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NATIONAL TEST IN MATHEMATICS COURSE B

AUTUMN 2008

Directions

Test time	240 minutes for Part I and Part II together. We recommend that you spend no more than 90 minutes on Part I.						
Resources	<p>Part I: "Formulas for the National Test in Mathematics Course B" <i>Please note that calculators are not allowed in this part.</i></p> <p>Part II: Calculators, also symbolic calculators and "Formulas for the National Test in Mathematics Course B".</p>						
Test material	<p>The test material should be handed in together with your solutions.</p> <p>Write your name, the name of your education programme/adult education on all sheets of paper you hand in.</p> <p><i>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.</i></p>						
The test	<p>The test consists of a total of 17 problems. Part I consists of 10 problems and Part II consists of 7 problems.</p> <p>For some problems (where it says <i>Only answer is required</i>) 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.</p> <p>Problem 17 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.</p> <p>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.</p>						
Score and mark levels	<p>The maximum score is 43 points.</p> <p>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".</p> <p>Lower limit for the mark on the test</p> <table border="0" style="width: 100%;"> <tr> <td style="padding-right: 20px;">Pass:</td> <td>12 points</td> </tr> <tr> <td>Pass with distinction:</td> <td>25 points of which at least 6 "Pass with distinction"-points.</td> </tr> <tr> <td>Pass with special distinction:</td> <td>25 points of which at least 13 "Pass with distinction"-points. You also have to show most of the "Pass with special distinction" qualities that the \square-problems give the opportunity to show.</td> </tr> </table>	Pass:	12 points	Pass with distinction:	25 points of which at least 6 "Pass with distinction"-points.	Pass with special distinction:	25 points of which at least 13 "Pass with distinction"-points. You also have to show most of the "Pass with special distinction" qualities that the \square -problems give the opportunity to show.
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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 $x^2 - 4x + 3 = 0$ (2/0)

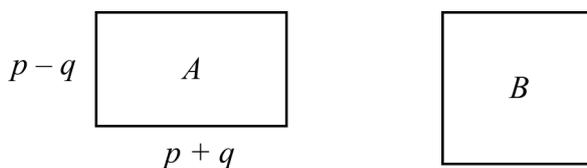
2. Find the equation for the straight line that passes through the points (1, 4) and (5, 8). (2/0)

3. Simplify the following expression as far as possible.

a) $(x + 4)^2 - 8x$ *Only answer is required* (1/0)

b) $x(x + 3) - 2x(3 + 4x)$ *Only answer is required* (1/0)

4.



Rectangle A and square B have the same size perimeter. Rectangle A has sides with lengths $p + q$ and $p - q$.

a) Write and simplify an expression for rectangle A 's area. (1/0)

b) Determine a simplified expression for square B 's area. (0/1)

5.



Axel is running an advertising campaign for a company and is handing out shirts. The shirts only come in the colours green, blue and pink. Axel spins a wheel to determine which colour shirt each person shall receive. The probability of getting each of the different colours green, blue and pink is the same. Alicia, Beatrice and Cecilia stand in line to receive a shirt.

- a) How great is the probability that Alicia will receive a pink shirt?
Only answer is required (1/0)
- b) How great is the probability that all three girls will receive a shirt of the same colour? (1/1)

6. A second degree curve intersects the x -axis where $x = 2$. It has a maximum point where $x = 5$
 For which additional value of x does the curve intersect the x -axis?
Only answer is required (1/0)

7. For a straight line $y = f(x)$ it is true that $f(3) - f(1) = 6$ and $f(0) = 5$
 Determine the equation of the straight line. (0/2)

8. In a right-angled triangle one side is 3.0 cm longer than the other side.
 The hypotenuse is in turn 3.0 cm longer than the longer of the other two sides.
 Calculate the length of the triangle's sides. (0/3)

9. In a mathematics textbook it states that:

”If the difference between two numbers is 1 then the difference between the square of the greater number and the square of the lesser number is always as great as the sum of the numbers.”

Show that this holds true for all such numbers.

(0/2/□)

10.



Magdalena goes to a pet shop to buy fish for her aquarium. She decides to buy two cichlids, a male and a female. The woman in the store catches two fish from an aquarium with 30 fish and says that it isn't possible to see which gender the fish are when they are small. That is why Magdalena does not know whether she has gotten both a male and a female.

When she gets home she starts to think about how many fish she would have to have bought in order to, with 90 %, certainty get at least one cichlid pair (a female and a male).

She makes some calculations where she assumes that there are as many females as males in the shop's aquarium when she buys her fish.

Calculation model 1

$$\begin{aligned} \text{males} & 0.5^4 \\ \text{females} & 0.5^4 \\ 1 - 0.5^4 - 0.5^4 & = \\ & = 0.875 \end{aligned}$$

Calculation model 2

$$\begin{aligned} \text{males} & \frac{15}{30} \cdot \frac{14}{29} \cdot \frac{13}{28} \cdot \frac{12}{27} \\ \text{females} & \frac{15}{30} \cdot \frac{14}{29} \cdot \frac{13}{28} \cdot \frac{12}{27} \\ 1 - \frac{15}{30} \cdot \frac{14}{29} \cdot \frac{13}{28} \cdot \frac{12}{27} - \frac{15}{30} \cdot \frac{14}{29} \cdot \frac{13}{28} \cdot \frac{12}{27} & \approx \\ & \approx 0.900 \end{aligned}$$

Describe how Magdalena can have reasoned when she set up her calculation models.

State which calculation model is correct based on her assumption and justify why.

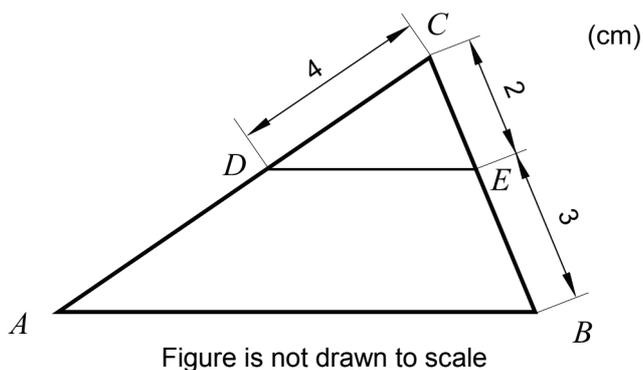
(0/2/□)

Part II

This part consists of 7 problems and you may use a calculator when solving them.
Please note that you may begin working on Part II without a calculator.

11. In the triangle ABC the line DE is parallel with the side AB .

Determine the length of the line AD .



(2/0)

- 12.

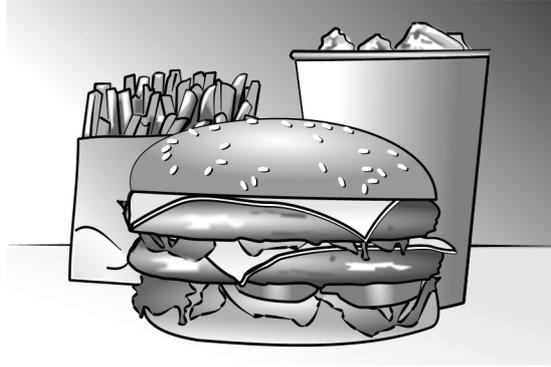


Niklas' grandmother has promised that she will buy a bicycle for him that is just as good as his friends' bikes. To be able to compare bicycles, Niklas asks his friends how much their bicycles cost. He received the following answers:

SEK12100 SEK4150 SEK850 SEK2300 SEK4150 SEK1200 SEK3500

- a) Determine the range for the bicycle prices. *Only answer is required* (1/0)
- b) Niklas will convince his grandmother to buy as expensive a bicycle as possible.
Which of the measures of central tendency; mean, median or mode is then the best choice, tactically? Justify your answer. (2/0)

13.



Emma is going to eat hamburgers with her mother, father and little sister. They order 2 value meals and 2 children's meals. For this, they pay SEK182. Standing behind them in line is Johannes with his 3 boys. He orders 1 value meal and 3 children's meals and pays SEK155.

What do the value meals and the children's meal cost, respectively? (3/0)

14. Lukas throws a stone diagonally up in the air from a bridge. The stone's height y metres over the water is given by the equation $y = 15 + 10t - 5t^2$ where t is the time in seconds after the stone has been thrown.

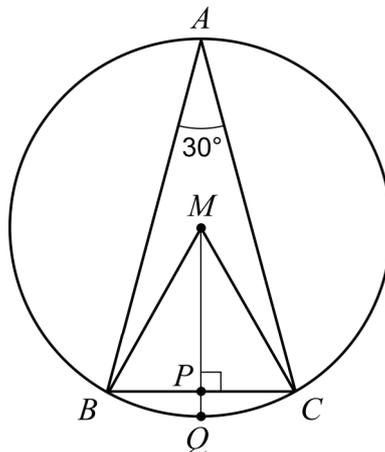
a) How high over the surface of the water is the stone when it leaves Lukas' hand?

Only answer is required (1/0)

b) How much time does it take before the stone hits the surface of the water? (0/1)

c) Calculate the stone's maximum height above the surface of the water. (0/1)

15. In the figure below, M is the circle's centre.
Determine the distance PQ when $BC = 4.0$ cm.



(1/2)

16. Study the system of equations $\begin{cases} y = 2x + 3 \\ y = kx + m \end{cases}$ where k and m are constants.

Explain how the value of k and the value of m affects the number of solutions for the system of equations. (0/2/□)

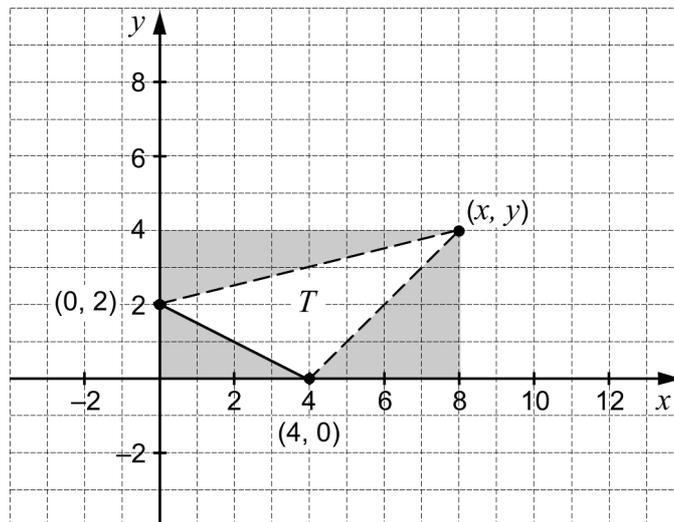
When assessing your work with the following problem your teacher will take into consideration:

- How close you come to a general solution
- How well you justify your conclusions
- How well you carry out your calculations
- How well you present your work
- How well you use the mathematical language and expressions

17. In this task you shall investigate where the third corner in a triangle can be placed so that the area will have a certain size. Two of the triangle's corners are always placed at points $(0, 2)$ and $(4, 0)$. The third corner is placed at point (x, y) . The point (x, y) lies in the first quadrant.

In triangle T below, the third corner is placed at point $(8, 4)$.

- Show that the triangle has an area of 12 units.



Now let the coordinates for the third corner vary.

- Investigate and describe where the third corner can be placed to get a triangle with an area of 12 units.

(2/4/□)