

<b>Part I</b>	Problems 1-10 which only require answers.
<b>Part II</b>	Problems 11-15 which require complete solutions.
<b>Test time</b>	120 minutes for part I and II together.
<b>Resources</b>	Formula sheet and ruler.

**Level requirements**      The whole test consists of Part I, Part II, Part III and an oral part and the maximum score is 75 points of which 28 E-, 23 C- and 24 A-points.

Level requirements for test grades

E: 18 points

D: 29 points of which 8 points on at least C-level

C: 38 points of which 15 points on at least C-level

B: 50 points of which 8 points on A-level

A: 61 points of which 14 points on A-level

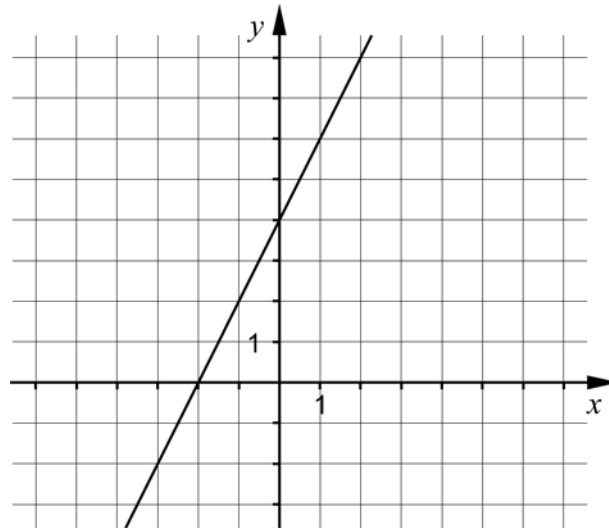
The number of points you can have for a complete solution or an answer is stated after each problem. You can also see what knowledge levels (E, C and A) you can show in each problem. For example (3/2/1) means that a correct solution gives 3 E-, 2 C- and 1 A-point.

For problems where *Only answers are required* you only have to give a short answer. For other problems it is required that you present your solutions, explain and justify your train of thoughts and, where necessary, draw figures.

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

**Part I:** Digital resources are not allowed. *Only answer is required.* Write your answers in the test booklet.

1.



a) Find the equation to the straight line in the figure. \_\_\_\_\_(1/0/0)

b) Draw a straight line with gradient  $k = -1$  in the coordinate system. (1/0/0)

2. Simplify the expression  $(x + 5)(x - 5) + 25$  as far as possible.  
\_\_\_\_\_ (1/0/0)

3. Solve the equations

a)  $x(x + 7) = 0$  \_\_\_\_\_(1/0/0)

b)  $\lg x = 3$  \_\_\_\_\_(1/0/0)

c)  $2^3 \cdot 2^x = 2^{2x}$  \_\_\_\_\_(0/1/0)

4. Which of the following equations A-E has non-real solutions?

A.  $x^2 = 16$

B.  $x^2 + 6 = 0$

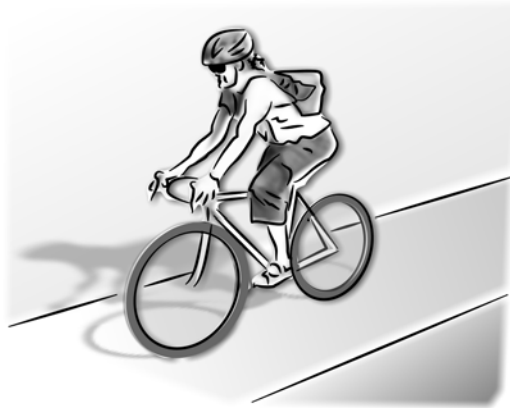
C.  $x^2 = 0$

D.  $x^2 - \sqrt{5} = 0$

E.  $x^2 - \frac{9}{4} = 0$

\_\_\_\_\_ (1/0/0)

5. It's 7 km by bike from Anna's home to her school. She usually bikes at a speed of 0.35 km/min. Write down a function that states the distance left  $y$  km before she reaches her school when she has been cycling for  $x$  minutes.



\_\_\_\_\_ (0/1/0)

6. It holds for a quadratic function that:

- The function has a zero at  $x = 4$
- The function has its maximum value at  $x = 1$

For which value of  $x$  does the function have its second zero?

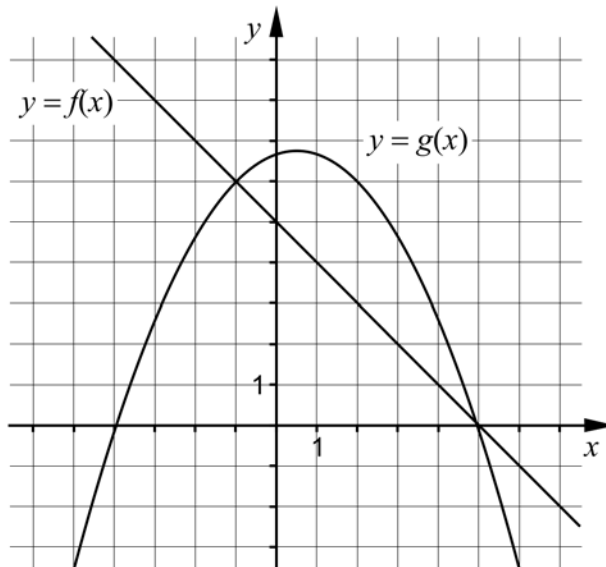
\_\_\_\_\_ (0/1/0)

7. Simplify the following expressions as far as possible.

a)  $\frac{\frac{3m}{x^7}}{\frac{2m}{x^7}}$  \_\_\_\_\_(0/1/0)

b)  $\frac{\sqrt{x} \cdot \sqrt{x} \cdot \sqrt{x}}{\sqrt{x} + \sqrt{x} + \sqrt{x}}$  \_\_\_\_\_(0/0/1)

8. The coordinate system shows the graphs of the linear function  $y = f(x)$  and the quadratic function  $y = g(x)$



Use the figure and answer the questions.

a) Find  $g(2)$  \_\_\_\_\_(1/0/0)

b) For what values of  $x$  is it true that  $f(x) < g(x)$ ? \_\_\_\_\_(0/2/0)

c) Write down the equation of a straight line that *does not* intersect any of the graphs to the functions. \_\_\_\_\_(0/0/1)

9. In the beginning of year 2011, Matilda bought a computer for SEK 10000. The value of the computer can be described by  $V(t) = 10000 \cdot 0.60^t$  where  $V$  is the value of the computer in SEK and  $t$  is the time in years after the purchase.



- a) What is the yearly percentage decrease of the value of the computer?  
 \_\_\_\_\_(1/0/0)
- b) Write down a new function that shows the value of the computer  $V$  in SEK as a function of time  $t$ , where the time  $t$  now will be counted in *months* after the purchase.  
 \_\_\_\_\_(0/0/1)

10. A simultaneous equations consist of two equations where each equation contains two variables  $x$  and  $y$ .

- a) One of the equations is  $3x + 2y = 12$   
 Give an example of what the second equation might look like if there are no solutions to the simultaneous equations.  
 \_\_\_\_\_(0/0/1)
- b) One of the equations is still  $3x + 2y = 12$   
 Give an example of what the second equation might look like if the only solution to the simultaneous equations is  $\begin{cases} x = 2 \\ y = 3 \end{cases}$   
 \_\_\_\_\_(0/0/1)

**Part II:** Digital resources are not allowed. Write your solutions on separate sheets of paper.

11. Solve the simultaneous equations  $\begin{cases} 2x - y = -9 \\ 5x + 2y = 0 \end{cases}$  algebraically. (2/0/0)

12. Solve the equations algebraically.

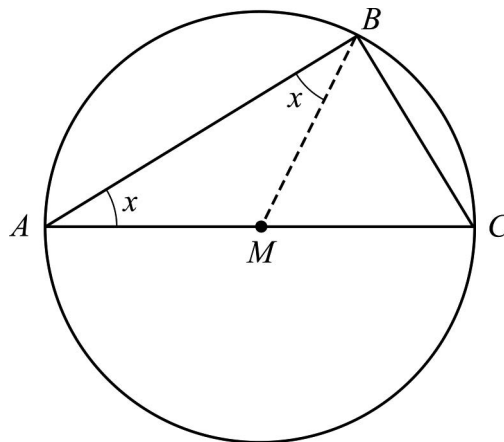
a)  $x^2 - 4x - 45 = 0$  (2/0/0)

b)  $(x+1)^2 = x+1$  (0/2/0)

13. Thales of Miletus was a Greek mathematician who lived 2600 years ago. He formulated a theorem with the following meaning:

*Every triangle inscribed in a circle has a right angle if one of the sides of the triangle is a diameter of the circle.*

The triangle  $ABC$  is inscribed in a circle in such a way. Side  $AC$  is a diameter of the circle. The point  $M$  is the midpoint of the line segment  $AC$ . The figure also shows the line segment  $BM$ .



a) Explain why the two angles denoted by  $x$  are of equal size. (1/1/0)

b) Show, without using the inscribed angle theorem, that Thales' theorem is correct. (0/2/2)

14.  $a$  is a constant in the equation  $x^2 - (a-1)^2 = 0$   
Solve the equation and simplify the answer as far as possible. (0/0/2)
15. There is a point  $P$  on the line  $y = 2x - 5$  in the first quadrant. The distance between the point  $P$  and the origin is 10 length units. Find the  $x$ -coordinate of the point  $P$ . Give an exact answer. (0/0/4)