This test will be re-used and is therefore protected by Chapter 17 paragraph 4 of the Official Secrets Act. The intention is for this test to be re-used until 2018-06-30. This should be considered when determining the applicability of the Official Secrets Act.

NATIONAL TEST IN MATHEMATICS COURSE B
SPRING 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 19 problems. **Part I** consists of 10 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 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 44 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: 13 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 14 ”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.

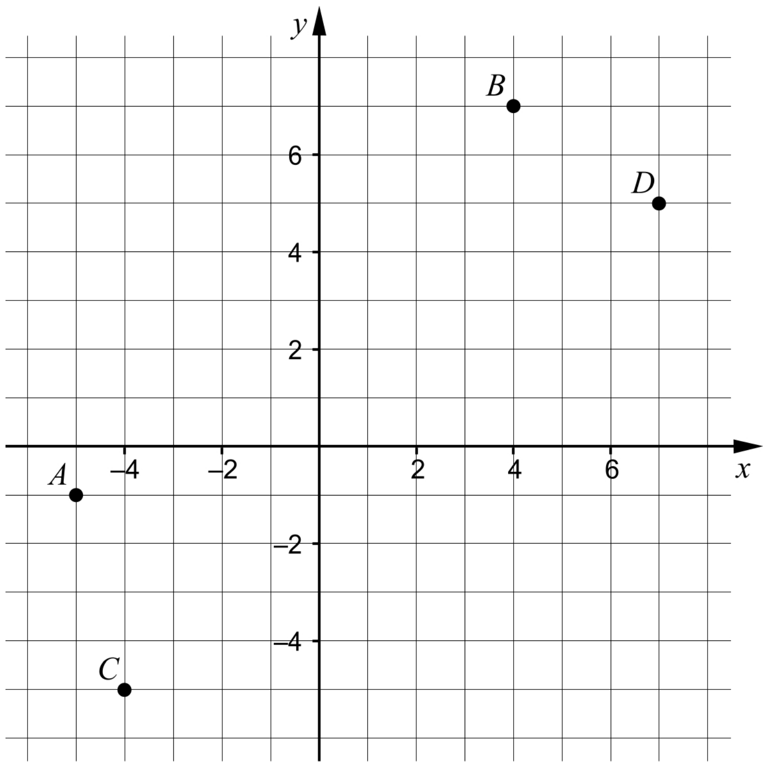
Part I

This part consists of 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. Solve the equation $x^2 + 4x - 32 = 0$ (2/0)

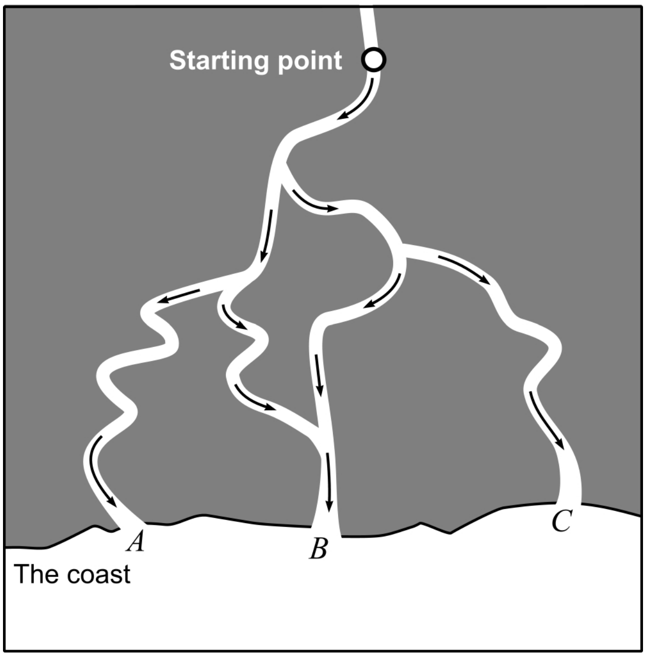
2. Solve the simultaneous equations $\begin{cases} 2x - y = -9 \\ 3x + 2y = 4 \end{cases}$ (2/0)

3. A line L_1 is drawn through the points A and B. Another line L_2 is drawn through the points C and D.



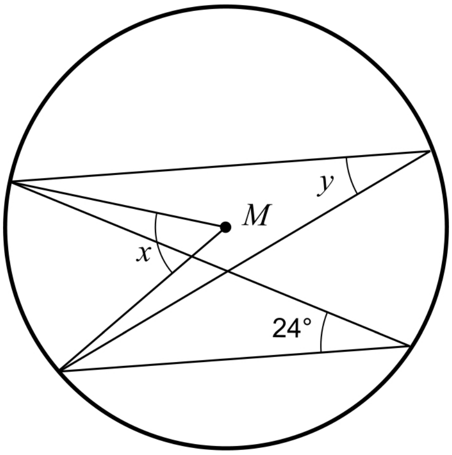
Are the lines L_1 and L_2 parallel? Justify your answer. (2/0)

4. Alicia and Benjamin are paddling down a river. They start at the starting point marked in the figure and paddle towards the coast. At each point where the river makes a branch they have to choose which way to go.



What is the probability that they end up in *B* if they make random choices at each branch? (2/0)

5. The figure shows a circle with centre *M*.

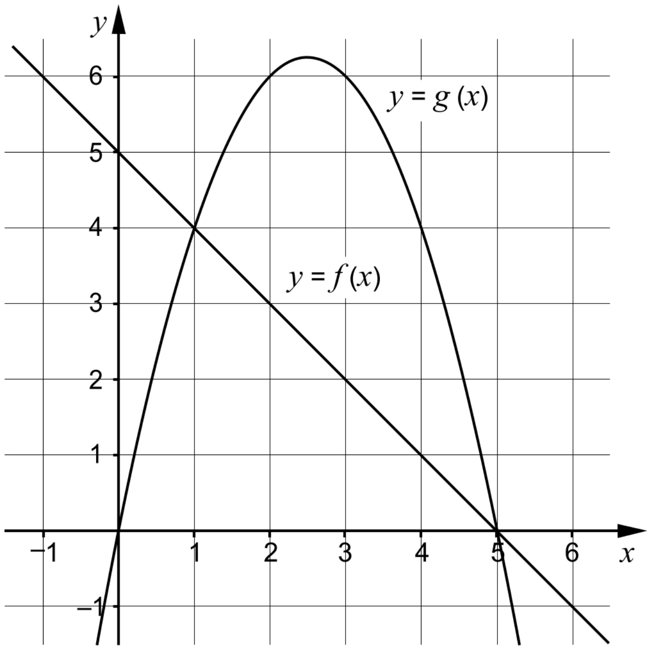


a) What is the size of angle *x*? *Only answer is reqiured* (1/0)

b) What is the size of angle *y*? *Only answer is reqiured* (1/0)

6. Simplify the expression $25+(x+5)(x-5)$ as far as possible. (1/0)

7. The figure shows the graphs of the functions f and g.



a) Determine $g(3)-f(3)$ *Only answer is required* (1/0)

b) For what values of x is $f(x)<g(x)$? *Only answer is required* (0/1)

8. Cecilia has been assigned the following problem in her mathematics book:

> Write numbers in the empty boxes so equality occurs:
>
> $(\square x-\square)^2=\square x^2-12x+\square$

Give an example of what Cecilia can write in the boxes so equality occurs.
Only answer is required (0/2)

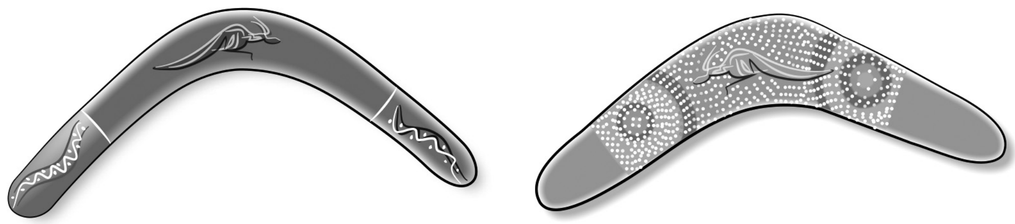
9. Dante and Elsa are discussing median and mean value.

Dante claims that:
”The mean value of three consecutive integers is always equal to the median of the numbers.”

Elsa replies:
”No, that’s not always true.”

Who is right, Dante or Elsa? Justify your answer. (0/1/¤)

10. The company Koori produces two different kinds of boomerangs, a traditional one and an exclusive variety.



The boomerangs are first hand carved and then painted. It takes three hours to carve a traditional boomerang and one hour to paint it. It takes four hours to carve an exclusive boomerang and three hours to paint it.

Over the course of a week they made a number of boomerangs so that at the end of the week all boomerangs in production were completed.
Those carving had worked a total of 150 hours and the painters a total of 100 hours.

How many boomerangs were produced during that week? (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.

11. Find the equation to the straight line that passes through the points (2, 26) and (7, 6). (2/0)

12. The price of a starter pack for a driving licence at a driving school is SEK 6 400. It includes theory and three driving lessons. The school also offers extra driving lessons at SEK 650 per lesson.

Felicia has saved SEK 12 000 for her driving education. She wants to know how many extra driving lessons she can afford with her savings. To get an answer to her speculation she writes down the following inequality:

$$6400 + 650x \leq 12000$$

a) Solve the inequality Felicia has written down. (1/0)

b) Help Felicia get an answer to her speculation by interpreting your solution to the inequality. (0/1)

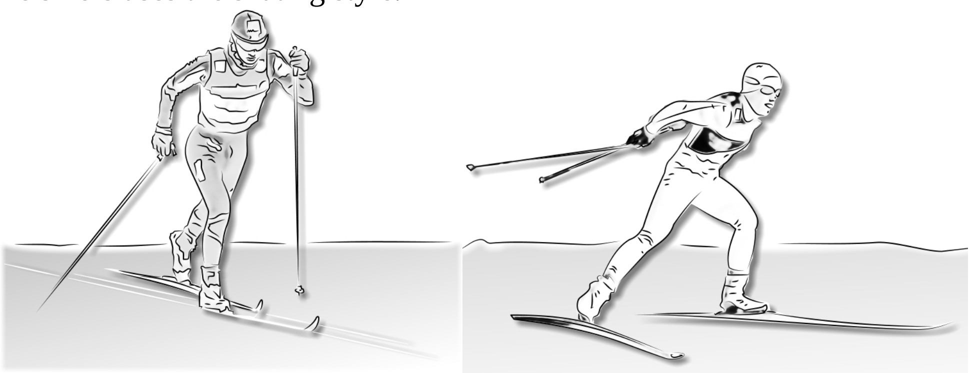
13. It holds for a quadratic function that:

- The function has a zero at $x = 4$
- The function has its largest value at $x = 1$

At what value of x can the second zero of the function be found?

Only answer is required (0/1)

14. Gustav often goes cross-country skiing. The county has a web camera placed by the ski trail where he goes skiing. Gustav visits the county web page and watches the web cast from the ski trail. He can see that some skiers use the skating style and some use the classic style. He decides to find out how large a proportion of the skiers uses the skating style.



Classic style *Skating style*

On ten different evenings he writes down the ski style of 20 consecutive skiers. He writes the results in a distribution table.

Date	Number of skiers	
	Classic style	Skating style
7 jan	𝍸 𝍸 𝍸	𝍸
9 jan	𝍸 𝍸 𝍷𝍷𝍷𝍷	𝍸 𝍷
12 jan	𝍸 𝍸 𝍸	𝍸
13 jan	𝍸 𝍷	𝍸 𝍸 𝍷𝍷𝍷𝍷
17 jan	𝍸 𝍸	𝍸 𝍸
19 jan	𝍸 𝍸 𝍷𝍷𝍷	𝍸 𝍷𝍷
20 jan	𝍸 𝍸 𝍷𝍷	𝍸 𝍷𝍷𝍷
23 jan	𝍸 𝍸 𝍷𝍷𝍷	𝍸 𝍷𝍷
26 jan	𝍸 𝍷𝍷𝍷𝍷	𝍸 𝍸 𝍷
28 jan	𝍸 𝍸 𝍷𝍷𝍷	𝍸 𝍷𝍷

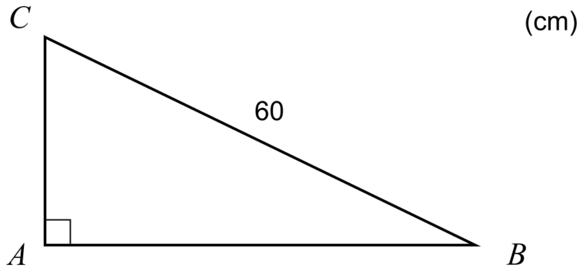
One day Gustav is on his way to the trail to ski.

a) Use Gustav’s table and calculate the probability that the first skier Gustav sees in the trail is a skating style skier. (1/0)

Out in the ski trail, Gustav notices that skiers with the same style sometimes ski in a group. He realizes that it might have affected the result of his investigation and that the method he used was not so good.

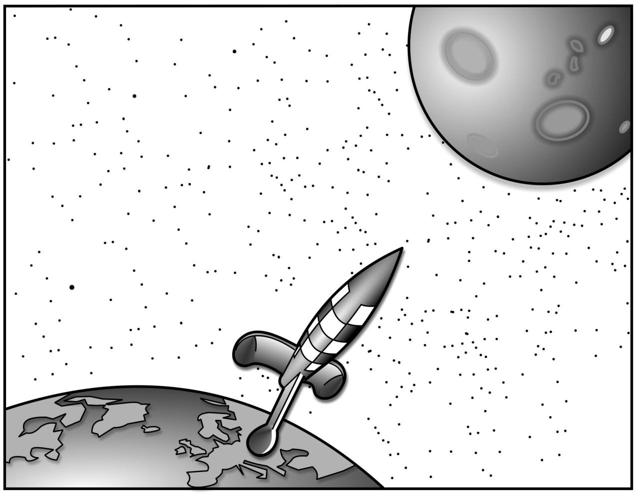
b) Suggest an improvement of the method in Gustav’s investigation. (0/1)

15. In the right-angled triangle *ABC*, the length of side *BC* is 60 cm, see figure.



Sides *AB* and *AC* have a total length of 82 cm.
Calculate the length of the shortest side of the triangle. (0/3)

16. Hugo and Ilona are going to perform a computer-simulation of a moon landing. They have one model each to describe the spacecraft's movement towards the surface of the moon from the moment the space craft starts its landing until it has landed on the moon.



Hugo uses the model $h(t) = \frac{t^2}{90} - \frac{20t}{3} + 1000$ where *h* is the height in metres above the surface of the moon and *t* is the time in seconds from the moment the spacecraft starts its landing.

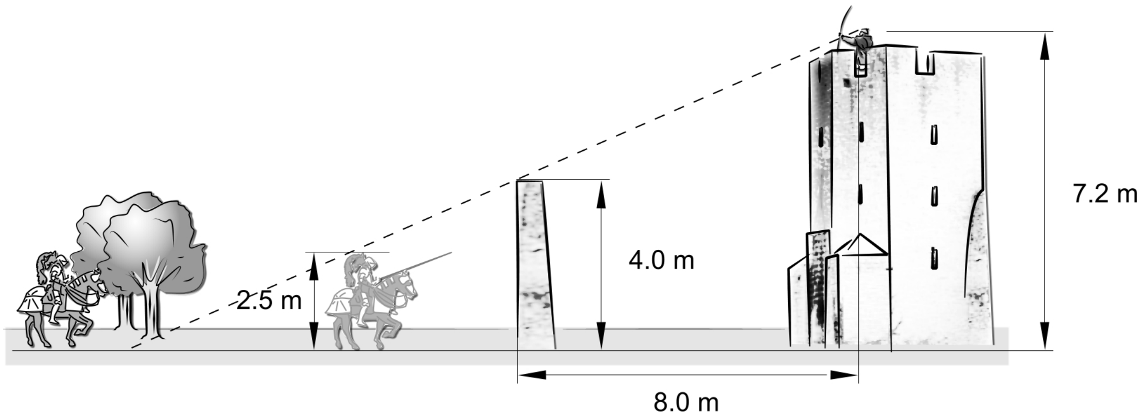
a) At what height above the moon does the spacecraft begin its landing according to Hugo's model? *Only answer required* (1/0)

b) Calculate $h(300)$ and interpret the result. (1/1)

Ilona uses the model $g(t) = 1000 - \frac{10t}{3}$ where *g* is the height in metres above the surface of the moon and *t* is the time in seconds from the moment the spacecraft begins its landing.

c) Compare and describe similarities and differences between the two models of how the spacecraft moves towards the surface of the moon. (0/2/¤)

17. The knight Sir Henric is hiding behind some trees. His plan is to enter the castle guarded by a guard in the tower. He must ride as quickly as possible towards the wall so that the guard cannot see him. At the wall, there is a secret passage that leads into the castle.

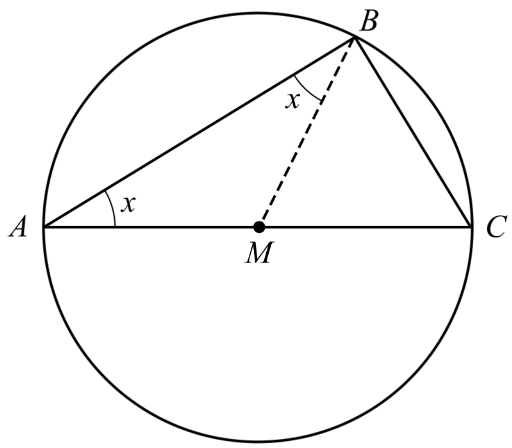


At what distance from the wall is Sir Henric out of sight for the guard? (0/3)

18. Thales of Miletus was a Greek mathematician who lived 2 600 years ago. He formulated the following theorem:

”Every triangle which is inscribed in a circle has a right angle if one of the triangle’s sides is a diameter of the circle”

The triangle *ABC* is inscribed in a circle in such a way. The side *AC* is a diameter of the circle. Point *M* is the centre of the side *AC*. In the figure the line segment *BM* has also been drawn.



a) Explain why the two angles x are of equal size. (1/0)

b) Show, without using the inscribed angle theorem*, that Thales’ theorem is correct. (0/1/¤)

* The inscribed angle theorem states that the measure of an inscribed angle in a circle equals one-half the measure of its intercepted arc.

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

19. 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*.

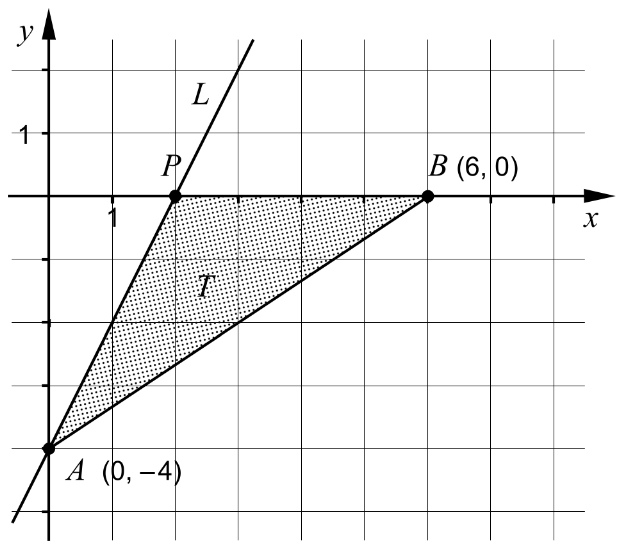
Your task is to investigate how the area *T* of the triangle depends on the gradient *k* of the line *L*.

- 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 how the area *T* of the triangle varies for different values of the gradient *k*.

- Determine a relationship for how the triangle's area *T* depends on the gradient of the line *k*.



(3/3/¤)