This material is confidential until the end of November 1997.

Directions

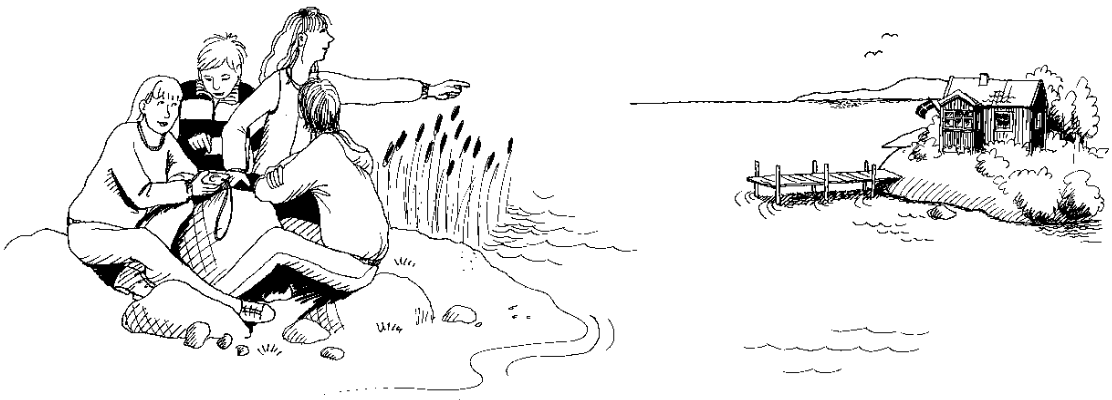
Test period	May 12 - June 2 1997.
Test time	180 minutes without a break.
Resources	Calculator (not symbolic computation) and table of formulas.
Test material	Test material should be handed in together with your solutions.
	Write your name, gymnasium programme/adult education and date of birth on all the papers you hand in.
Test	The test is made up of 13 questions.
	Most ot the problems are of long-answer type. With these problems, it is not enough to give a short answer, it requires: • that you write down what you do • that you explain your train of thought • that you draw figures when needed • that you show how you use your calculator in numerical and graphical problem solving.
	For some exercises, (where it says ”*Only an answer is required*”) only the answer needs to be given.
	Try all of the problems. It can be relatively easy, even towards the end of the test, to earn some points for a partial solution or presentation.
The grading levels	The teacher responsible will explain the grade which are required for ”Passed” and ”Passed with Distinction”. On the test one can attain a maximum of 47 points.

1. Find the indefinite integral $F(x)$ for the function $f(x) = 3x^2 + 2x - 3$ if $F(1) = 4$. (2p)

2. Give an expression representing the area between the curve $y = 4x - x^2$ and the x-axis. Calculate the area. (2p)

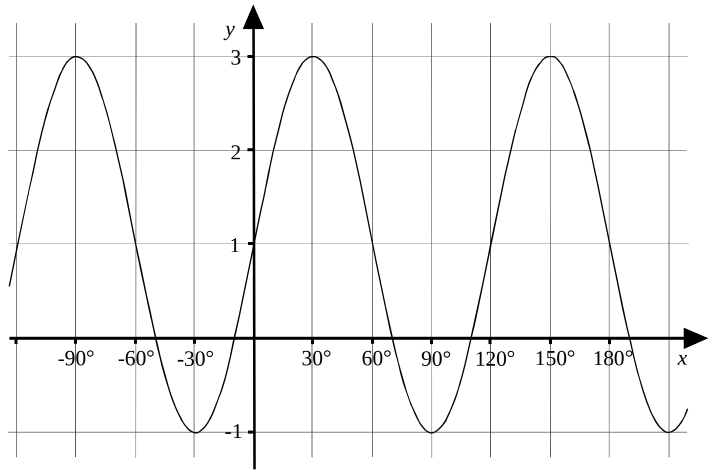
3. The integral $\int_1^2 x(x-3)dx$ has the value $-\frac{13}{6}$. Verify this answer using an indefinite integral. (3p)

4. Some teenagers sat on a stone, *S*, on the beach and looked at a bridge, *Ö*, on an island far out in the bay. They decided to use their mathematical kowledge to calculate the distance between the stone and the bridge. They measured a distance *SP*, 100 m long, along the beach. After the measurement they estimated the angles *SPÖ* and *PSÖ* using a compass. The angles *SPÖ* and *PSÖ* were 30° and 135° each. What did they found out? (3p)



5. Simplify $f(x) + f''(x)$ for the function $f(x) = 4\sin 3x - 5\cos x$ (3p)

6. The diagram shows the graph of the function $y = A\sin kx + b$
Find the constants *A*, *k* and *b*. *(Only answer is required)* (3p)



7. Determine if $y = x(\ln x - 1)$ is a solution of the differential equation

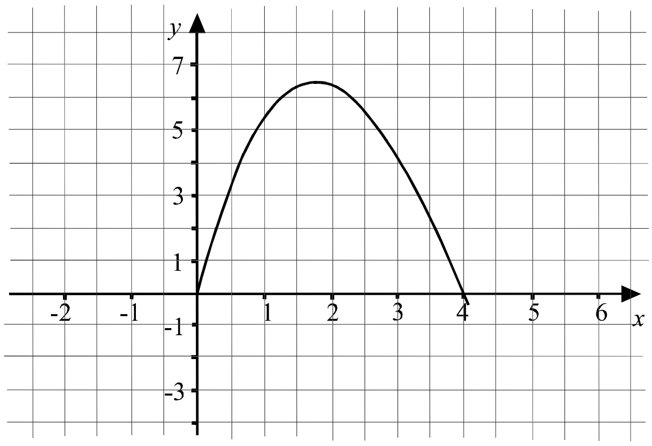
$y' = \dfrac{y}{x} + 1$ for $x > 0$. (3p)

8. In the figure to the right, the graph of the function $y = f(x)$ is sketched.

One of the following alternatives

28, 24, 17, 12 and 6.3

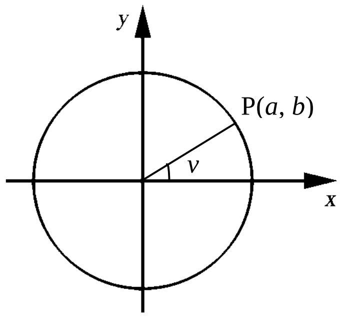
is the correct value of the integral $\int_0^4 f(x)dx$.



a) Indicate which one of the above values is correct.
(Only answer is required) (1p)

b) Explain your choice in a). (2p)

9. The point P in a unit circle has the coordinates (a, b) (see figure to the right).
Make a new figure and indicate where the angles $v + 180^\circ$ and $v + 270^\circ$ are situated on the unit circle.



Give the following trigonometric expressions in another way using the coordinates of the point P.

a) $\sin(v + 180^\circ)$

b) $\cos(v + 270^\circ)$

(3p)

10. Find the area of the region bounded by the curve $y = \sqrt{2x+3}$, the line $y = x$ and the x-axis. Express your answer in exact form. (4p)

11. a) Show that the equation $\dfrac{2\sin 2x}{1-\sin^2 x} = 5$ can be written as $\tan x = 1.25$. (2p)

b) Solve the equation $\tan x = 1.25$ completely. (2p)

12. An electric engineer has programmed an automatic switch. The program follows a mathematical model which indicates the moment, *M*, during the day when it begins to get dark in a certain village:

$$M = 19 - 4\cos\left(\frac{\pi(360 - t)}{180}\right)$$

where *M* is the time in hours (*M* = 12.5 corresponds to 12:30) and *t* is the time in days (*t* = 1 corresponds to January the first). The model works provided that each month is assumed to be 30 days long.

Find according to the model:

a) at what time of the day it gets dark in the middle of April, (2p)
b) for which months, are there days, when the darkness arrives at 6 p.m.(18:00), (3p)
c) at which times of the year, the change from sunshine to darkness is the fastest. (3p)

13. The curve $y = 4.5 \cdot e^{0.25x}$ and the line $y = 12 - x$ enclose together with the *x*-axis and the *y*-axis an area. When this area is rotated about the *x*-axis, it generates a volume of revolution. Give a good approximation of this. (6p)