

Part D	Problems 15-22 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 55 points consisting of 22 E-, 19 C- and 14 A-points.

Level requirements for test grades

E: 13 points

D: 22 points of which 6 points on at least C-level

C: 29 points of which 11 points on at least C-level

B: 37 points of which 4 points on A-level

A: 44 points of which 7 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.

15. 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)

16. 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)

17. Yamal is going to buy 100 fish for his new aquarium. He wants to buy blue tetras, fantail goldfish and cichlids, see pictures.



Blue tetra



Fantail goldfish



Cichlid

The price of a blue tetra is SEK 10 /piece, a fantail goldfish is SEK 50/piece and a cichlid SEK 200/piece. Yamal considers whether it is possible to buy a total of 100 fish at a cost of exactly SEK 3000, if 4 of the 100 fish he buys are cichlids.

Yamal writes down the following simultaneous equations:

$$\begin{cases} 4 + x + y = 100 \\ 800 + 50x + 10y = 3000 \end{cases}$$

a) Explain what y represents in the simultaneous equations. *Only answer is required* (1/0/0)

b) How many blue tetras and fantail goldfish can Yamal buy if he buys 4 cichlids and as a total he is going to buy 100 fish at a cost of SEK 3000? (2/0/0)

18. Julia has been given the task of writing a logic symbol between the equations $x = 2$ and $x^2 = 4$ in order to get a true statement. She incorrectly chooses to write a material equivalence between the equations.

Which logic symbol should Julia use instead? Justify your answer. (0/2/0)

19. The Beaufort Scale is a measure of wind speed created at the beginning of the 19th century by Sir Francis Beaufort. Each step on the scale is represented by an integer, the so-called Beaufort number. The table below shows wind speed, description and sea conditions for some Beaufort numbers.

Beaufort number	Wind speed (m/s)	Description	Sea conditions
0	0 – 0.2	Calm	Flat
1	0.3 – 1.5	Light air	Ripples without crests
2	1.6 – 3.3	Light breeze	Small wavelets. Crests of glassy appearance, not breaking.
3	3.4 – 5.4	Gentle breeze	Crests begin to break, scattered whitecaps
...			
12	32.7 –	Hurricane force	Large objects are hurled about, windows break, boats are washed up on shore

The relation between wind speed v m/s and the Beaufort number B is given by the formula

$$v = 0.8365 \cdot B^{\frac{3}{2}}$$

The storm Hilde struck large parts of Sweden on November 16, 2013. The highest wind speed was measured to 29 m/s.

- a) When calculating B the value is rounded to an integer.
Calculate the Beaufort number B for the wind speed 29 m/s. (2/0/0)

For extreme wind forces, there are other scales. One of them is the TORRO scale, used for wind forces up to 130 m/s. The relation between wind speed v m/s and the number T according to the TORRO scale is given by the formula

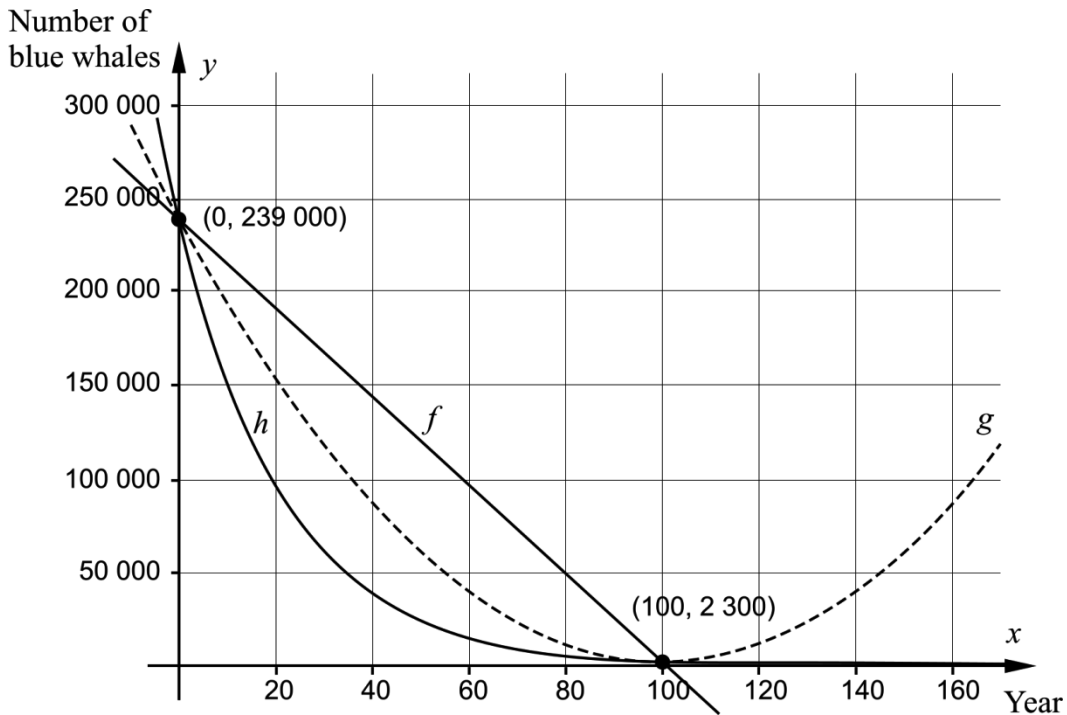
$$v = 0.8365 \cdot \sqrt[3]{8} \cdot (T + 4)^{\frac{3}{2}} \text{ where } T \text{ is rounded to an integer.}$$

- b) Write down a formula for B expressed in T . Simplify as far as possible. (0/1/1)

20. The largest animal that has ever existed on earth is the blue whale. Over the last hundred years, the number of blue whales has decreased drastically due to hunting.

In the year 1900, there were approximately 239 000 blue whales in the oceans, and a hundred years later, the number of blue whales was approximately 2 300.

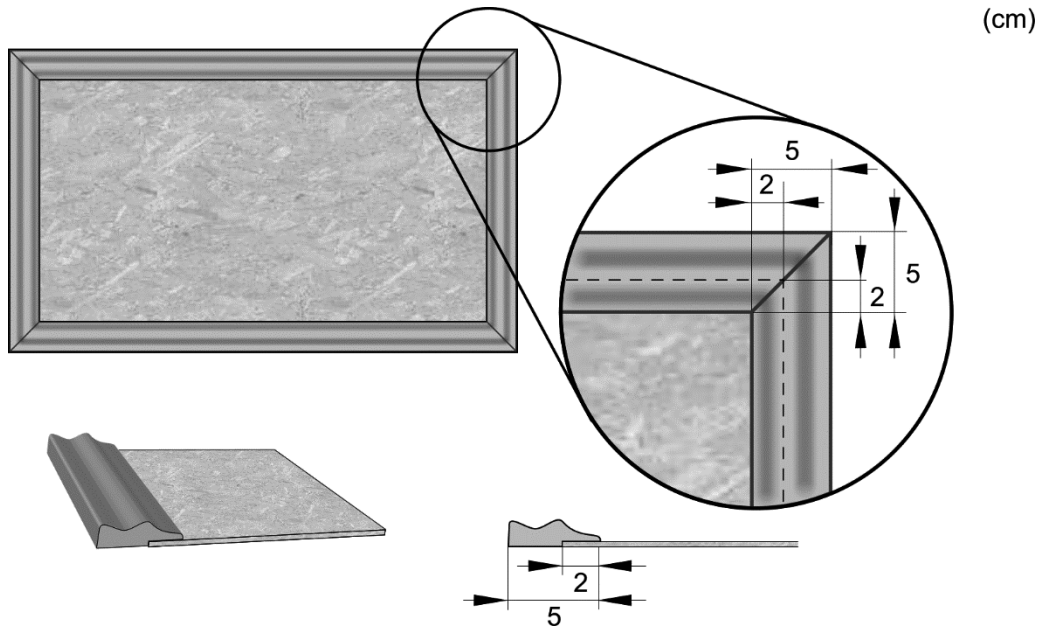
The figure shows the graphs of three functions, f , g and h where $y = f(x)$, $y = g(x)$ and $y = h(x)$. The three functions represent three different models of how the number of blue whales might have decreased in the 20th century. y is the number of blue whales and x is the number of years from the year 1900.



Assume that the yearly percentage change in the number of blue whales was constant during the 20th century and continues to be constant during the 21st century.

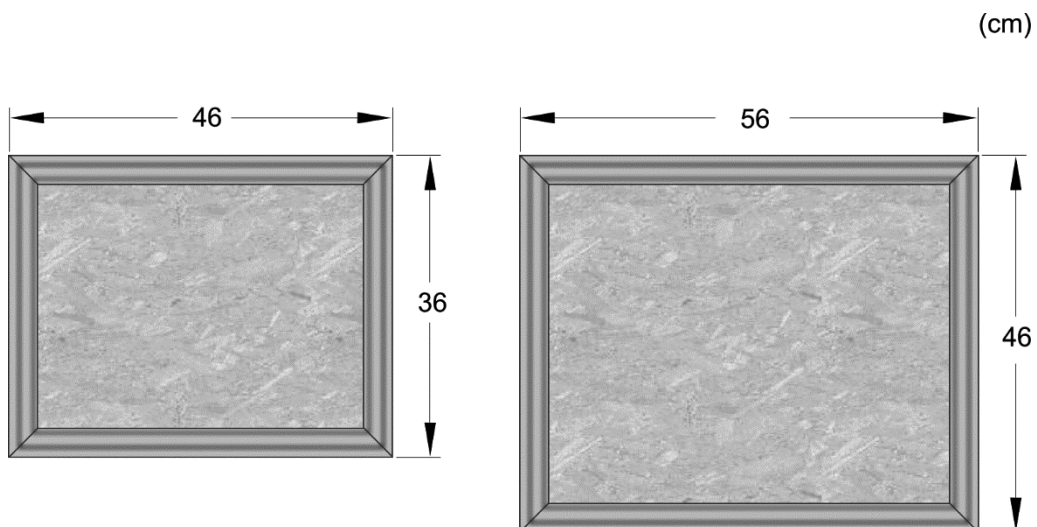
- a) Which of the three models will then represent the decrease in the number of blue whales after the year 1900? Justify your answer. (0/1/0)
- b) How many blue whales will there be in the year 2065 if the yearly percentage change of the number of blue whales continues to be constant? (0/3/0)
21. It 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)

22. 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.



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/m² 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.



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)