NATIONAL TEST IN MATHEMATICS COURSE B

SPRING 2009

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 16 problems. **Part I** consists of 8 problems and **Part II** consists of 8 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 16 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 43 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:	24 points of which at least 6 ”Pass with distinction”-points.
Pass with special distinction:	24 points of which at least 12 ”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 8 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.

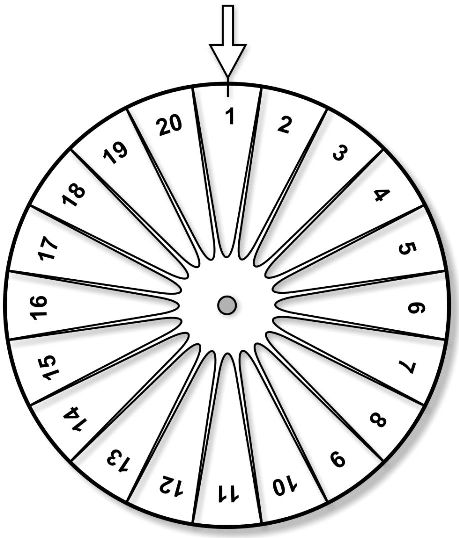
1. A straight line passes through the point (3, 1) and has a gradient $k = -2$

a) Draw the line in a coordinate system. (1/0)

b) Determine the equation of the line. (1/0)

2. Solve the equation $x^2 + 10x - 24 = 0$ (2/0)

3. A Wheel of Fortune has 20 spaces numbered from 1 to 20. Every number that is divisible by three gives a prize.



Hamid spins the wheel once.
What is the probability that he will win a prize? *Only answer is required* (1/0

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

5. A quadratic curve which has its minimum point at (4, 2) intersects the y-axis at the point (0, 5)

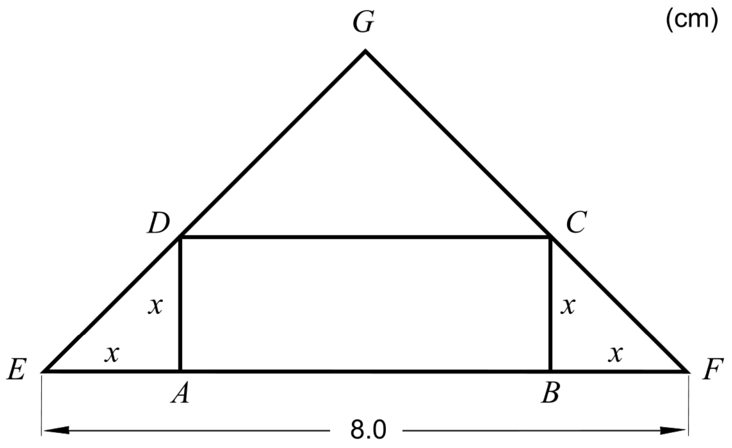
Write down another point on the curve. *Only answer is required* (1/0)

6. Determine the value of the constant a for which the simultaneous equations

$$\begin{cases} x + ay = 7 \\ 3x + y = 11 \end{cases}$$

have a solution when $x = 3$ (0/2)

7. The rectangle *ABCD* is inscribed in the triangle *EFG*. The distances *EA* and *BF* are of the same length as one side of the rectangle, see figure.



a) Write down an equation that you can use to calculate x if the area of the rectangle is 6.0 cm^2. (0/1)

b) What are the side lengths of the rectangle when the area is 6.0 cm^2? (0/2)

8. The numbers x and y satisfies the relation $x^2 + 2xy + y^2 = 9$

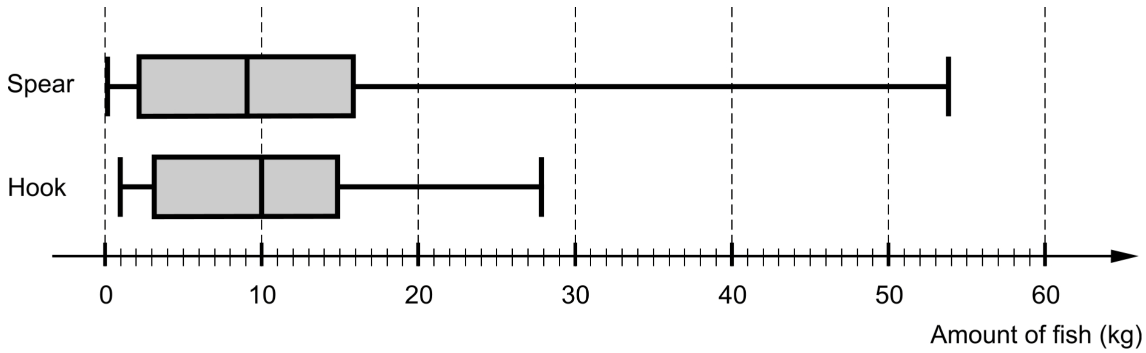
Show that all the solutions to the relation can be described by two straight lines in a coordinate system. (0/2/¤)

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.

9. Two researchers studied the fishing of the Gwaimasi village in a rain forest in New Guinea. They registered the amount of fish each man in the village caught during one year. There were 14 men in the village, and each one of them used two fishing methods, spear and hook.

The results of the study are presented in a box plot and in a table.



The table shows the mean and the median of the yearly catch per man and fishing method.

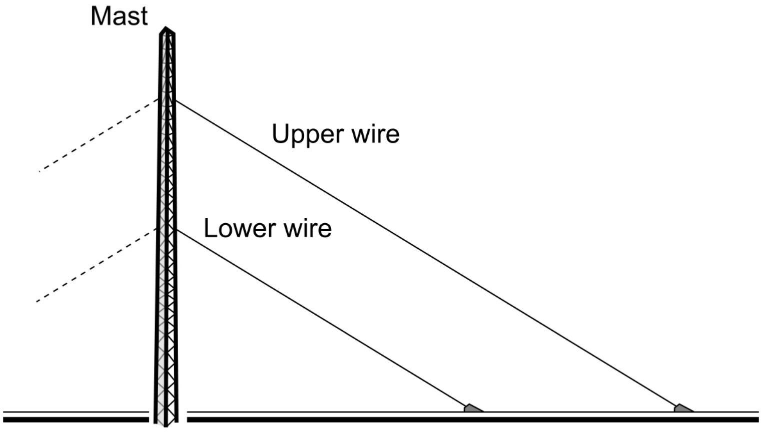
	Median (kg)	Mean (kg)
Spear	9.2	14.7
Hook	10.0	10.3

a) How much fish did the most successful fisher catch when using a hook?
Only answer is required (1/0)

b) What percentage of the men using hooks caught between 3 kg and 15 kg fish?
Only answer is required (1/0)

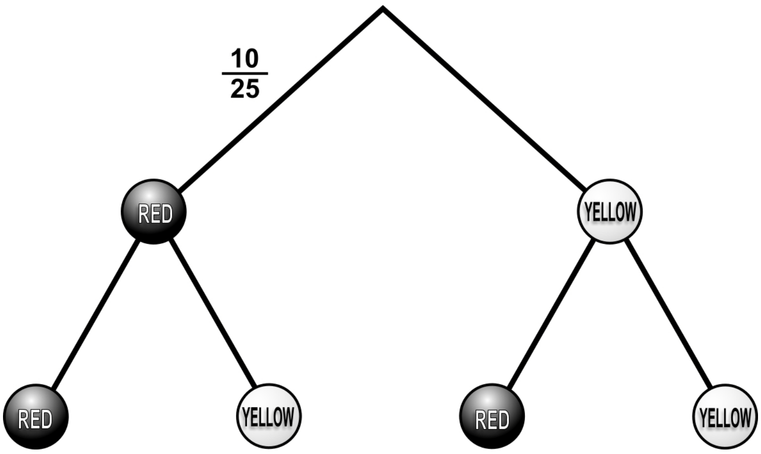
c) What was the total amount of fish caught by the 14 men during that year?
Only answer is required (1/0)

10. A 30-metre high mast is attached to the ground by wires that run from the mast diagonally to the ground. The upper wire has a length of 40 metres and its abutment is located 5 metres below the top of the mast. The lower wire has its abutment another 10 metres down the mast. It runs parallel to the upper wire.



What is the length of the lower wire? (2/0)

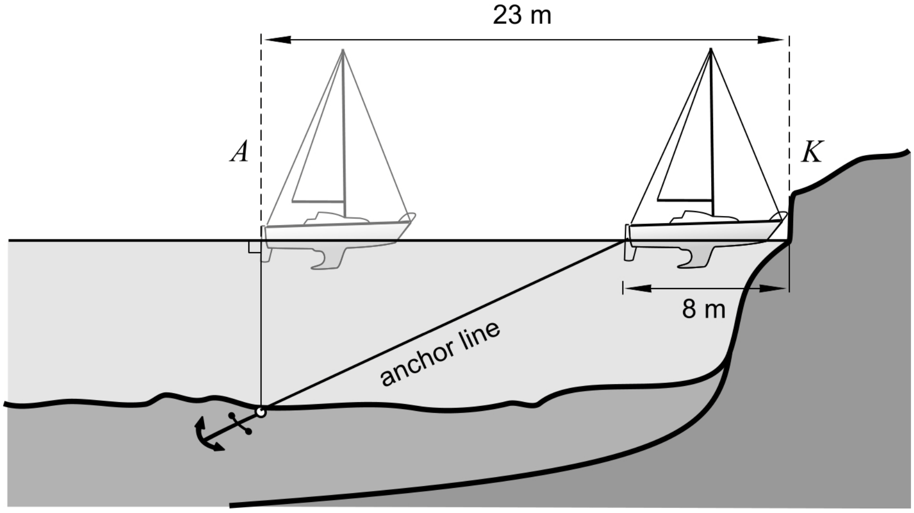
11. Ulrika has a jar with 10 red and 15 yellow marbles. She is going to calculate the probability of getting two marbles of different colour if she takes two marbles from the jar.
Ulrika starts to draw a tree diagram.



a) Help Ulrika complete the tree diagram. Copy the tree diagram and fill in the missing probabilities. (2/0)

b) Calculate the probability that Ulrika gets two marbles of different colour if she takes two marbles from the jar. (1/1)

12. An 8-metre long sailing boat comes into a bay to anchor. The distance from point *A* where the sailor wants to let his anchor down to rock *K* is 23 metres. To make sure the anchor digs well into the bottom, it is recommended that the length of the anchor line is three times the water depth. When the anchor is firmly set, the boat will drift as far as the anchor line allows.



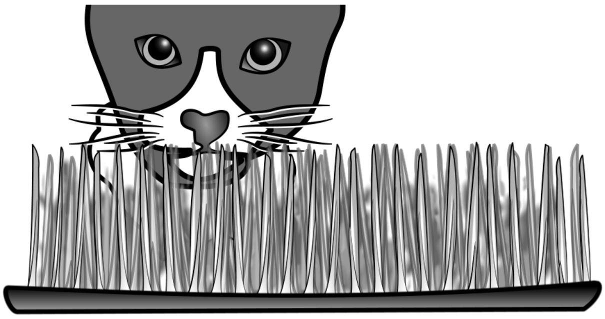
To prevent the boat from hitting the rock *K* the water must not be too deep where the anchor is cast since the lenght of the anchor line should be three times the water depth.

a) Is there a risk that the sailing boat will hit the rock *K* if the wather depth at the anchorage *A* is 7 metres? (2/0)

b) What is the maximum depth allowed at *A*? (0/2)

13. A group of students at a school investigated how quickly cat grass grows. They put some seeds in a pot and when the grass started to germinate they measured the height of the blades of grass once every day. The table shows the results of their experiment.

Time (days)	Height (cm)
0	0.5
1	0.8
2	1.3
3	2.1
4	3.3
5	5.2
6	8.1
7	13.4



The students came to the conclusion that the growth can be described by a mathematical model given by the function:
$y = 0.5 \cdot 1.6^x$, where y is the height of the grass in cm and x is the time in days.

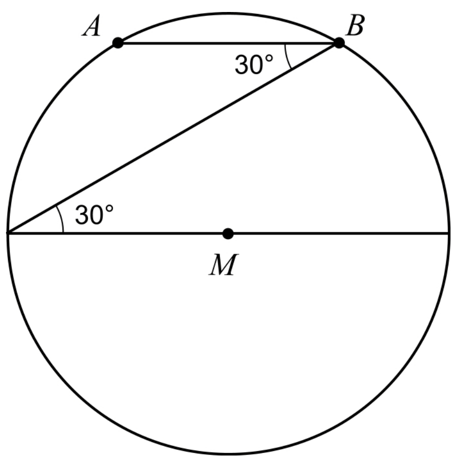
a) What do the numbers 0.5 and 1.6 in the function represent? (2/0)

b) Describe and show what you would do to arrive at the number 1.6, using data from the table above as a starting point. (0/2)

14. There was a fair in Karesuando. Timo sold bilberry juice. He had small bottles that cost SEK50 and large bottles that cost SEK130. The small bottles contained one litre and the large ones three litres. At the end of the day, he had sold 100 bottles and earned SEK9240.

How many litres of juice did he sell? (0/3)

15. The points *A* and *B* lie on the perimeter of a circle with centre *M*.



Show that segment *AB* has the same length as the radius of the circle. (0/2/¤)

When assessing your work with the following problem, the teacher will take into consideration • how close to a general solution you are • how well you justify your conclusions • how well you carry out your calculations • how well you present your work • how well you use mathematical language and ways of expressing yourself

16. The triangle in the coordinate system below has its corners at the points *A*, *B*, and *P*. The point *P* is movable along the *x*-axis and its *x*-coordinate lies within the interval $0 < x < 6$
The line *L* passes through the points *A* and *P*.

Your task is to investigate how the area *T* of the triangle depends on the gradient *k* of the line *L*.

- Determine *T* and *k* when *P* has coordinates $(2, 0)$
- When *P* moves along the *x*-axis, the area of the triangle and the gradient of the line will change. Investigate and describe, in as much detail as possible, how the area *T* of the triangle varies for different values of the gradient *k*.

(3/3/¤)