Part D	Problems 18-25 which require complete solutions.
Test time	120 minutes.
Resources	Digital resources, formula sheet and ruler.

Level requirements

The test consists of three written parts (Part B, Part C and Part D). Together they give a total of 57 points consisting of 20 E-, 20 C- and 17 A-points.

Level requirements for test grades
E: 14 points
D: 22 points of which 6 points on at least C-level
C: 28 points of which 11 points on at least C-level
B: 37 points of which 5 points on A-level
A: 44 points of which 9 points on A-level

The number of points you can get for a complete solution is stated after each problem. You can also see what knowledge levels (E, C and A) you can show in each problem. For example (3/2/1) means that a correct solution gives 3 E-, 2 C- and 1 A-point.

For problems labelled "*Only answer is required* " you only have to give a short answer. For other problems you are required to present your solutions, explain and justify your train of thought and, where necessary, draw figures and show how you use your digital resources.

Write your name, date of birth and educational programme on all the sheets you hand in.

Name: _____

Date of birth: _____

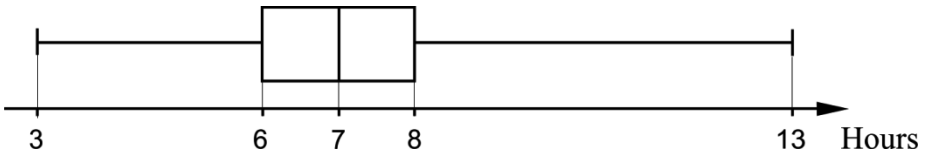
Educational programme: _____

Part D: Digital resources are allowed. Do your solutions on separate sheets of paper.

18. A straight line passes through the points (0, 0) and (3, 6.45). Another line has the equation $y = 2.15x + 3$. Show that the lines are parallel. (2/0/0)

19. It holds for the function f that $f(x) = x^2 - 4x + C$, where C is a constant. The point (5, 7) lies on the graph of the function. Determine the coordinates of another point that also lies on the graph. (2/0/0)

20. The box plot shows the results of a random sample. The random sample states the number of hours a person slept per night during a period of 15 nights.



The values of the random sample below are arranged in order of size. Two values have been replaced by x and y respectively.

x, 5, 6, 6, 7, 7, 7, y, 8, 8, 8, 8, 9, 9, 13

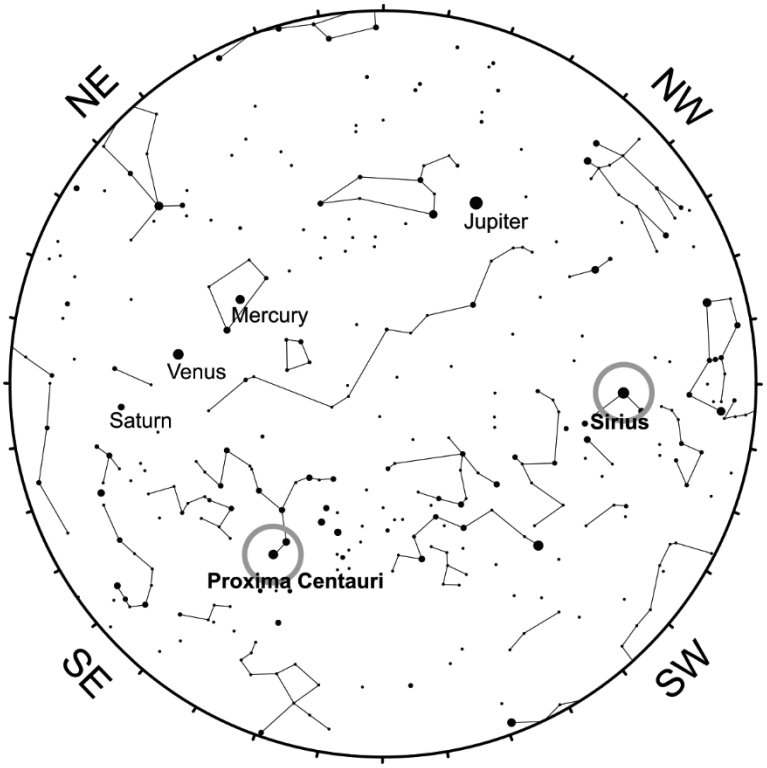
What are the values of x and y? Justify your answer. (2/0/0)

21. The magnitude M is a measure of the brightness of a star and can be calculated with the formula

$$M - 5 = a - 5\lg\left(\frac{r}{3 \cdot 10^{16}}\right)$$

where r is the distance in metres from the Earth to the star and a is a constant for a specific star, see table below.

Name of star	M	a	r
The sun	4.80	−26.7	$1.50 \cdot 10^{11}$
Sirius A		−1.46	$8.14 \cdot 10^{16}$
Proxima Centauri	15.5	11.1	



a) Calculate the magnitude M of the star Sirius A. (2/0/0)

b) Calculate the distance r to the star Proxima Centauri. (0/2/0)

22. The very first model of a computer from a well-known computer company was sold in 2013 and the following could be read in a news item:

> The price of the computer has had a thousandfold increase since it was originally sold in 1976. It was made by hand by the two founders of the company, the leader Steve Jobs and the programmer Steve Wozniak, in Jobs' garage.[1]

According to the news item, the computer was sold in 2013 at a price that was a thousand times as high as the price in 1976. Assume that the percentage increase has been the same every year.

Calculate the yearly percentage increase in price between the years 1976 and 2013 for the computer. (0/3/0)

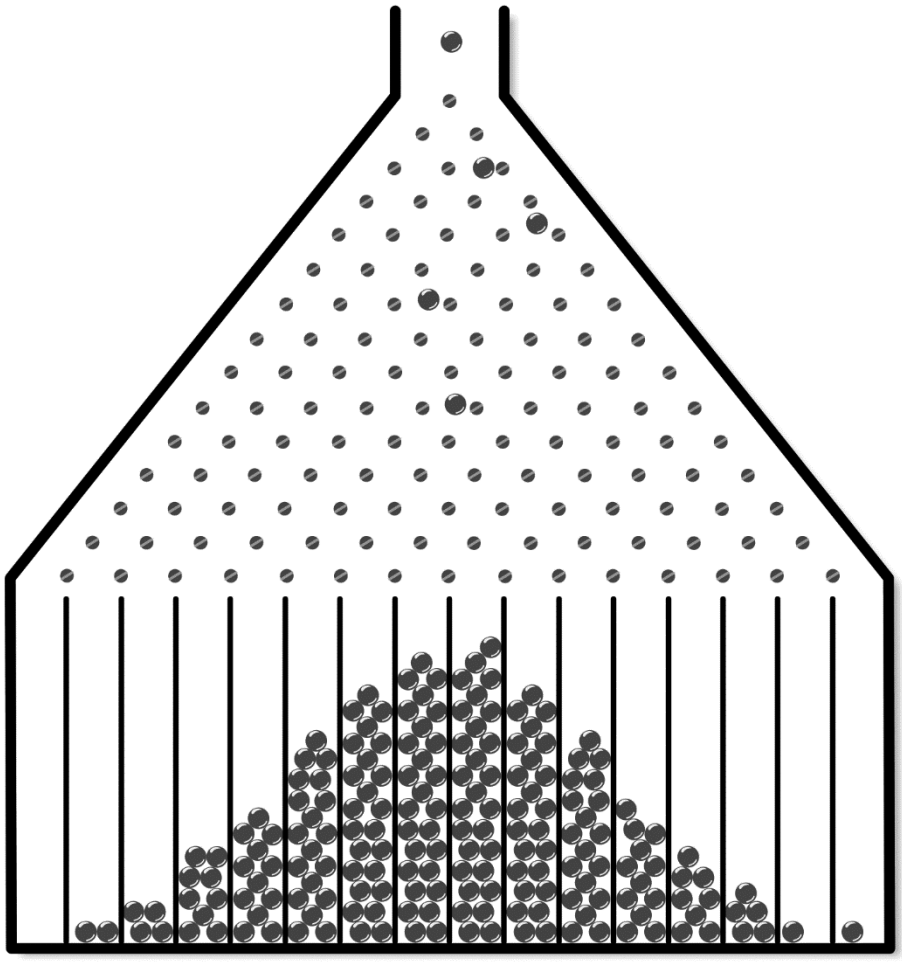
23. It holds for a function f where $f(x) = kx + m$ that

- $f(x+2) - f(x) = 3$
- $f(4) = 2m$

Find the function f. (0/0/2)

[1] TT May 26 2013

24. A Galton board is a device used to illustrate the normal distribution. Balls are dropped and change direction by passing a number of pins. The balls are collected in different bins and the number of balls in the bins is approximately normally distributed around the centre of the board. See figure.



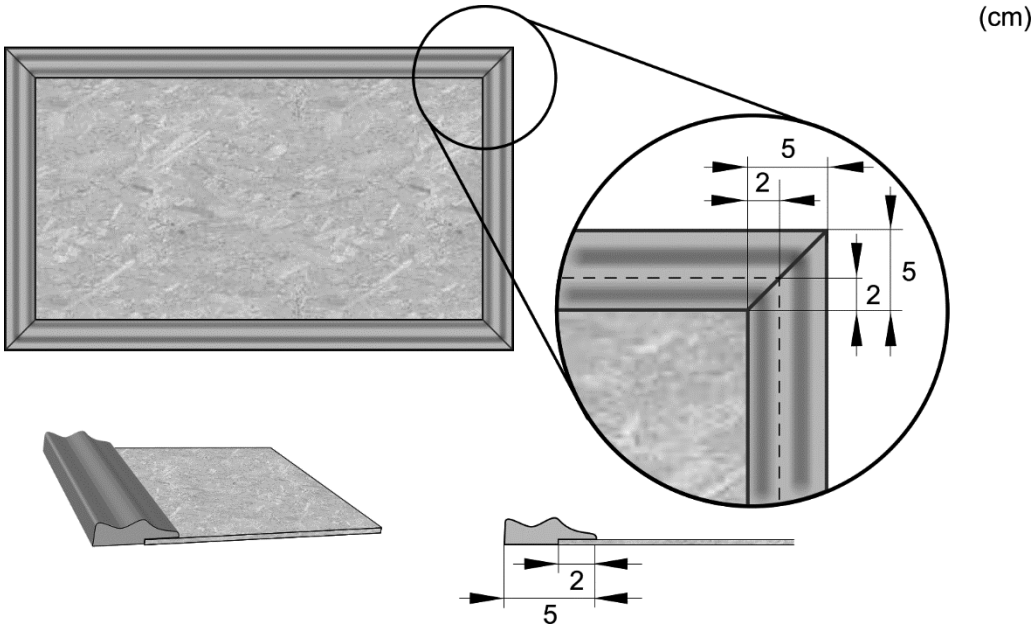
Bin no 1 2 3 4 5 6 7 8 ... ...

In one experiment, 1478 balls were dropped onto the Galton board with 16 bins. 136 balls were collected in bin 6, 223 balls in bin 7 and 281 balls in bin 8.

How many balls should have been collected in bin 5? (0/0/2)

25. A company manufactures notice boards of different sizes. Each notice board consists of a rectangular plate surrounded by a frame. The frame consists of four parts which are sawn from a 5 cm wide strip of wood. The edges of the parts are sawn at an angle of $45°$ and the look of the strip of wood only makes it possible to mount the parts in one way. The frame is mounted so that it overlaps the front of the plate with 2 cm. See figure.

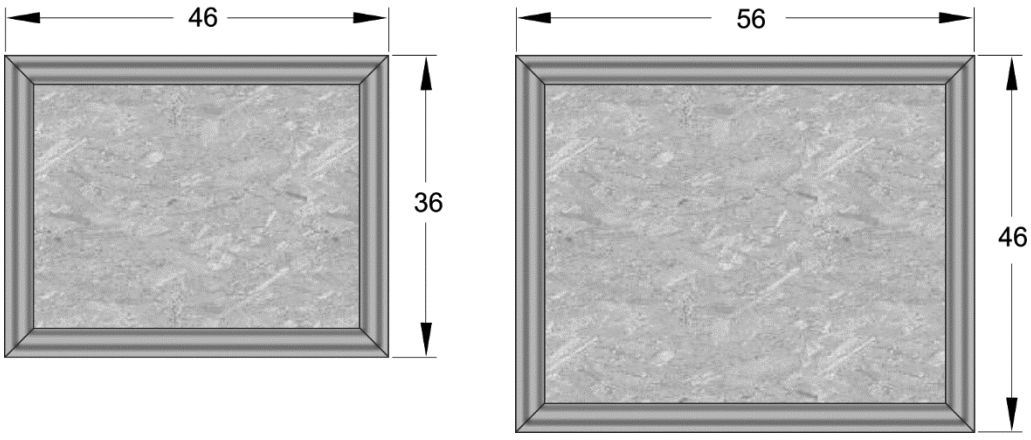
(cm)



The material cost of a notice board depends on the area of the plate and the length of the strip of wood. The price of the plate is in SEK/m^2 and for the strip of wood SEK/m.

The material cost for a notice board that is 36 cm wide and 46 cm long is SEK 59. The material cost for a notice board that is 46 cm wide and 56 cm long is SEK 81. See figure.

(cm)



Write down a general expression for the total material cost of a notice board that is a m wide and b m long. (0/0/4)