Part D	Problems 16–28 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 58 points consisting of 21 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: 29 points of which 11 points on at least C-level
B: 38 points of which 5 points on A-level
A: 45 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 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.

16. The figure shows a circle with centre *M*. The points *A*, *B* and *C* lie on the perimeter of the circle.
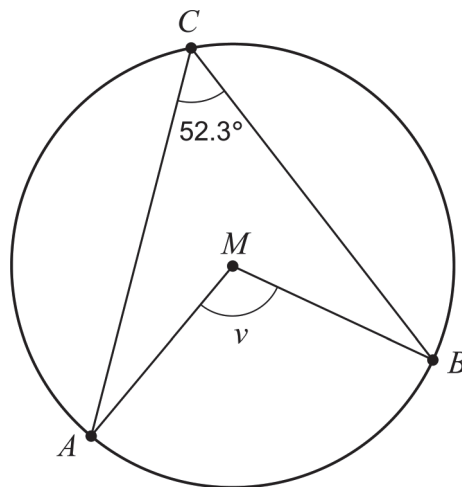
Determine the angle *v*.   *Only answer is required*   (1/0/0)

17. Solve the equation $\sqrt{2.11x - 5} = 8.6$ and give your answer to at least one decimal place.   *Only answer is required*   (1/0/0)

18. A quadratic function *f* is given by $f(x) = 3x^2 + 5x + 7$
    Give an example of a point that lies on the graph of *f*.
                                   Only answer is required   (1/0/0)

19. The table shows some values of the variables *x* and *y*.

| x	22	23	24	25	26	27	28
y	4.2	5.6	4.9	3.6	3.1	1.9	2.5

Using these values, a best fit relation in the form $y = ax + b$ can be determined.

Determine *a* and *b* using linear regression. Give your answer to at least two decimal places.   *Only answer is required*   (1/0/0)

20. In a right-angled triangle *ABC*, the side *AB* is 5.6 cm and the side *BC* is 1.8 cm. The triangle *DEF* is similar to the triangle *ABC*. The side *EF* is twice as long as the side *BC*, see figure.
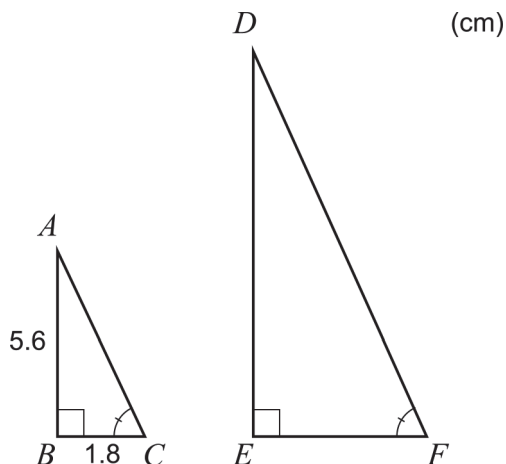

How many times larger is the area of the triangle *DEF* compared to the area of the triangle *ABC*? (2/0/0)

21. The picture shows the Municipal Asphalt Plant in New York.


Photo av Jim Henderson / CC0

The outer edge of the front of the building can be described by the graph of the quadratic function *f*. The function *f* is given by $f(x) = -0.14x^2 + 3.92x$ where *x* and $f(x)$ are measured in metres and the *x*-axis is placed at ground level along the front of the building. See figure.
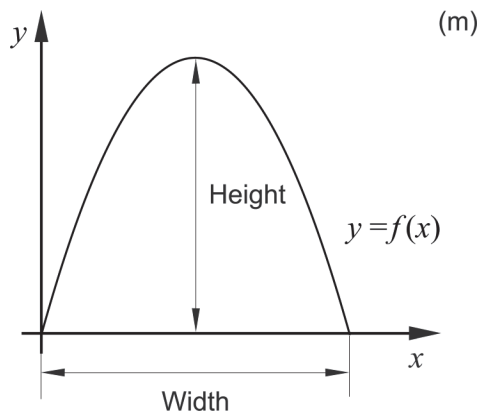
Determine the width and height of the building. *Only answer is required* (2/0/0)

22. In the year 2018, the newspaper Times of India printed a story on the number of tigers in India having more than doubled since 2006.
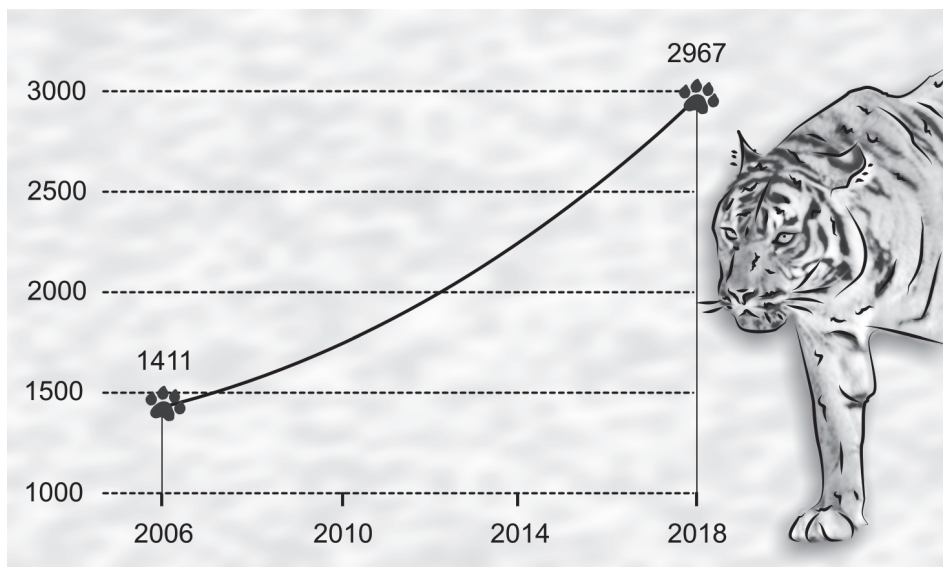

The newspaper claimed that there were 1411 tigers in India in 2006 and that there were 2967 tigers in 2018. Assume that the number of tigers was counted at the beginning of 2006 and at the beginning of 2018. Also assume that the annual rate of change in percent was constant during the time period, and that the rate of change will be the same after 2018 as well.

Determine in what year the number of tigers is expected to be 5000.   (0/3/0)

23. The figure shows the quadrilateral *PMQR* in a circle where *P*, *Q* and *R* lie on the perimeter of the circle and *M* is the centre of the circle. The angles *a*, *b* and *c* are marked in the figure.
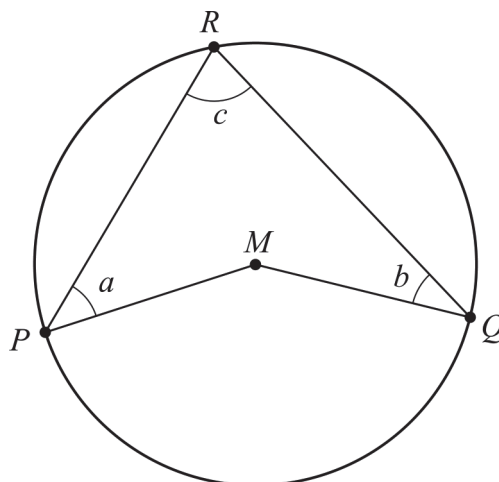
Show that the relation $a + b = c$ holds for all quadrilaterals *PMQR* where *P*, *Q* and *R* lie on the perimeter of the circle and *M* is the centre of the circle.   (0/2/0)

24. Edith and Adrian drive the same route from Umeå to Hudiksvall. Adrian starts first and Edith starts when Adrian has already travelled 13 km. After a while, Edith passes Adrian. Adrian's average speed is 72 km/h until Edith passes him, and Edith's average speed is 81 km/h until she passes Adrian.
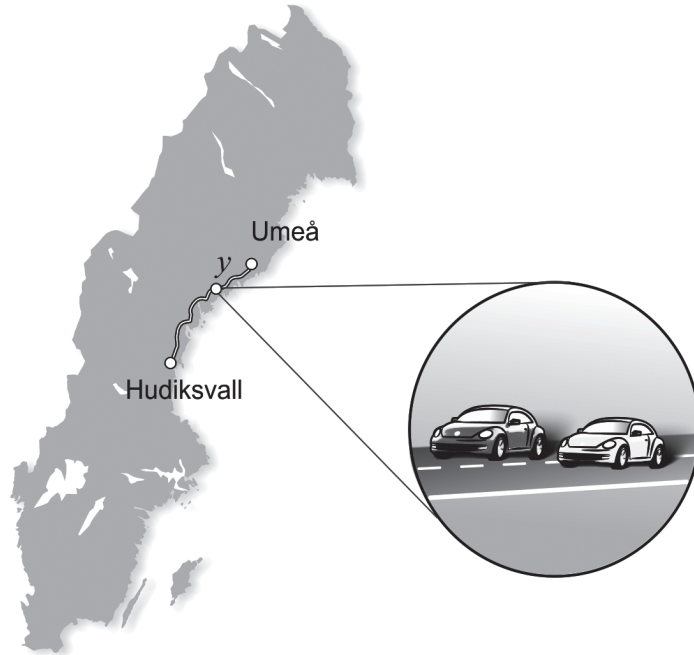
The partial system of equations can be used to find out how far Edith has travelled when she passes Adrian.

$$\begin{cases} y = 81x \\ \dots \end{cases}$$

where y km is the distance Edith has travelled until she passes Adrian. See figure.

a) Interpret what x means in this context. (1/0/0)

When Edith passes Adrian, they have travelled a third of the distance between Umeå and Hudiksvall.

b) Calculate the distance between Umeå and Hudiksvall. (0/0/2)

25. The hourly wages of four people satisfy the following:

Mean: 210 SEK/h
Median: 200 SEK/h
Range: 80 SEK/h

Investigate the possible hourly wages for the person with the highest hourly wage. (0/2/0)

26. Assume that a, b and c are three consecutive integers where $a < b < c$.

Investigate if the expression $\dfrac{a^2 + b^2 + c^2 - 2}{3}$ is always an integer for any

such consecutive integers a, b and c. (0/0/3)

27. The function f is given by $f(x) = \dfrac{x^2}{a}$ where a is a constant and $a > 0$

A line segment S is drawn from the point on the graph of the function where the x-coordinate is a to the point on the graph of the function where the x-coordinate is $2a$.

Determine the length of the line segment S in terms of a. (0/0/2)

28. The figure shows the rectangle $ABCD$ with one point P on the side BC. When the line segments DP and AB are extended, they intersect in the point Q.
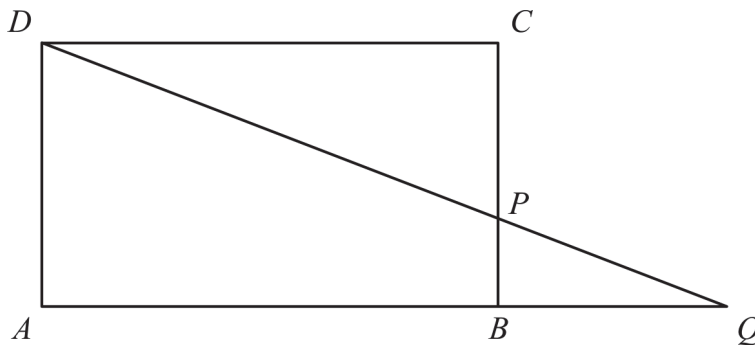
Determine $\dfrac{AB}{AQ}$ if $BP = a$ and $PC = 3a$. (0/0/3)