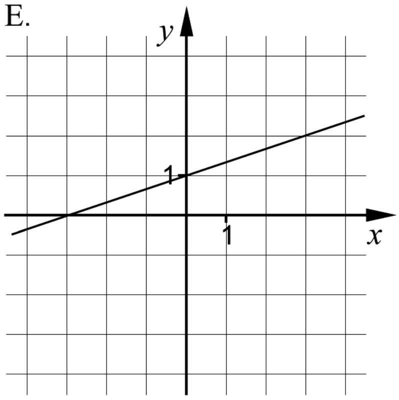
C.



D.



E.

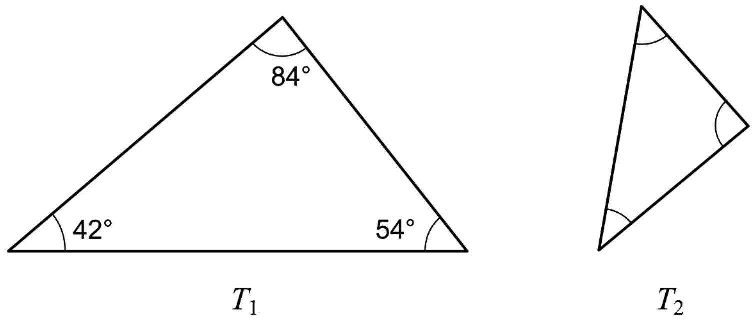


2. Solve the equations and give exact answers.

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

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

3. The triangles T_1 and T_2 are similar.



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) $a^{\frac{1}{3}} \cdot a^{\frac{2}{3}} = a^3 \cdot a^x$ _______________________ (0/1/0)

b) $x^2 - \mathrm{i}^2 = -3$ _______________________ (0/1/0)

c) $4^x + 4^x + 4^x + 4^x = 2^{12}$ _______________________ (0/0/1)

8. Find an exact value of x^3 if $\lg x^{\frac{3}{5}} = 2$ _______________________ (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) $x(x + 3) = x + 3$ (0/2/0)

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.

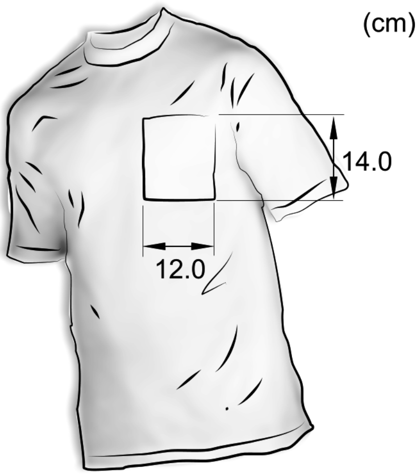


Figure 1

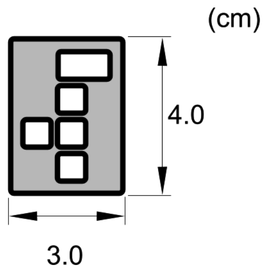
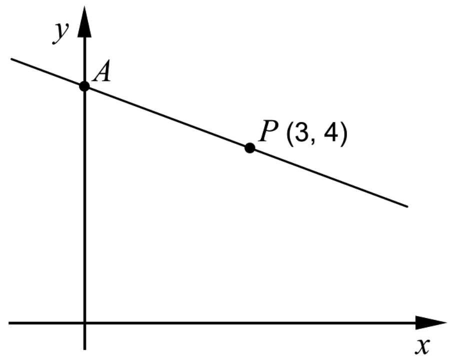


Figure 2

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.

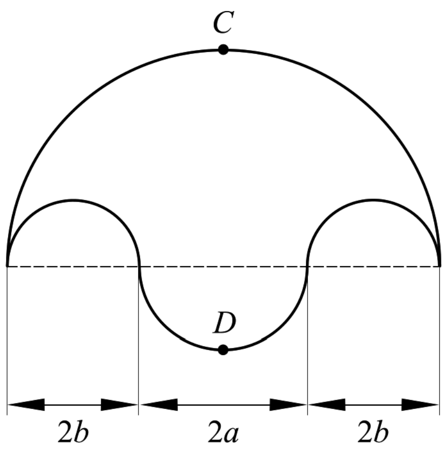


Figure 1

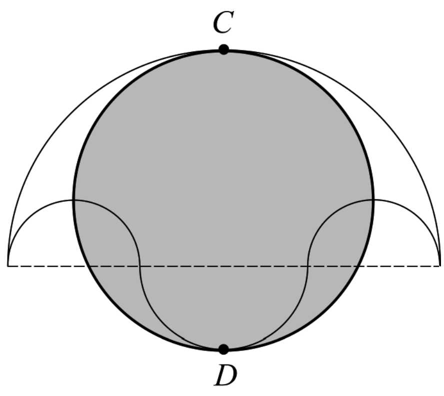


Figure 2

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)

Part D	Problems 16-24 which require complete solutions.
Test time	120 minutes.
Resources	Digital resources, formula sheet and ruler.

Level requirements

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

Name: ______________________________

Date of birth: ______________________________

Educational programme: ______________________________

Part D: Digital resources are allowed. Do your solutions on separate sheets of paper.

16. Linnea is going to solve the following mathematical problem:

> At a football match the spectators consisted of 7 times as many men as women. The total number of spectators was 2936.
> How many men and women respectively were there?

Linnea writes down the following correct simultaneous equations to solve the problem:

$$\begin{cases} x = 7y \\ x + y = 2936 \end{cases}$$

a) What does x represent in Linnea's simultaneous equations? (1/0/0)

b) Solve Linnea's simultaneous equations and specify how many men and women respectively there were among the spectators. (2/0/0)

17. Benjamin has noticed that the volume of toiletries is given both in millilitres (ml) and in the American unit fluid ounces (fl oz).

Benjamin reads on a bottle of after shave and a bottle of shampoo and makes a table of values, see below.

	x (fl oz)	y (ml)
After shave	3.4	100
Shampoo	8.4	250

Benjamin claims that he can use the table of values and find a relation between the two volume units. He plots the values as two points in a coordinate system, and draws a line through them.

a) Use the values in the table and determine the equation of Benjamin's line. Give your answer exactly in the form $y = kx + m$. (2/0/0)

b) Use the equation in problem a) and calculate how many millilitres should be printed on a bottle of volume 4.0 fluid ounces. (1/0/0)

c) There is an inconsistency in Benjamin's relation. Give an example of a volume x fluid ounces where Benjamin's relation does not work. Justify. (0/1/0)

18. The table below shows random samples for two different statistical materials.

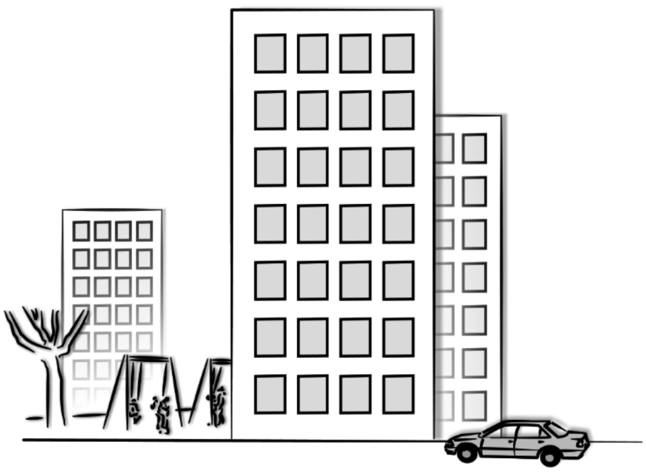
Random sample A	2	4	13	22	24
Random sample B	2	12	13	14	24

The mean and the median are 13, both for random sample A and random sample B.

a) Calculate the range and the standard deviation for the random samples A and B respectively. (2/0/0)

b) Explain the possible differences between the random samples A and B by using the different statistical measures. (1/0/0)

19. A cooperative flat was bought in June 2000 for SEK 850 000. In June 2011, it was sold at a price of SEK 1.6 million.



Assume that the yearly percentage increase has been of the same size during the whole period of time. Calculate the yearly percentage increase in value for the cooperative flat. (0/2/0)

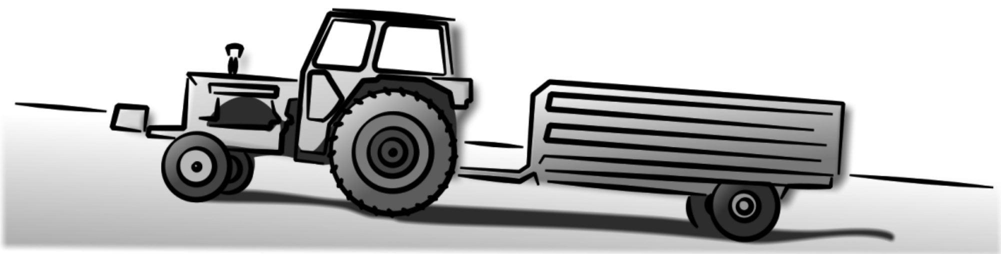
20. It holds for a straight line that:

- the gradient $k > 0$
- the line passes through the point $P(3, 5)$

a) Investigate whether the line can pass through the point (6, 4). (1/0/0)

b) There are a number of points Q such that a line through P and Q has a positive gradient. Investigate what values the coordinates of Q, x and y, should have in order to satisfy the above conditions. (1/1/1)

21. The fuel consumption of a tractor depends, among other things, on the speed of the tractor.



Under certain conditions, the fuel consumption of a tractor can be described by the model

$B(v) = 0.0010v^2 - 0.040v + 0.92 \qquad v > 0$

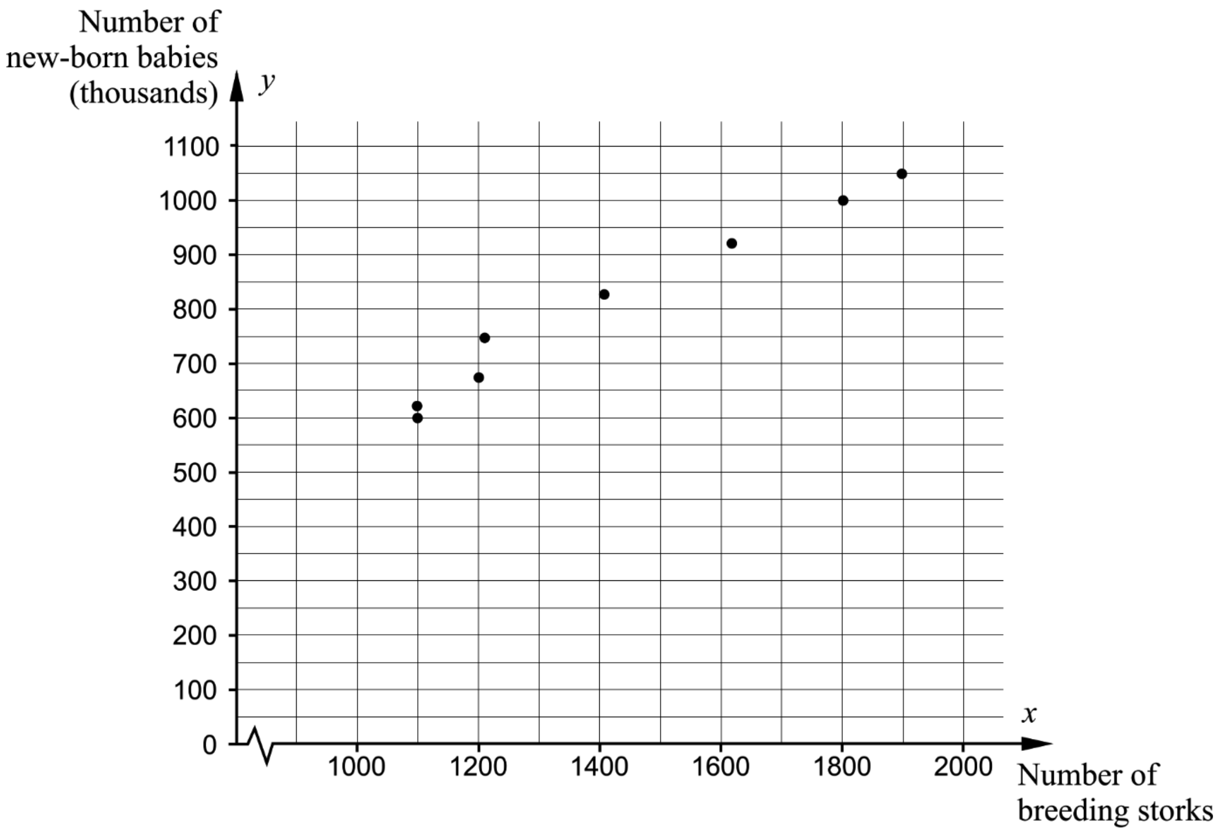
where B (litres/km) is the fuel consumption and v (km/h) is the speed of the tractor.

a) Calculate the fuel consumption of the tractor at a speed of 10 km/h. (1/0/0)

b) Determine the lowest fuel consumption the tractor can have according to this model. (0/2/0)

22. The table and diagram below show the number of breeding storks and the number of new-born babies in West Germany between the years 1965 and 1978.

Year	Number of breeding storks	Number of new-born babies (thousands)
1965	1900	1050
1966	1800	1000
1968	1610	920
1970	1405	825
1972	1208	750
1974	1200	675
1976	1100	620
1978	1100	600

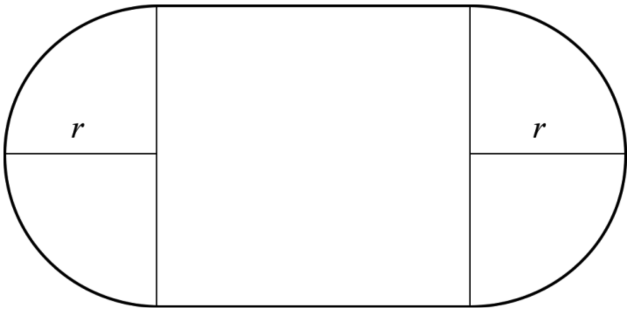


a) Find a linear relation between the number of new-born babies in thousands, y, and the number of breeding storks, x. (0/2/0)

b) The correlation between x and y is 0.99. Simon comes to the conclusion that there is a strong causality between the number of new-born babies in thousands and the number of breeding storks in West Germany.

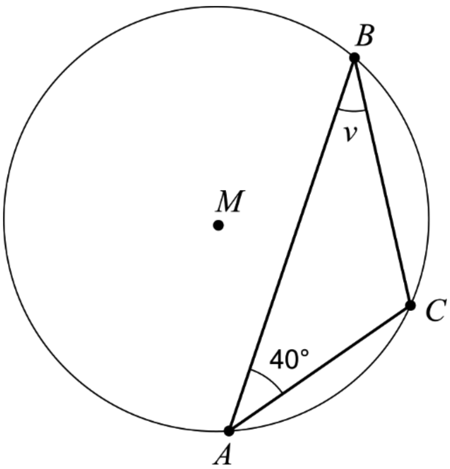
Is Simon right? Justify your answer. (0/1/0)

23. The figures below show a racecourse. The course where the horses run has a length of 800 m. The area bounded by the racecourse has the shape of one rectangle and two semi-circles and has an area of 43 000 m^2.



Determine the radius r of the semi-circles. (0/0/4)

24. The triangle ABC is inscribed in a circle with centre M. The distance AC has the same length as the radius of the circle. The angle $BAC = 40°$, see figure.



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