NATIONAL TEST IN MATHEMATICS COURSE B
AUTUMN 2012

Directions

Test time	240 minutes for Part I and Part II together. **We recommend that you spend no more than 60 minutes on Part I.**
Resources	**Part I:** ”Formulas for the National Test in Mathematics Course B”. *Please note that calculators are not allowed in this part.* **Part II:** Calculators, also symbolic calculators and ”Formulas for the National Test in Mathematics Course B”.
Test material	The test material should be handed in together with your solutions. Write your name, the name of your education programme/adult education on all sheets of paper you hand in. *Solutions to Part I should be handed in before you retrieve your calculator. You should therefore present your work on Part I on a separate sheet of paper. Please note that you may start your work on Part II without a calculator.*
The test	The test consists of a total of 18 problems. **Part I** consists of 9 problems and **Part II** consists of 9 problems. For some problems (where it says *Only answer is required*) it is enough to give short answers. For the other problems short answers are not enough. They require that you write down what you do, that you explain your train of thought, that you, when necessary, draw figures. When you solve problems graphically/numerically please indicate how you have used your resources. Problem 18 is a larger problem which may take up to an hour to solve completely. It is important that you try to solve this problem. A description of what your teacher will consider when evaluating your work is attached to the problem. Try all of the problems. It can be relatively easy, even towards the end of the test, to receive some points for partial solutions. A positive evaluation can be given even for unfinished solutions.
Score and mark levels	The maximum score is 45 points. The maximum number of points you can receive for each solution is indicated after each problem. If a problem can give 2 ”Pass”-points and 1 ”Pass with distinction”-point this is written (2/1). Some problems are marked with ¤, which means that they more than other problems offer opportunities to show knowledge that can be related to the criteria for ”Pass with Special Distinction”.

Lower limit for the mark on the test

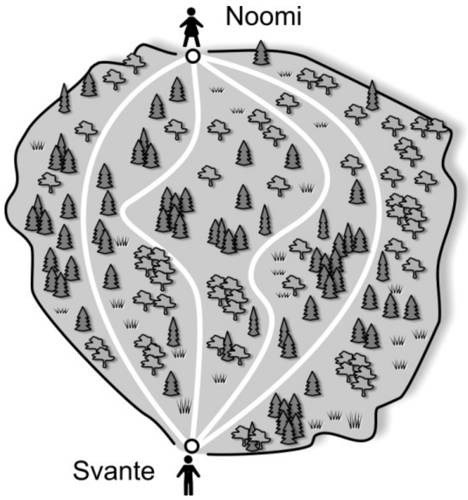
Pass:	12 points.
Pass with distinction:	25 points of which at least 7 ”Pass with distinction”-points.
Pass with special distinction:	25 points of which at least 15 ”Pass with distinction”-points. You also have to show most of the ”Pass with special distinction” qualities that the ¤-problems give the opportunity to show.

Part I

This part consists of 9 problems that should be solved without the aid of a calculator. Your solutions to the problems in this part should be presented on separate sheets of paper that must be handed in before you retrieve your calculator. Please note that you may begin working on Part II without the aid of a calculator.

1. Solve the equation $x^2 - 2x - 24 = 0$ (2/0)

2. Noomi and Svante are standing on opposite sides of a forest region that they are about to cross. There are four different paths through the forest region. They both choose paths at random, without knowing which path the other one chooses. They start at the same time and walk at approximately the same pace.



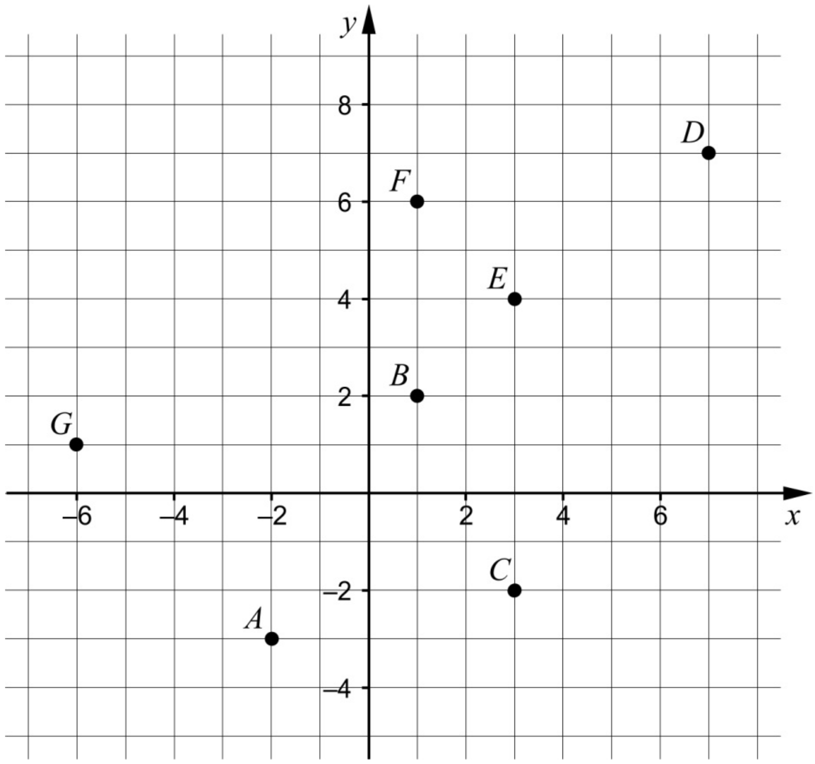
What is the probability that Noomi and Svante do *not* meet?

Only answer is required (1/0)

3. Let $f(x) = x^2 + 5x$

Calculate $f(4) - f(2)$ (1/0)

4.



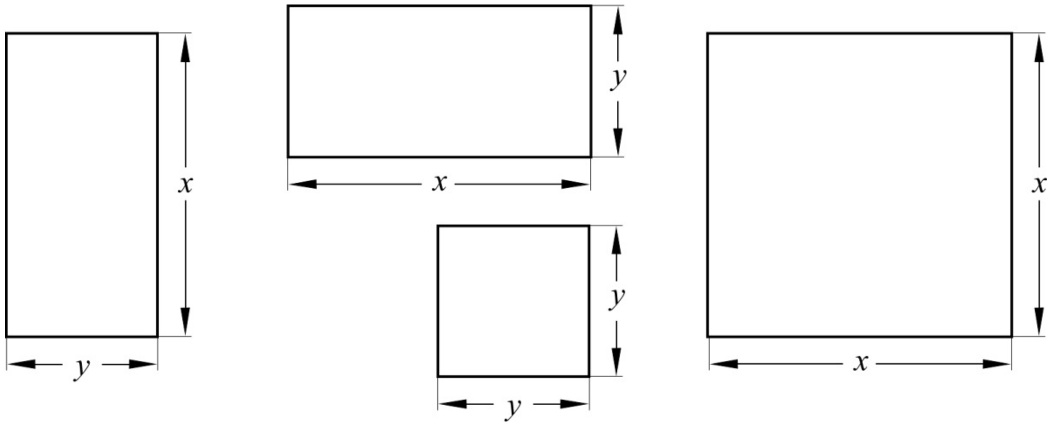
a) Two of the points *A*-*G* lie on the graph of $y = 3x + 3$
Which ones? *Only answer is required* (1/0)

b) A straight line passes through the point *B* and intersects the *y*-axis at the point $(0, 4)$
Determine the equation of the line in the form $y = kx + m$
Only answer is required (1/0)

5. Solve the inequality $4x + 15 < 10 - x$ (1/0)

6. Simplify $(x+3)^2 - 3(4+x)$ as far as possible. (2/0)

7. The figures show squares and rectangles with side lengths *x* and *y*.



a) Determine an expression for the total area of the four figures.
Simplify the expression as far as possible. (1/0)

Another square has an area equal to the total area of the four figures.

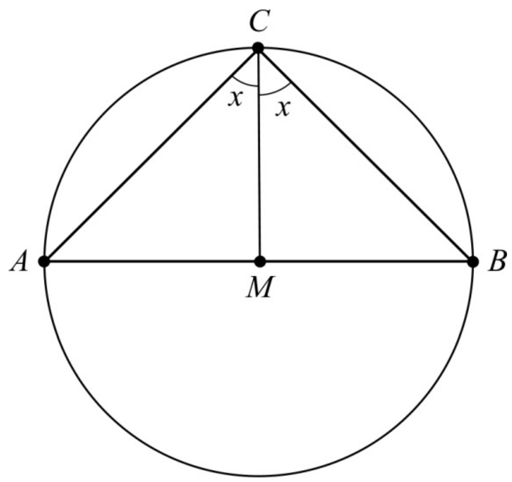
b) Find a simplified expression for the side length of this square. (0/1)

8. It holds for a linear system of equations that:

- One of the equations is $2x + 3y = 23$
- The second equation contains both *x* and *y*
- There is only one solution to the linear system of equations
- It holds that $x = 4$ for the solution

Give an example of what the second equation might look like and write down the solution to the linear system of equations. (0/2)

9. The figure shows a triangle *ABC* that is inscribed in a circle. The side *AB* passes through the centre of the circle *M*. The angles *ACM* and *BCM* are of equal size.



Show that the distance *CM* is perpendicular to the distance *AB*. (0/2/¤)

Part II

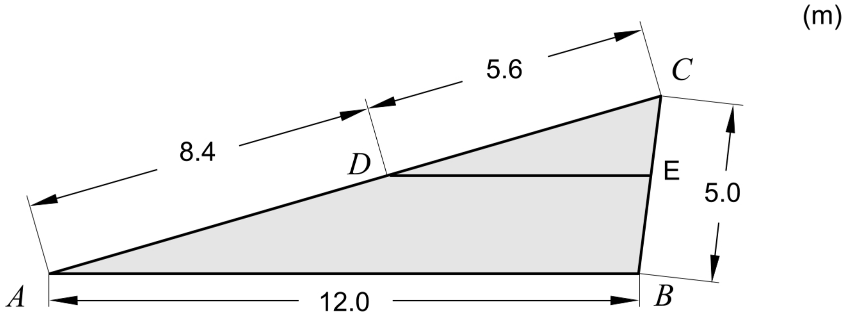
This part consists of 9 problems and you may use a calculator when solving them.
Please note that you may begin working on Part II without a calculator.

10. Elsa takes out a box of ice cream bars from the freezer. The box contains four ice cream bars with vanilla flavour and six ice cream bars with strawberry flavour. Elsa randomly picks one ice cream bar from the box. Hugo then also randomly picks one ice cream bar from the box.

a) What is the probability that Elsa picks an ice cream bar with vanilla flavour? (1/0)

b) What is the probability that Elsa and Hugo pick ice cream bars with the same flavour? (1/1)

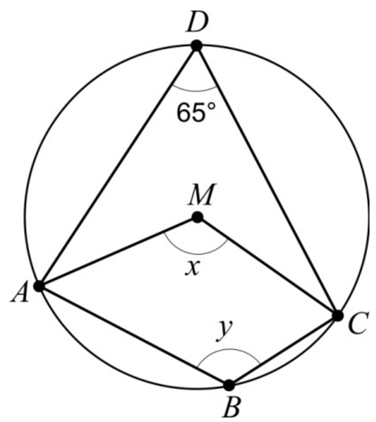
11. The figure shows the triangle *ABC* where the distance *DE* is parallel to the distance *AB*.



a) Calculate the length of the distance *DE*. (2/0)

b) Calculate the length of the distance *BE*. (0/2)

12. The quadrangle *ABCD* is inscribed in a circle with centre *M*.



a) Find the angle *x*. *Only answer is required* (1/0)

b) Find the angle *y*. *Only answer is required* (0/1)

13. The committee of the association Freja are planning on investing in a new HiFi system. Since the HiFi system is expensive, they sent an email to the 520 members. The email was finished with the question:

”Do you think the association should buy the HiFi system?”

The email answers were compiled:

Yes: 65
No: 115

a) What was the nonresponse rate in percentage? (1/0)

The committee decided to investigate the nonresponse rate. They called 60 randomly chosen members of the nonresponse group and asked the question again.

The phone answers were compiled:

Yes: 38
No: 22

At the next committee meeting, the secretary and the treasurer discussed the result:

Treasurer:

”I have compiled all the answers we have received via email and phone.

Number of Yes: 65+38=103
Number of No: 115+22=137

A larger number of people have answered no which means we cannot buy the HiFi system.”

Secretary:

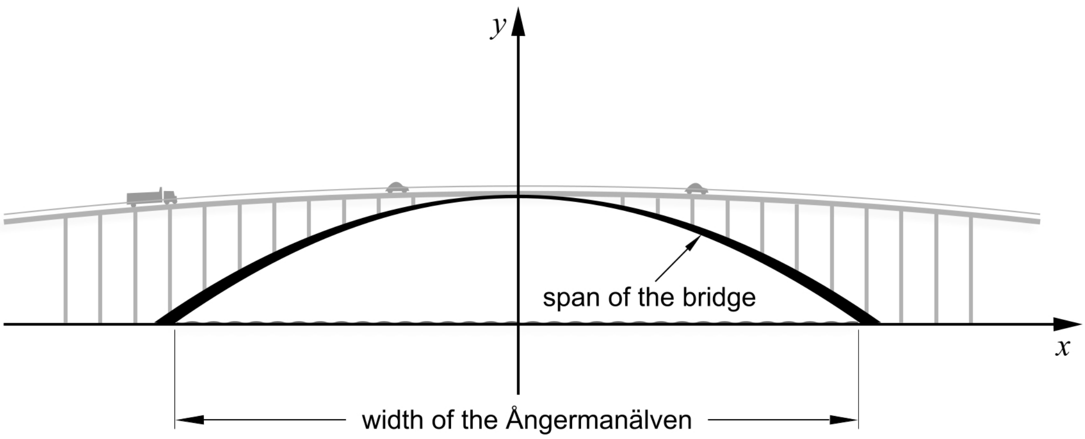
”I don’t agree with you. You need to take the size of the nonresponse group into consideration. The result is then different and we have the support to buy the HiFi system.”

b) Use calculations to show that the secretary might be right. (0/2)

14. Hanna and her friends are sitting at a café in Gothenburg. She collects SEK 324, which is the equivalent of four teas and six lattes. When she has placed her order and paid, she has SEK 28 left. Hanna then realises that she mixed up the number of teas with the number of lattes when she placed her order.

How much is a cup of tea and a latte respectively at the café? (0/2)

15. Sandöbron is a bridge crossing the Ångermanälven. The bridge was built in 1943 and was until 1964 the world's largest single span concrete bridge.



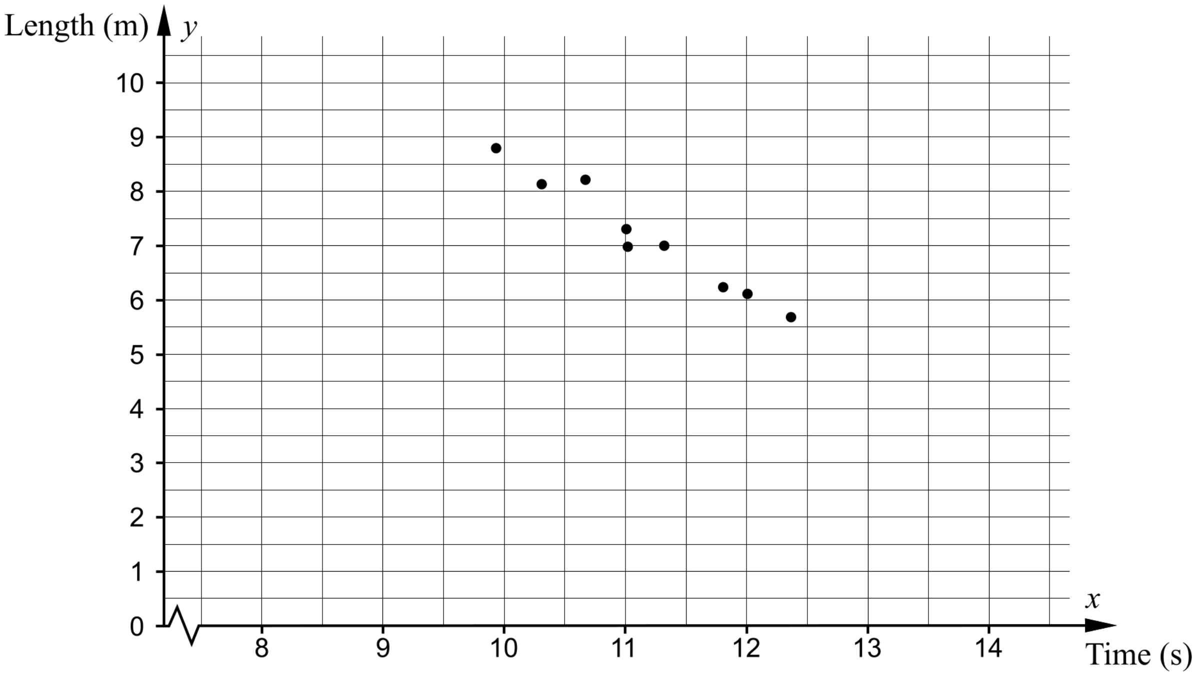
The span of the bridge can be described by the quadratic function $y = h(x)$ where
$h(x) = -0.0023x^2 + 40$

$h(x)$ is the height above the water in metres.
x is the distance in metres along the surface of the water from the middle of the bridge.

a) How high above the water are the cars when they pass the highest point of the bridge? *Only answer is required* (1/0)

b) Calculate the width of the Ångermanälven under the bridge. (0/2)

16. Nine people competing in both the long jump and in the 100-metre dash report their best results. Their results are marked in the diagram below. The diagram indicates that there seems to be a linear connection between the length of a jump and the time of a 100-metre race.



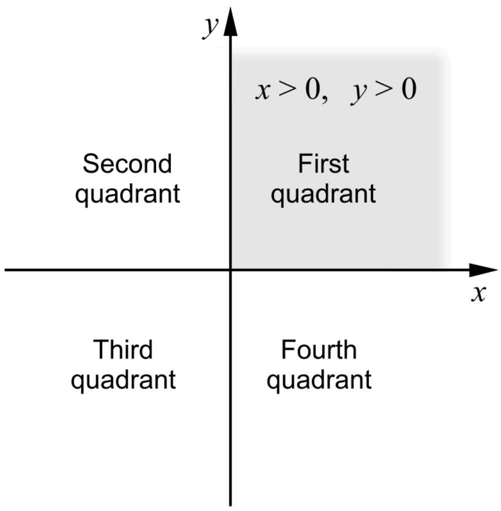
a) Draw a straight line that shows the connection between the length of a jump and the time of a 100-metre race in the best possible way. Determine the equation of this line in the form $y = kx + m$ (1/1)

The connection can be seen as a model of how the length of a jump depends on the time of a 100-metre race.

b) Usain Bolt holds the world record in 100 metres with a time of 9.58 seconds. How long might Usain Bolt jump in the long jump according to this model? (1/0)

c) Investigate if there are any limitations to this model. (0/1/¤)

17. The two straight lines $y = x - 4$ and $y = ax + 2$, where a is a constant, intersect in the first quadrant.



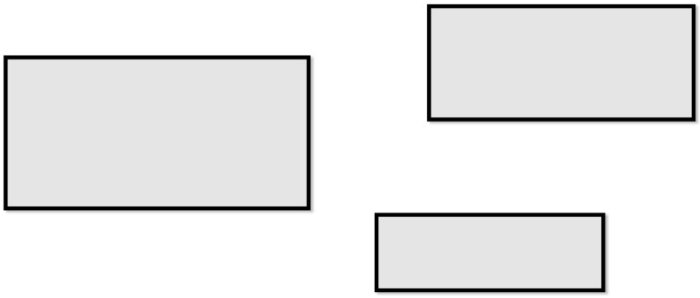
Investigate the possible values of the constant a. (0/1/¤)

When assessing your work with this problem the teacher will take into consideration:
- How well you carry out your calculations
- How close to a general solution you are
- How well you justify your conclusions
- How well you present your work
- How well you use mathematical language

18. Your task is to investigate rectangles with a common property:

The width is always 2 cm greater than the height.

Three examples of such rectangles are given below:



- Is there a rectangle of this type which has a perimeter of 5 cm?
  Is there a rectangle of this type which has a perimeter of 3 cm?
- Is there a rectangle of this type which has a area of 11.25 cm^2?
  Is there a rectangle of this type which has a area of 1 cm^2?
- Is there a rectangle of this type which has a diagonal of 8 cm?
  Is there a rectangle of this type which has a diagonal of 1 cm?
- Write down formulas for the perimeter, area and length of the diagonal, expressed in one single variable, for this type of rectangle.
- Investigate which limitations there are for the values that the perimeter, area and length of the diagonal can have. (4/4/¤)