Part D	Problems 19–28 which require complete solutions.
Test time	120 minutes.
Resources	Digital tools, formula sheet and ruler.

The test consists of three written parts (part B, C and D).
Together they give a total of 59 points consisting of 21 E-, 22 C- and 16 A-points.

Level requirements for test grades
E: 15 points
D: 24 points of which 7 points on at least C-level
C: 31 points of which 13 points on at least C-level
B: 39 points of which 5 points on A-level
A: 46 points of which 8 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 tools.

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 tools are allowed. Several of the tasks require that you use digital tools to solve them. For the other tasks, it can be an advantage to use digital tools when solving the task. Write down your solutions on separate sheets of paper.

19. The function f given by $f(x) = (2x - 1)^5$ cannot be differentiated using the differentiation rules treated in this course.

    Use your digital tool to calculate a value for $f'(2)$.

    Only answer is required   (1/0/0)

20. A geometric sum is given by $B + B \cdot 1.4 + B \cdot 1.4^2 + ... + B \cdot 1.4^{21}$ where B is a constant.

    Determine B so that the sum is 250 000   (2/0/0)

21. The graph of the function $f(x) = 3x^2 + 4x$ has a tangent in the point where $x = 2$. The equation of the tangent can be written as $y = kx - 12$

    Determine k.   (2/0/0)

22. The length of boys can be described using the simple model $f(x) = 78 \cdot e^{0.07x}$ where $f(x)$ is the length in centimetres and x is the age of boys in years.

    a) Determine at what age boys are 125 cm tall according to the model.   (2/0/0)

    b) Use the model and determine how fast boys grow when they are exactly 6 years old.   (0/1/0)

    c) Investigate if the model is also valid for boys in upper secondary school.   (1/0/0)

23. The functions f and g are given by $f(x) = \dfrac{12}{x} + 8x$ and $g(x) = \sqrt{x}$

Solve the equation $f'(x) = g'(x)$.
Give your answer to at least two decimal places. (0/2/0)

24. Julius and Sophia are planning to start a web store to sell beanbags. They plan to sell two different models of beanbag, model A and model B.


The purchase price of a model A beanbag is 600 SEK and for a model B beanbag it is 400 SEK. They can buy beanbags for, at most, 60 000 SEK. In their warehouse, they can store, at most, 125 beanbags.

Julius and Sophia expect to sell all the beanbags they purchase, and that the profit per unit will be 500 SEK for each model A beanbag they sell and 400 SEK for each model B beanbag they sell.

Determine how many beanbags of each model they should buy to maximize their profit. (0/4/0)

25. The function f is given by $f(x) = 2^x$. The figure shows the graph of the function f and a secant line between two points on the graph.
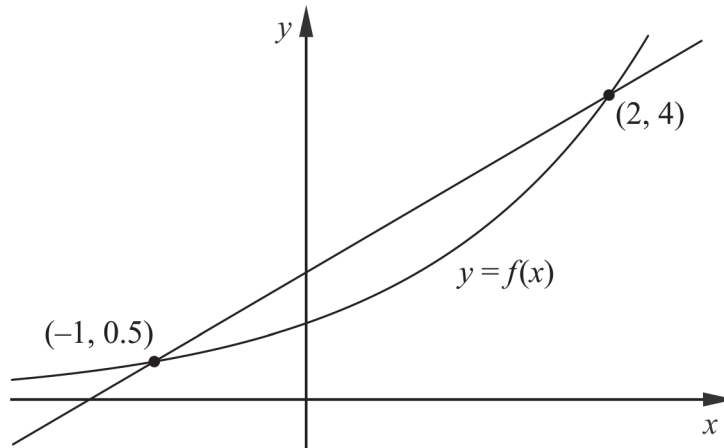
A tangent to the graph is drawn, that is parallel to secant line. Determine the x-coordinate of the point of tangency. Give your answer to at least two decimal places. (0/2/0)
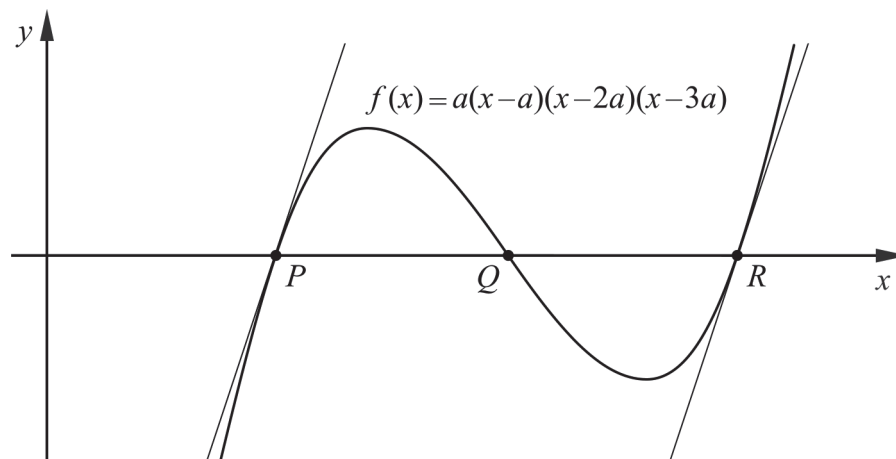
26. The function f is given by

$$f(x) = a(x-a)(x-2a)(x-3a) = ax^3 - 6a^2x^2 + 11a^3x - 6a^4$$

where a is a constant, $a > 0$

The graph of f intersects the x-axis in the points P, Q and R. See figure.

Show algebraically that the tangents to the graph in the points P and R are parallel, regardless of the value of the constant a. (0/0/2)

27. Wilma has an old moped.

The fuel usage of the moped can be described using the simplified model
$f(x) = 0.3 + 0.5e^{-0.76x}$ where $f(x)$ is the fuel consumption in
litres/Swedish mile and x is the distance travelled in Swedish miles.
(One Swedish mile = 10 kilometres)

Wilma starts with 4.0 litres of petrol in the fuel tank. Determine how far
Wilma can drive before running out of petrol according to the model. (0/0/2)

28. The artisan Suzanna is planning to make jewellery of silver and gold. Each
piece of jewellery will consist of a rectangular silver plate and a gold wire.
The gold wire will be soldered to the silver plate, 8 mm from the corners.
See figure.
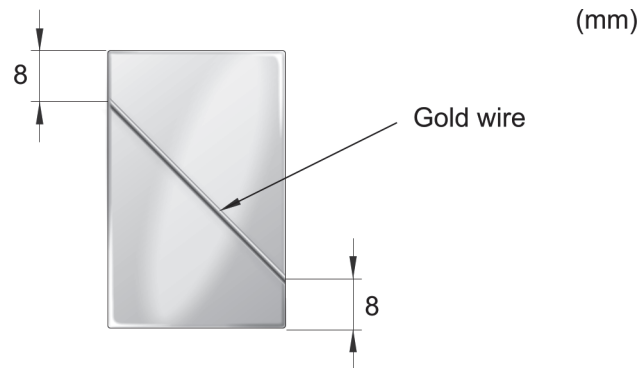
Gold wire is expensive, and therefore she wants to use as little gold as
possible for the piece of jewellery. The piece of jewellery cannot weigh too
much and Suzanna therefore decides that the silver plate should have area
550 mm².

Determine what length the gold wire will have if Suzanna uses as little gold
wire as possible for the piece of jewellery. (0/0/3)