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 2014.

NATIONAL TEST IN MATHEMATICS COURSE B
AUTUMN 2004

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, 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. *Answers 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 10 problems and **Part II** consists of 9 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 39 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:	11 points
Pass with distinction:	23 points of which at least 6 ”Pass with distinction”-points.
Pass with special distinction:	In addition to the requirements for ”Pass with distinction” you have to show ”*Pass with special distinction*” *qualities in at least two* of the ¤-problems. You must also have at least 12 ”Pass with distinction”-points.

Name: ______________________________ School: ______________________________

Education programme/adult education: ______________________________

Part I

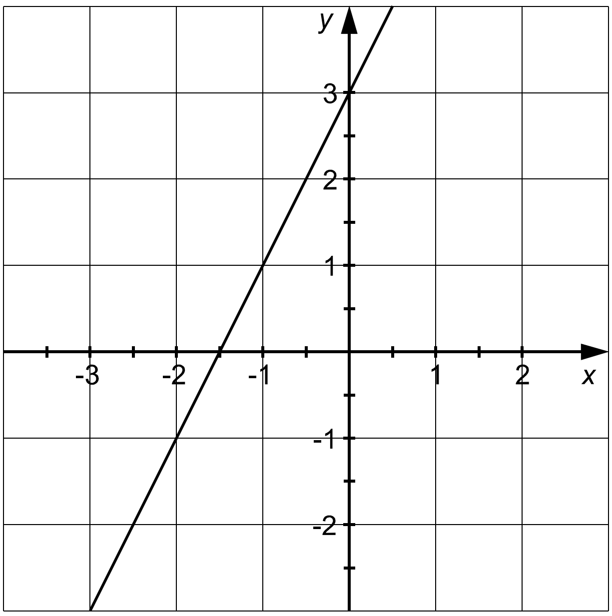
This part consists of 10 problems that should be solved without the aid of a calculator. Your answers to the problems in this part should be presented on separate sheets of paper that must be handed in before you retrieve your calculator. Please note that you may begin working on Part II without the aid of a calculator.

1. Solve the following equations

a) $x^2 - 6x - 40 = 0$ *Only answer is required* (1/0)

b) $x^2 - 16 = 0$ *Only answer is required* (1/0)

2. The figure below shows the graph of a function $y = f(x)$



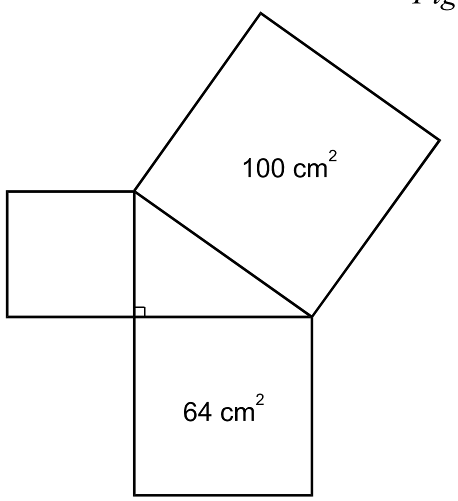
a) Determine $y = f(0)$ *Only answer is required* (1/0)

b) For which x is $f(x) = 0$? *Only answer is required* (1/0)

3. In a coordinate system, draw a straight line that passes through the point (0, 2) and has the gradient -3 *Only answer is required* (1/0)

4. The largest square in the figure below has an area of 100 cm^2 and the second largest has an area of 64 cm^2.

Figure not drawn to scale



a) Determine the area of the smallest square. *Only answer is required* (1/0)

b) Determine the area of the right-angled triangle. *Only answer is required* (1/0)

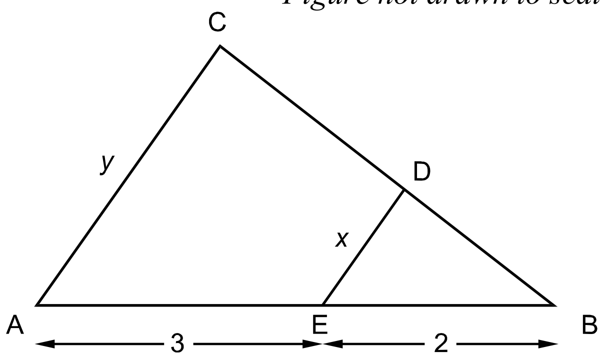
5. Karin is playing a game of dice where two six-sided dice are thrown simultaneously. To win she must get a sum of eight.

a) What is the probability of Karin getting two fours? *Only answer is required* (1/0)

b) What is the probability of Karin getting a sum of eight? *Only answer is required* (1/0)

6. In the figure below DE is parallel to AC.

Figure not drawn to scale



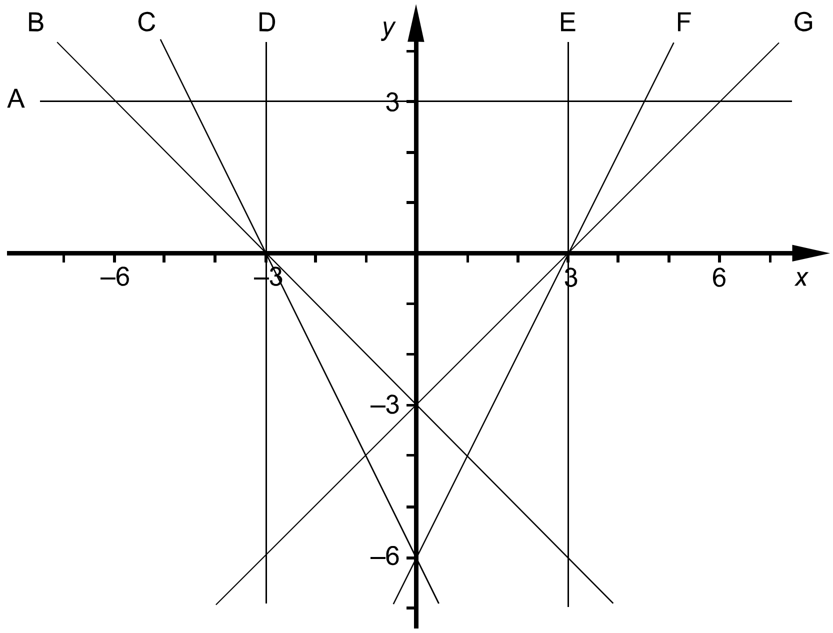
Determine the ratio $\frac{y}{x}$ *Only answer is required* (1/0)

7. Which is the largest positive integer that satisfies the inequality $3x - 1 < 51 - x$?

Only answer is required (0/1)

8. Which of the lines A-G in the coordinate system has the equation $2x - 6 = 0$?

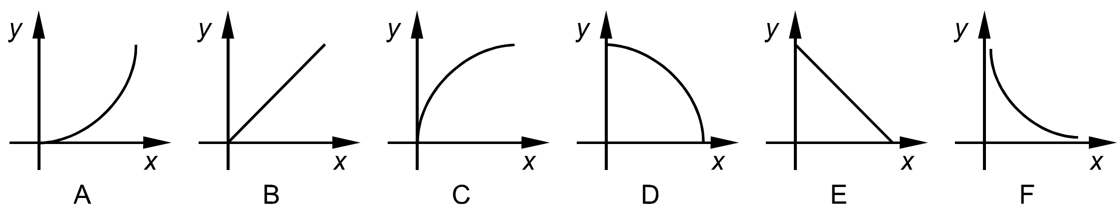
Only answer is required (0/1)



9. It takes y hours to travel 120 km at a speed of x km/h.

Which of the following graphs shows y as a function of x?

Only answer is required (0/1)



10. Give an example of a function $y = f(x)$ such that $f(2) = 2 \cdot f(0)$

Only answer is required (0/1)

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 your calculator.

11. Find the equation for the straight line that passes through the points (2, 6) and (8, 9). (2/0)

12. The sports association at the school has arranged a floorball match. Krister is sitting at the entrance selling tickets. Tickets cost SEK 20 if you are a student at the school and SEK 50 for others.

The board of the sports association wants to know how many of the visitors are students.

When the match is over Krister has sold 280 tickets in all and he has SEK 6410 in the cash-box. To calculate how many students have bought tickets for the match he writes down the equation $x \cdot 20 + y \cdot 50 = 6410$

a) What do x and y represent in the equation? *Only answer is required* (1/0)

b) Since the equation contains two variables, x and y, Krister needs another equation to be able to calculate how many students have bought tickets to the match.

Write down this equation. *Only answer is required* (1/0)

c) Calculate how many students bought tickets to the match. (2/0)

13. There is one number t that gives the expression $(t+1)(t-1) - t(t-1)$ the value $\frac{1}{3}$

Determine the exact value of t . (1/1)

14. Lisa reads about an essay competition in a magazine. Five prizes are to be awarded. The total prize money is SEK 12400. Each prize is half the preceeding prize, for example the second prize is half the first prize.

Since Lisa likes writing essays she decides to participate. Her essay is awarded the third prize. When Lisa receives the money she is disappointed at how little it is. She had calculated that the mean value of the prizes was SEK 2480 and she only got SEK 1600.

Explain to Lisa why the mean value is not a good measure of the size of the middle prize when the total prize money is distributed according to the above model. (0/2)

15. A lottery consists of 100 lottery tickets. 5 of these are winning tickets and the rest are blank and give no prize. Axel is first in line and buys the first two lottery tickets.

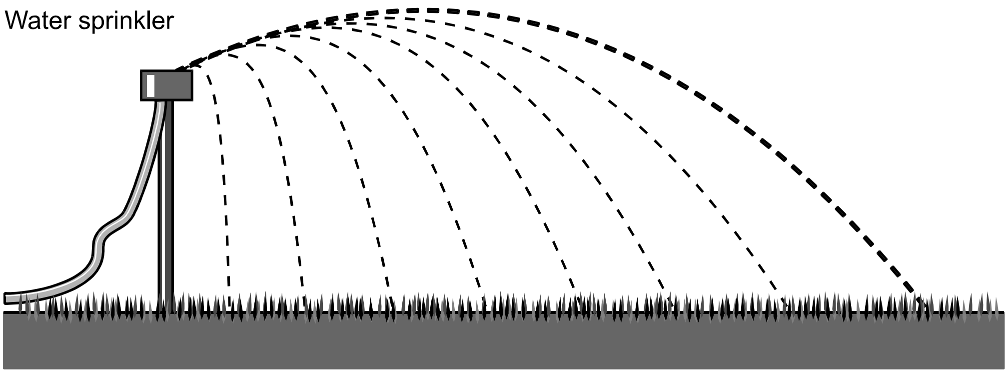
What is the probability that at least one of his lottery tickets is a winning ticket? (0/2)

16. A water sprinkler is placed on a pole on a flat lawn. The sprinkler rotates watering a circular area from the pole outwards.

The jet of water that reaches the furthest away from the sprinkler can be described by the function

$$y = 1 + 0.75x - 0.25x^2\,,\ x \geq 0$$

where y is the height of the jet of water in metres above the lawn at the distance x metres from the pole.

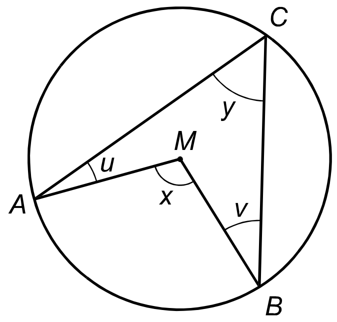


a) How high above the lawn is the sprinkler placed?
Only answer is required (1/0)

b) How large an area does the sprinkler water? (0/3)

17. *A*, *B* and *C* are three points on a circle which has centre *M*. *M* lies between the segments *AC* and *BC*. In the figure below four angles, *x*, *y*, *u* and *v*, are marked. There is a relationship between these four angles.

Show that this relationship can be written $x = u + v + y$ (0/2/¤)



18. In a triangle one angle is 1.5 times greater than another angle.

Which values are possible for the smaller of these angles? (0/1/¤)

When assessing your work with the following problem the teacher will take into consideration:

- How well you carry out your calculations
- How well you present and comment on your work
- How well you justify your conclusions
- What mathematical knowledge you show
- How well you use the mathematical language
- How general your solution is

19. This problem is about solutions to the simultaneous equations

$$\begin{cases} y = x + 2 \\ y = kx + 1 \end{cases}$$

The x- and y-values of the solutions can be positive, negative or zero. Sometimes x and y have the same signs and sometimes they have different signs. This is decided by the value of k.

You are now going to investigate which values of k give x and y with the same sign and which give different signs.

- Solve the simultaneous equations graphically or algebraically for $k = 2$. Do the x- and y-values of the solution have the same or different signs?

- Choose a negative value of k. Find out whether x and y have the same or different signs for your chosen value of k.

- Investigate which values of k give x and y with the same sign and which give different signs. (3/3/¤)