

Concerning test material in general, the Swedish Board of Education refers to the Official Secrets Act, the regulation about secrecy, 4th chapter 3rd paragraph. For this material, the secrecy is valid until the expiration of December 2012.

NATIONAL TEST IN MATHEMATICS COURSE B AUTUMN 2002

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 calculators are not allowed in this part.

Part II: 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 10 problems and **Part II** consists of 8 problems.

To 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 41 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 \square , 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: 11 points

Pass with distinction: 24 points of which at least 6 "Pass with distinction points".

Pass with special distinction: The requirements for Pass with distinction must be well satisfied. Your teacher will also consider how well you solve the \square -problems.

Name: _____

School: _____

Education programme/adult education: _____

Part I

This part consists of 10 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. Simplify $(x + 4)(x - 4)$ as far as possible. *Only answer is required* (1/0)

2. Solve the equation $x^2 - 10x + 9 = 0$ (2/0)

3. Find the linear function which graph passes through (2, 6) and the origin. (2/0)

4. They are having a stand-up comedy show at school. Jenny and four other students are going to perform and are therefore on stage in the school's auditorium. They are drawing lots for their turns to perform. Five slips of paper with the numbers 1, 2, 3, 4 and 5 (one number on each slip of paper) are folded and put into a hat. Their turns are decided by the numbers on the slips. Jenny gets the chance to draw her slip first.

 What is the probability that Jenny does not have to be the first one to perform?
Only answer is required (1/0)

5. a) Write down a quadratic function and call it $f(x)$ *Only answer is required* (1/0)
 b) Calculate $f(2)$ for your function. *Only answer is required* (1/0)

6. Solve the inequality $3(2x - 5) < 9$ (2/0)

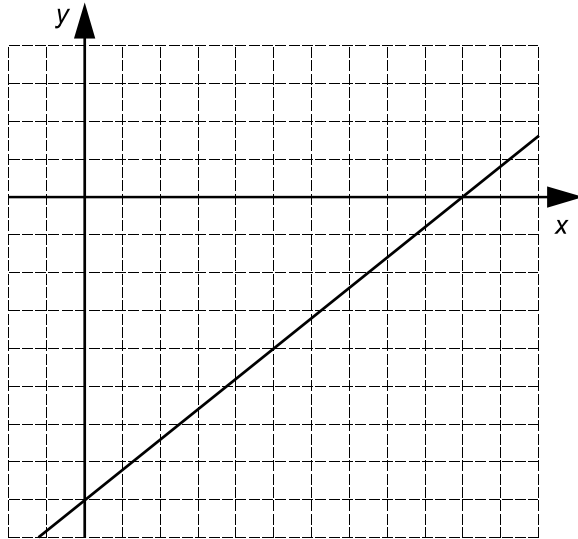
7. Which of the following statements is true? *Only answer is required* (0/1)

 A right-angled triangle can
 A) ... be equilateral
 B) ... be isosceles
 C) ... have one obtuse angle
 D) ... have sides with lengths 1 cm, 2 cm and 3 cm

8. On her computer Sandra has plotted the graph to the function $y = 20x - 40$. The picture below shows what the screen looks like. As you can see, the coordinate axes have not been graduated.

Copy the picture and graduate the x - and y -axis in a suitable way.

(2/0)



9. Your friend does not understand what is meant by the slope of a straight line and how the gradient can be determined.

Show, in great detail, preferably with examples, how you would explain this to your friend.

(2/1)

10. Investigate how the value of the constant a affects the number of the solutions to the simultaneous equations $\begin{cases} y = ax + 5 \\ y = 2x + 8 \end{cases}$

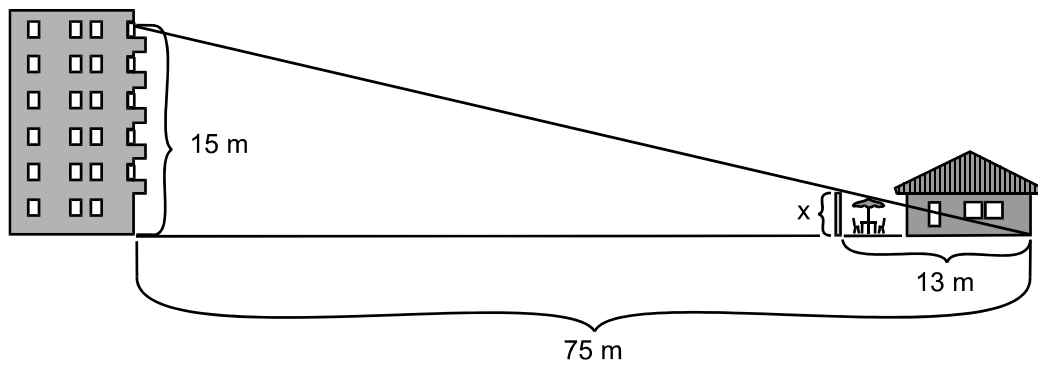
(1/2/0)

Part II

This part consists of 8 problems and you may use a calculator when solving them. Please note that you may begin working on Part II without your calculator

11. Solve the simultaneous equations $\begin{cases} x - y = 13 \\ 2x + y = 26 \end{cases}$ (2/0)

12. The Svenssons have decided to build a fence to shut off their garden from people's view. How high does the fence have to be to prevent the neighbours at the top floor from looking into their garden? (2/0)



13. In the summer of 1998 many people complained about the weather. In Luleå, it rained 35 days during the summer months while a total of 57 days were without rain. If it rained one day, it also rained the following day in 40 % of the occasions.

Pelle booked a two-day visit in Luleå well in advance. What was the probability that it rained during both his days in Luleå?

(0/2)

14. Östfallet Golf Club has two different kinds of memberships, complete membership and green fee membership. The table below shows the conditions for the different memberships.

	Complete membership	Green fee membership
Annual fee	SEK 4 275	SEK 2 000
Single round	SEK 0	SEK 150

How many rounds do you at least need to play a year if a complete membership is to be cheaper than a green fee membership?

(0/2)

A member with complete membership pays SEK 15000 as a loan to the club. The money is paid back when the member terminates his/her membership. In the annual fee for complete membership is included a yearly 5.2% loss of interest rate for the member's loan to the club.

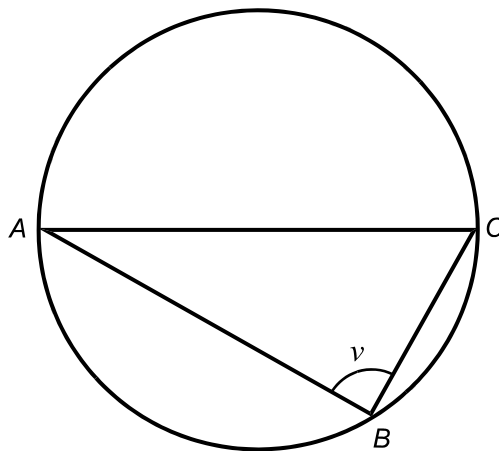
15. The petrol consumption $f(v)$ litres/10 kilometres for a car depends on its velocity v km/h and can approximately be described by the formula

$$f(v) = 0.50 + 3.7 \cdot 10^{-5} \cdot v^2$$

The formula is valid within the interval $70 \leq v \leq 150$.

A family drives a number of kilometres at 110 km/h. How much would this family's petrol consumption decrease, in percent, if the velocity on the driven distance is reduced to 90 km/h? (0/2)

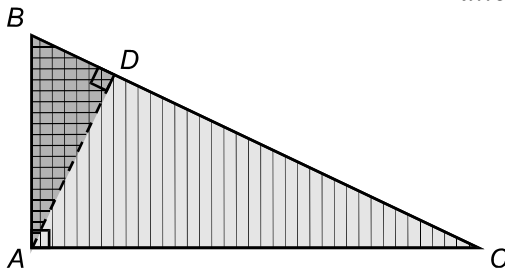
16. The triangle ABC is inscribed in a circle, see the figure below. The chord AC passes through the centre of the circle. The radius of the circle is 2.0 metres.



- a) Find the angle v . (1/0)
- b) Calculate the length of the chord AB if it is 1.0 metre longer than the segment BC . (0/2)

17. Show that the triangles ABD and ACD are similar. (0/2/□)

Calculations based on measurements are not allowed.



When assessing your work with problem 18 your teacher will consider the following:

- What mathematical knowledge you present
- How well you calculate the inquired intervals
- How well you reason about your conclusions
- How well you present and comment on your work

18. Kalle, an upper secondary school student, earns money on the side at Karlson's petrol station. Karlson considers extending his services and start selling groceries. To form an opinion of whether this would be profitable he asks Kalle to do a random sample survey to find out how many percent of the customers would use such a service. In school, Kalle has learnt that the result of a random sample survey is always uncertain to some degree. In a school book he finds the following text:

When carrying out a statistical survey it is usually impractical to ask every member of the population, but a selection must be done. An interval can be stated that with 95% certainty will include the value that would have been received if examining the whole population.

$$p \pm 1.96 \cdot \underbrace{\sqrt{\frac{p(100-p)}{n}}}_{\text{confidence interval}}$$

p = share in sample test, in percent, of the asked with the property that is being examined

n = size of random sample test

In a questionnaire, Kalle asks the following question:

Will you buy groceries at Karlson's petrol station? ☐ Yes ☐ No ☐ Don't know

In a random sample survey it turned out that 48.1 % ($p = 48.1$) out of 1000 customers ($n = 1000$) answered *Yes* to Kalle's question.

- Use the formula above and calculate within which interval the value is (with 95% certainty) that Kalle would have received if asking all the customers.

In the same survey the share answering *No* was 49.0 % and the share *Don't know* 2.9 %

- Use the formula above and calculate the interval for the '*No*' answers. What can be said about the share of '*Yes*' answers compared to the share of '*No*' answers if all the customers are taken into account?

- Examine and explain how the confidence interval $1.96 \cdot \sqrt{\frac{p(100-p)}{n}}$ is affected both by n and by p .

(2/5/∞)