NATIONAL TEST IN MATHEMATICS COURSE B
AUTUMN 2001

Directions

Test time — 240 minutes without a break 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 19 problems. **Part I** consists of 11 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 19 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 in Assessment Criteria 2000.

Lower limit for the mark on the test
Pass: 13 points
Pass with distinction: 25 points of which at least 7 “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 ¤-problems.

Name: _____ School: _____

Education programme/adult education: _____

Part I

This part consists of 11 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. In a pot there are nothing but red and black balls. The probability of taking a red ball out of the pot is 75%.

Suggest how many red and black balls there might be in the pot.

Only answer is required (1/0)

2. Give an example of a value of x such that $2x - 1 < 3$

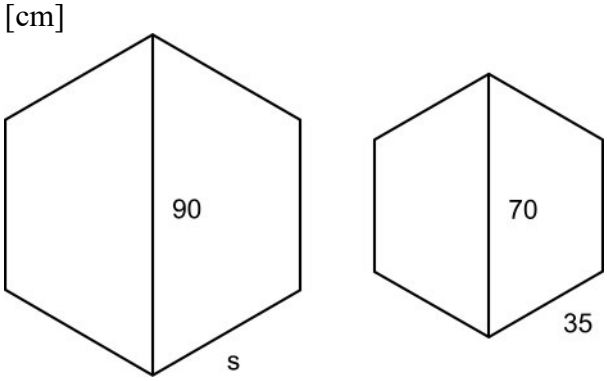
Only answer is required (1/0)

3. Solve the equation $x^2 - 4x - 45 = 0$ (2/0)

4. The following two hexagons are similar. Calculate s.

Only answer is required (1/0)

[cm]



5. Which of the following expressions is a simplification of $(x-2)(x+2)$?

A. $x^2 - 4x + 4$

B. $x^2 + 4x + 4$

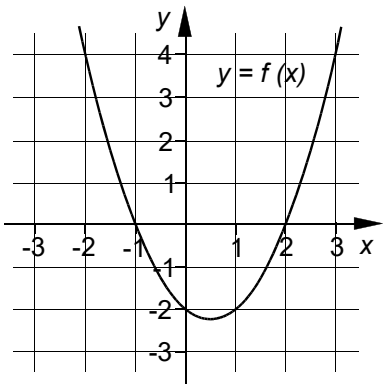
C. $x^2 + 4$

D. $x^2 - 4$

E. $x^2 + 2x$

F. $x^2 - 2x$ *Only answer is required* (1/0)

6. The figure to the right shows the graph of a function $y = f(x)$



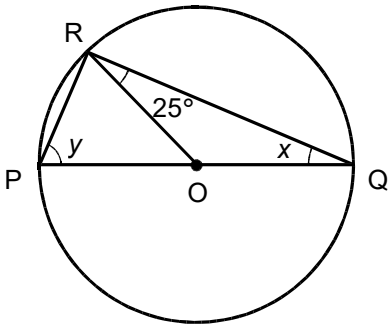
a) Find $f(0)$

Only answer is required (1/0)

b) Find the solutions to the equation $f(x) = 0$

Only answer is required (2/0)

7. The points P, Q and R are on a circle. O is the centre of the circle. PQ is the diameter of the circle.



Find the angle y (0/2)

8. The sum of two numbers, x and y, is at least as large as their product.

How is this condition written in mathematical signs and symbols?

A. $x + y \leq xy$
B. $x + y \geq xy$
C. $x + y < xy$
D. $x + y > xy$
E. $x + y = xy$ *Only answer is required* (0/1)

9. The point $(50, a)$ is on the line that has the equation $2x + y = 5$

Find a *Only answer is required* (0/1)

10. The solutions of simultaneous equations are $x = 1$ and $y = 3$
Give an example of such simultaneous equations. *Only answer is required* (0/1)

11. Explain when it is suitable to use the median instead of the mean value. (1/1)
Give an example.

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 a calculator

12. Draw a straight line in a system of co-ordinates.
Find the gradient of the line. (2/0)

13. The TRISS lottery ticket is a popular one. At the back of the lottery ticket, there is the following prize plan:

Prize plan for 8 000 tickets.
If the number of lottery tickets is changed the prize plan is proportionally changed.
* Average sum in public TV - draws.

Antal		Vinst	Totalt
4	x	2 500 000kr*	10 000 000kr
16	x	250 000kr**	4 000 000kr
4	x	1 000 000kr	4 000 000kr
40	x	100 000kr	4 000 000kr
400	x	10 000kr	4 000 000kr
2 000	x	1 000kr	2 000 000kr
44 000	x	100kr	4 400 000kr
172 000	x	75kr	12 900 000kr
680 000	x	50kr	34 000 000kr
748 000	x	25kr	18 700 000kr
1 646 464			98 000 000kr

* Lottery tickets with 3 CLOVES. If the winner chooses one single payment instead of monthly payments 500 000 kr is paid.
** Lottery tickets with 3 TV-SCREENS.

a) Calculate the probability that you win a prize if you buy a TRISS lottery ticket. (1/0)

b) Calculate the probability that you win a prize larger than 10 000 SEK if you buy a TRISS lottery ticket . (2/0)

c) If you buy one TRISS lottery ticket a week during one year, how many 25 SEK prizes can you expect to win during that year? (1/1)

14. A straight line passes through the points $(-1, 3)$ och $(1, 9)$
Find the equation of the line expressed in the form $y = kx + m$ (2/0)

15. At Bosse's Car Company you can hire a car at 225 SEK per day plus 30.40 SEK per ten kilometres. At Persson's Private Cars you can hire the same make of car at 300 SEK per day plus 25 SEK per ten kilometres.

Investigate how the distance covered, during one day, affects the choice of car hire service. (1/2)

16. In a municipality there are two schools, East and West. The East school has 1350 students and the West has 520 students. In both schools it is forbidden to have a mobile phone switched on during the lessons.

To see if the rule has any support among the students, the students' councils in both schools have carried out a common survey. In each school some SP-classes were chosen and all the students were asked:
"Do you think that you should be allowed to have your mobile phone switched on during the lessons?"
The answers can be seen in the table below:

School	"No answer"	"Yes"	"No"
East	17	27	58
West	30	49	16

The students' councils summarised the survey as follows:

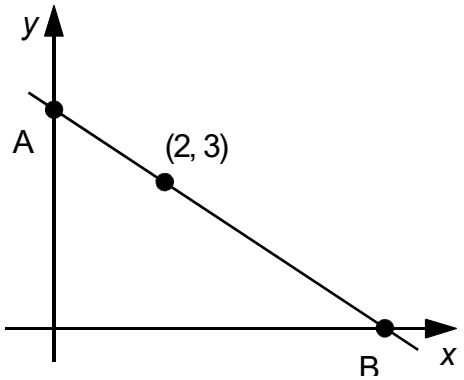
Total percent of "Yes"-answers: $\dfrac{27+49}{27+49+58+16} \approx 51\ \%$

Conclusion: The majority of the students favor having their mobile phones switched on.

a) Give two examples of critical opinions on the survey. (1/1)

b) Explain why your criticism can affect the conclusions that can be drawn from the survey. (0/1)

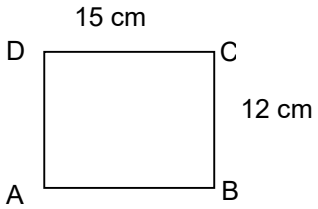
17.

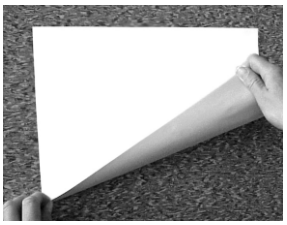


A straight line through the point (2, 3) passes through the positive *y*-axis at A and the positive *x*-axis at B, see figure. The *x*-coordinate of point B is three times as large as the *y*-coordinate of point A. Calculate an exact value of the *y*-coordinate of point A.

(0/3/¤)

18. ABCD is a white rectangular shaped sheet of paper where the back is grey. The sheet is folded so that the folding line passes through corner A and so that corner B ends up on side CD (see right figure).

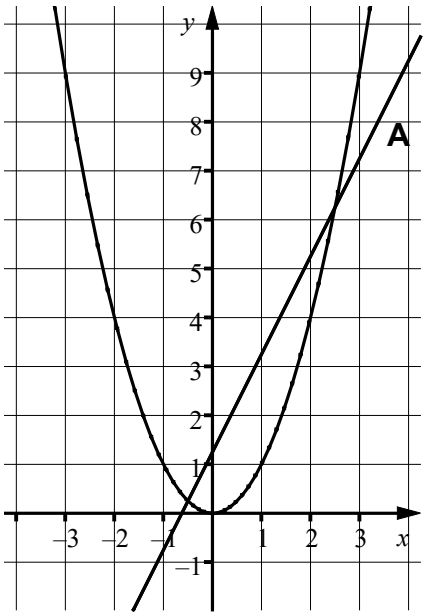




Calculate the area of the folded (grey) part of the sheet.
Calculations based on measurements are not accepted. (0/4/¤)

Present your solution to problem 19 partly in this booklet (the table) and partly on separate test sheets.

19. This problem deals with intersections between the curve $y = x^2$ and straight lines



In the left figure, you can read the x-co-ordinates for the points where the curve and line A intersects:

$x_1 = -0.5$

$x_2 = 2.5$

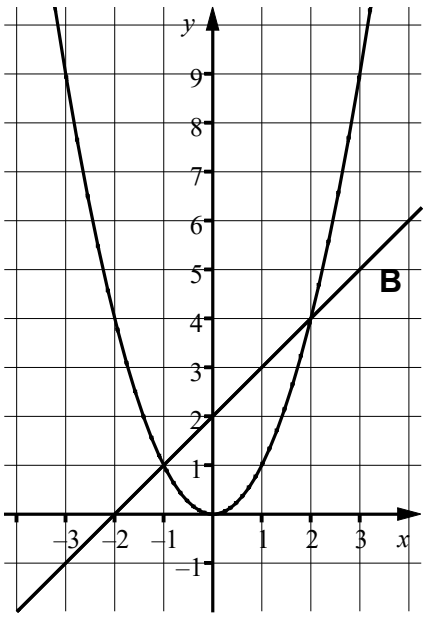
Then the sum $x_1 + x_2 = 2$

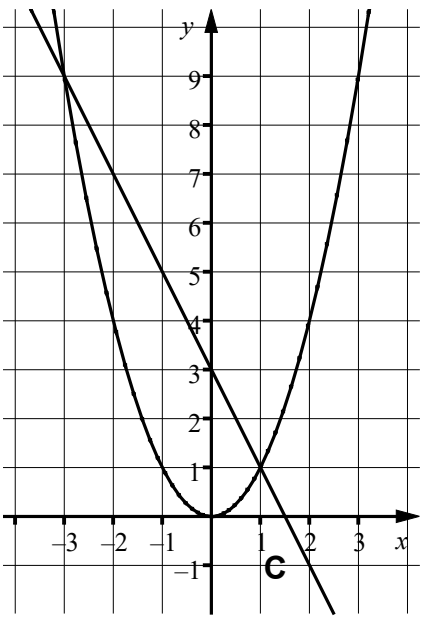
and the product $x_1 \cdot x_2 = -1.25$ are calculated.

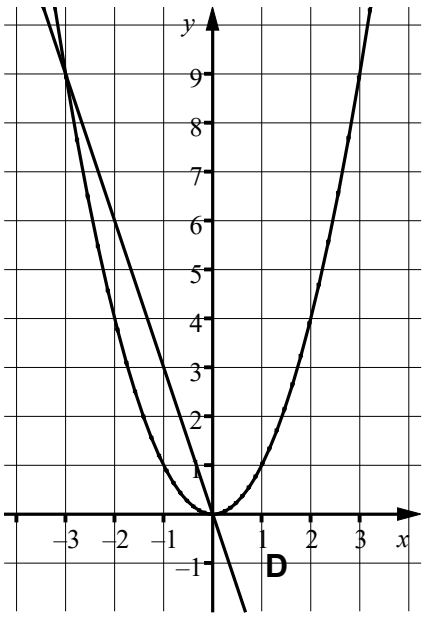
From the figure we can see that the k- and m-values are $k = 2$ and $m = 1.25$

All the values have been entered in the table on the next page.

- Do the corresponding readings in the figures below. Then fill out the table on the next page.







Line		A	B	C	D
x-co-ordinate for the left intersection with curve	x_1	-0.5			
x-co-ordinate for the right intersection with curve	x_2	2.5			
The sum of the x-co-ordinates	$x_1 + x_2$	2			
The product of the x-co-ordinates	$x_1 \cdot x_2$	-1.25			
The gradient of the line	k	2			
The y-co-ordinate for intersection with the y-axis.	m	1.25			
Equation of the line		$y = 2x + 1.25$			

- In words, write down what you can conclude from the table.

- By reading off the intersection between the curve $y = x^2$ and the line $y = 2x + 1{,}25$ you can find a graphic solution to the quadratic equation $x^2 = 2x + 1{,}25$
  Show that the reading of the x-coordinates of the intersection points is correct by solving the quadratic equation $x^2 = 2x + 1{,}25$ algebraically.

- Try to show that what you have concluded from the table is true for all lines that intersect with the curve $y = x^2$ (3/4/¤)

When assessing your work your teacher will consider the following:
- To what extent you solve the problem
- How well you formulate your conclusions
- How general is the method you use when you show your final conclusion
- How well you present your work