This material is confidential until the end of Januari 1999.

Directions

Test period	December 8 – December 17 1998.
Test time	180 minutes without a break.
Resources	Calculator and formula sheet. A formula sheet is attached to the test.
Test material	The test material should be handed in with your solutions.
	Write your name, gymnasium programme/adult education and date of birth on the papers you hand in.
The test	The test is made up of 15 problems.

Most of the problems are of the *long-answer type*, where a short answer is not sufficient, but it is required

- that you write down what you do
- that you explain your train of thought
- that you draw figures when necessary
- that you show how you have used your resources when you have solved problems numerically/graphically.

Some of the problems (where it is stated *Only an answer is required)* need only an answer.

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 score levels	The teacher responsible will inform you about the scores required for "Passed" and "Passed with Distinction". The maximum score is 40 points

1. Solve the equation $x^2 - 4x - 5 = 0$ (2p)

2. Solve the simultaneous equations $\begin{cases} x + y = 23 \\ 3x + 6y = 96 \end{cases}$ (2p)

3. For a quadratic function it holds that

- the graph of the function cuts the *x*-axis at $x = -2$ and $x = 4$
- the x^2 - term is negative

a) Draw a system of co-ordinates and mark in the points where the graph cuts the *x*-axis. *Only an answer is required* (1p)

b) For what *x*-value does the function have a maximum or a minimum value? *Only an answer is required* (1p)

c) In the system of co-ordinates, sketch how the graph to the function might look. *Only an answer is required* (1p)

4. In the science fiction series *Star Trek the Next Generation*, captain Picard and chief engineer La Forge become shut up in a room with nuclear radiation. When La Forge reads off his measuring instrument, they have already acquired a radiation dose of 93 rad. The radiation dose increases by 4 rad/minute. A radiation dose of 350 rad is lethal.
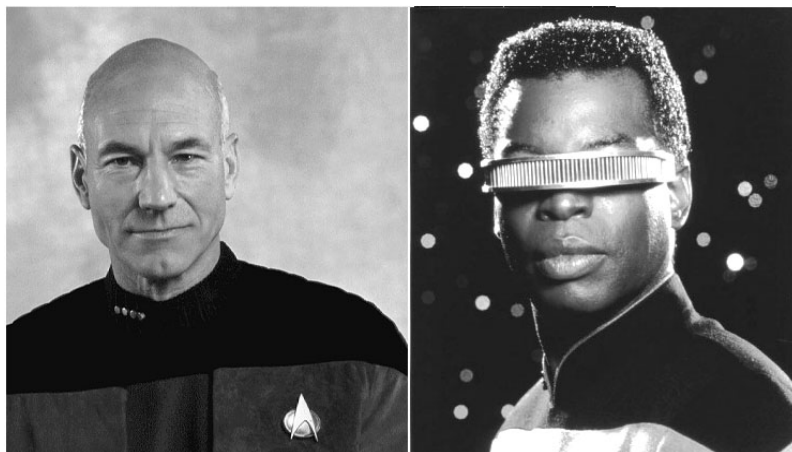
a) Write down an expression which describes the radiation dose *y* rad as a function of the time *x* minutes. The time is counted from the moment when La Forge reads off his measuring instrument. *Only an answer is required* (1p)

b) How long time does the two heroes have to get out of the room? (2p)

5. Solve the equation $(n-3)^2 = 2n+9$ (2p)

6. The point (2, 3) lies on a straight line that has gradient $k = 4$.

Find the co-ordinates for another point on the line. (2p)

7. Ulla goes by car to school every morning. On her way she passes two traffic lights which, in her opinion, always show red light.

The first traffic light shows red light for 68 seconds and something else than red light for 34 seconds.

The second traffic light shows red light for 78 seconds and something else than red light for 32 seconds.
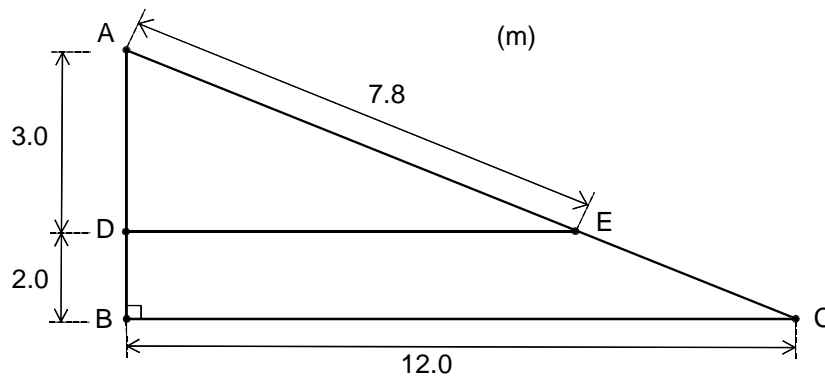
The traffic lights change independently of each other.

a) What is the probability that she gets red light at the first traffic light? (1p)

b) What is the probability that she gets red lights at both traffic lights? (2p)

8. In the triangle ABC below, side DE is parallel to side BC.

Calculate the length of the distance EC **in two different ways.** (3p)

9. Your class-mate has solved the inequality $3x + 2 > 6x - 4$ (see below).
He has been told that he has not solved it correctly, but he cannot find the error in his solution.

$3x + 2 > 6x - 4$

$3x - 6x > -2 - 4$

$-3x > -6$

$3x > 6$

$x > 2$

Help him by telling him where he has made a mistake and describe how he can correct it. (2p)

10. At ice-hockey matches at Globen in Stockholm, anyone who wants to can buy a match programme for 25 SEK. At the end of the game prizes are raffled and the match programmes are the raffle tickets.

At a match between Djurgården and Brynäs, three cruises to Helsinki were raffled.

Calculate the probability that you win one if these cruises if you buy a match programme.
You have to make up the information you need to be able to carry out your calculations. (2p)

11. Åsa and Torbjörn work at a summer camp. The children at the camp are served medium-fat milk (1,5% fat) to the meals. One day, they receive a wrong delivery that contained only low-fat milk (0,5% fat) and ordinary milk (3% fat). Therefore, they decide to mix the two types of milk. Åsa writes the following on a note:

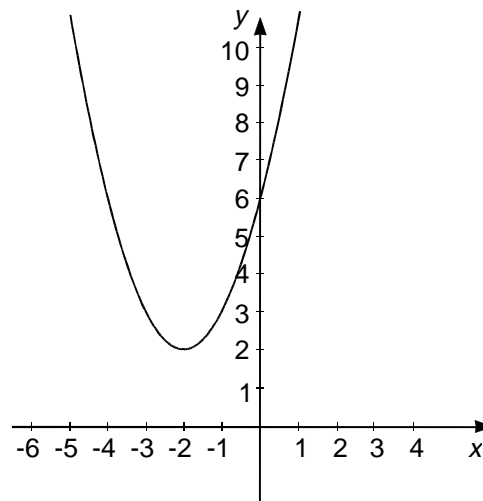> a litres of low-fat milk and b litres of ordinary milk
>
> $a + b = 10$ (1)
> $0.005a + 0.03b = 0.015 \cdot 10$ (2)

a) Explain what equation (1) describes. (1p)

b) Explain what equation (2) describes. (1p)

c) How much milk of each type do they intend to mix? (2p)

12. You are going to solve the equation $x^2 + 4x + 6 = 0$

You choose to do a graphical solution and you draw the graph to the function $y = x^2 + 4x + 6$ as is shown in the figure.
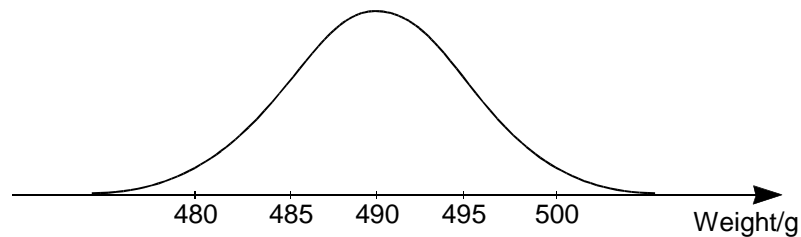

What information does the graph give about the solution to the equation $x^2 + 4x + 6 = 0$?
How can you see that from the diagram? (2p)

13. According to the declaration of ingredients, one tin of Misse cat food contains 500 g. A survey shows that the weight is normally distributed around the mean value 490 g and that the standard deviation is 5 g according to the diagram below.
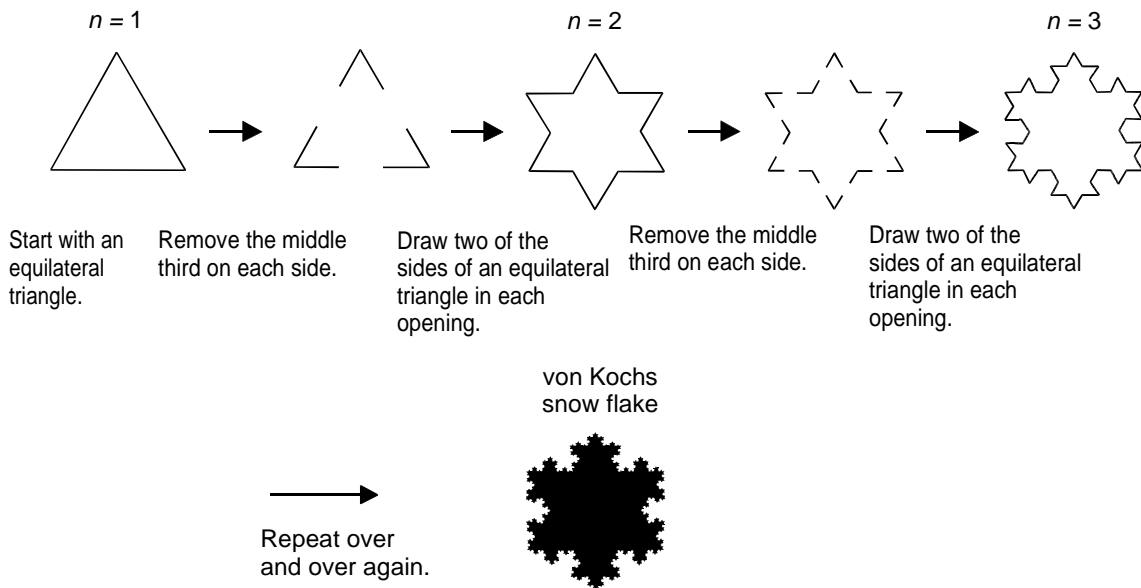

a)   A supermarket buys 3000 tins of Misse cat food.

How many of these tins can be expected to contain at least the 500 g of cat food that is stated on the tin?   (2p)

b)   In the survey, the mean value is 490 g. Suppose that the standard deviation would be greater than 5 g.

Explain in words how the distribution of the weights of the tins and thereby also the look of the graph changes by the changed standard deviation.
Also, sketch the two graphs with standard deviation 5g respectively greater than 5 g **in one single diagram.**   (2p)
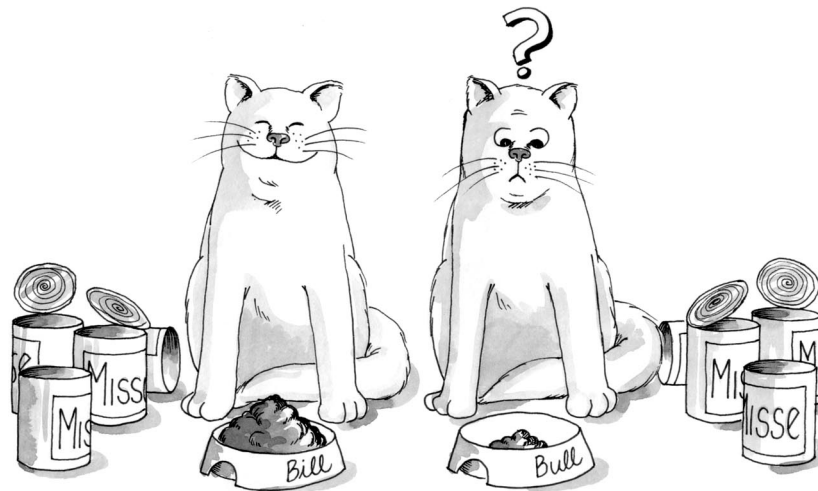
14. Within the part of mathematics that is called chaos theory, fractals are used to describe shapes in nature, for example thunderclouds, littorals and fern-leafs. von Koch's snow flake is a fractal. It can be drawn in the following way:

| $n = 1$ | $n = 2$ | $n = 3$ |

Start with an equilateral triangle.

Remove the middle third on each side.

Draw two of the sides of an equilateral triangle in each opening.

Remove the middle third on each side.

Draw two of the sides of an equilateral triangle in each opening.

Repeat over and over again.

von Kochs snow flake

A functional expression of the sum of the angles $f(n)$ degrees in the figures that are formed in this procedure is $f(n) = 540 \cdot 4^{n-1} - 360$.

a) Use the functional expression to calculate the sum of the angles $f(3)$. (1p)

b) By means of the functional expression the sum of the angles for the figure, when $n = 2$, can be calculated to $1800°$.

Use the figure and explain, as thoroughly as you can, that this sum of angles is correct. (2p)

15.
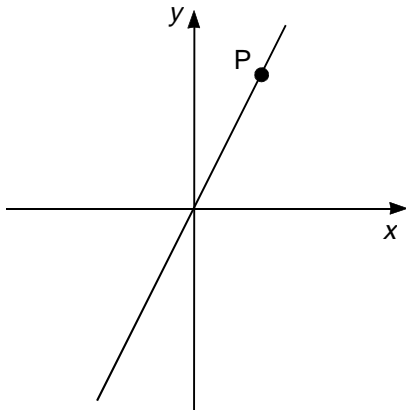
On the line $y = 2x$, there is a point P. The distance from P to the origin is 24 units of length.

Find the x-co-ordinate of the point P, $x > 0$. (3p)