Part B	Problems 1-10 which only require answers.
Part C	Problems 11-19 which require complete solutions.
Test time	150 minutes for Part B and Part C together.
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 62 points consisting of 22 E-, 23 C- and 17 A-points.

Level requirements for test grades
E: 15 points
D: 24 points of which 7 points on at least C-level
C: 32 points of which 13 points on at least C-level
B: 41 points of which 5 points on A-level
A: 49 points of which 9 points on A-level

The number of points you can have for a complete solution is stated after each problem. You can also see what knowledge level(s) (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 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.

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

Name: ______________________________

Date of birth: ______________________________

Educational programme: ______________________________

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

1. Specify a complex number z in the form $z = a + bi$ so that

a) $\operatorname{Im} z = 4$ _______________ (1/0/0)

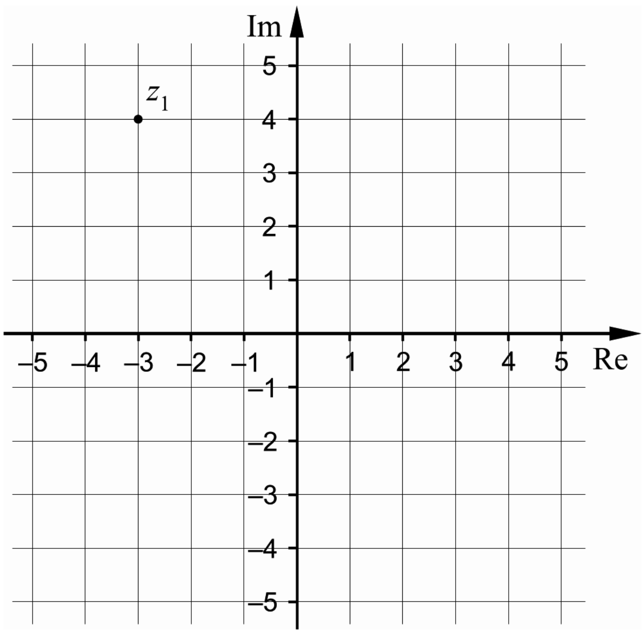
b) $\arg z = 45°$ _______________ (1/0/0)

2. Differentiate

a) $f(x) = \cos 5x$ _______________ (1/0/0)

b) $g(x) = x \cdot e^x$ _______________ (1/0/0)

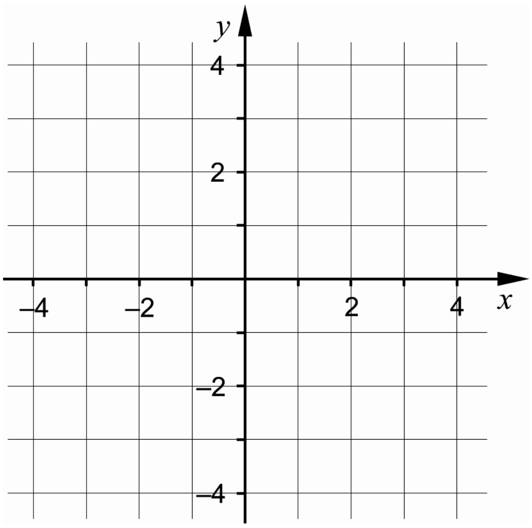
3. The figure below shows a complex plane where the number z_1 is marked.



a) Calculate $|z_1|$ _______________ (1/0/0)

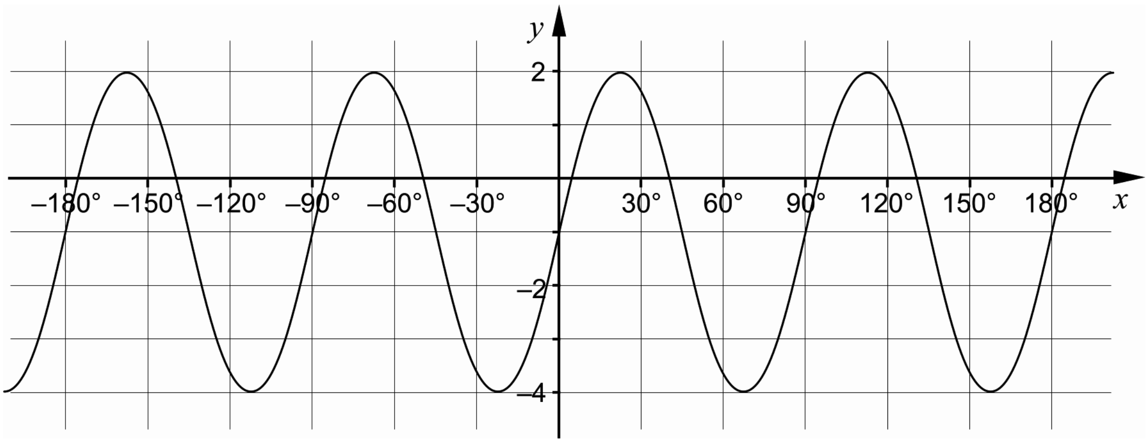
b) Mark the number $\bar{z}_2$ in the complex plane above when $z_2 = -5 - i$ (1/0/0)

4. a) Use the coordinate system below and mark a region whose area can be calculated by $\int_{-1}^{1}(3+x)\,dx$ (1/0/0)



b) Determine the value of $\int_{-1}^{1}(3+x)\,dx$ ____________________ (1/0/0)

5. The figure shows the graph of the function $y = A\sin kx + B$



Determine the constants A, B and k

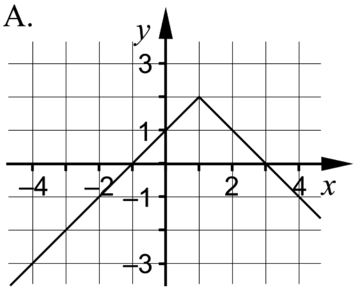
$A =$ ____________________

$B =$ ____________________

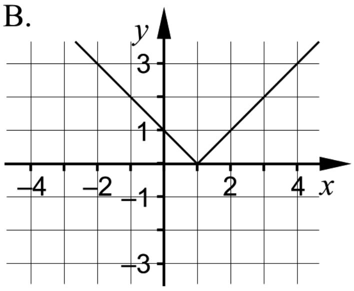
$k =$ ____________________ (1/1/0)

6. Which of the following figures A-H shows the graph of the function $f(x) = 2 - |x - 1|$?

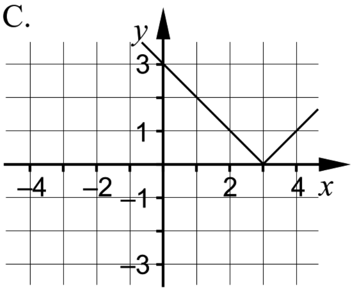
A.



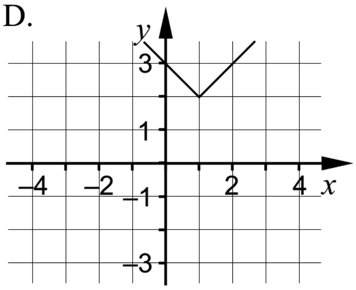
B.



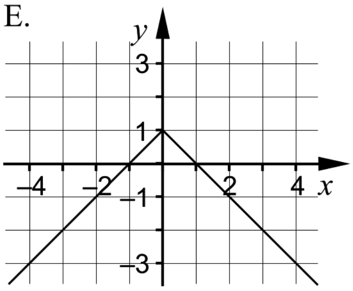
C.



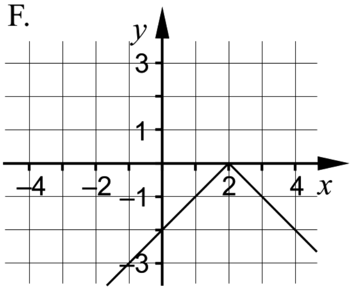
D.



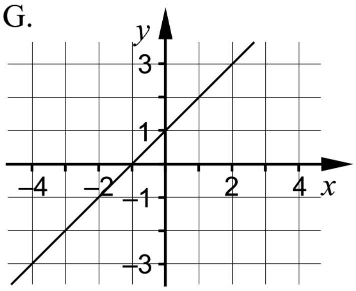
E.



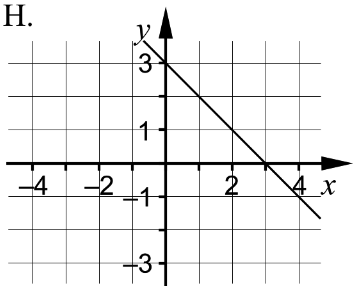
F.



G.



H.

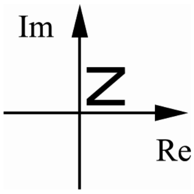


________________________ (0/1/0)

7. Calculate $\lim\limits_{h \to 0} \dfrac{f(h) - f(0)}{h}$ when $f(x) = 2x + \sin x$

________________________ (0/0/1)

8. A set of complex numbers that together form the letter Z is marked in the complex plane.

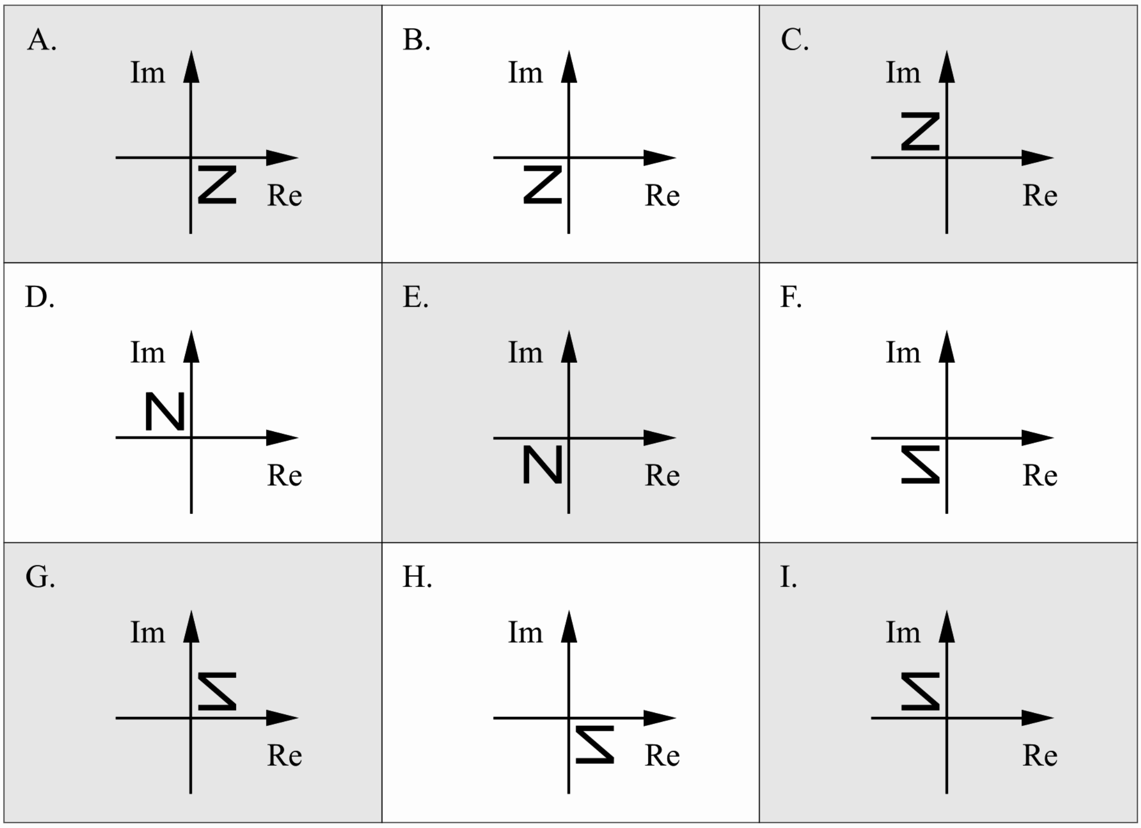


a) Which of the alternatives A-I below shows the figure formed by the conjugates to the numbers that form Z in the figure above?

_______________________ (0/1/0)

b) Which of the alternatives A-I below shows the figure formed when the numbers forming Z in the original figure above are multiplied by i?

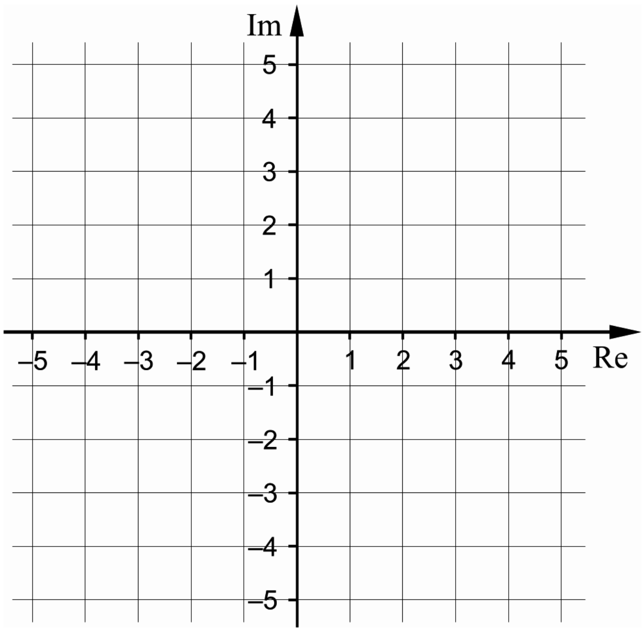
_______________________ (0/0/1)



9. Write down a function f that has the derivative $f'(x) = x^2 \cdot e^{x^3+5}$

______________________ (0/0/1)

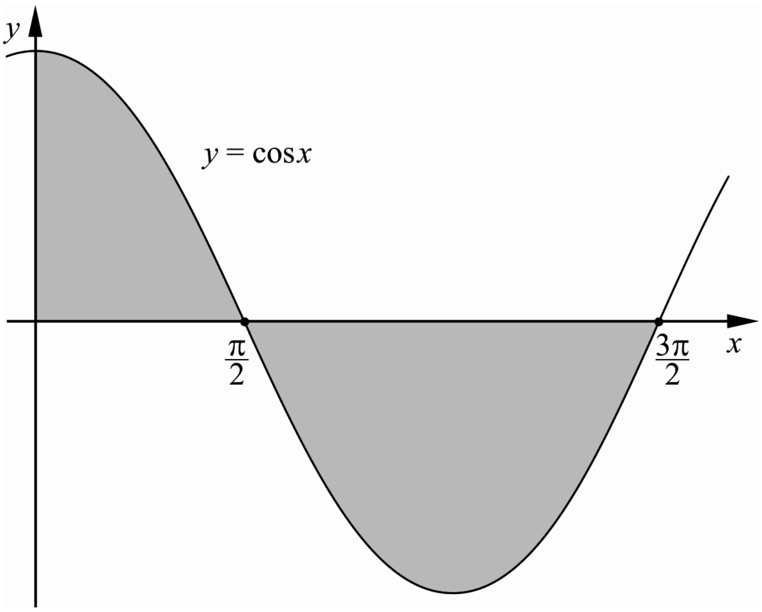
10. In the complex plane, mark the complex numbers z for which it holds that $|z-4| = |z-2i|$



(0/0/2)

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

11. Calculate the total area of the shaded regions in the figure below.



(2/0/0)

12. Show that $\sin^2 30° + \cos^2 30° = \sin^2 51° + \cos^2 51°$ (2/0/0)

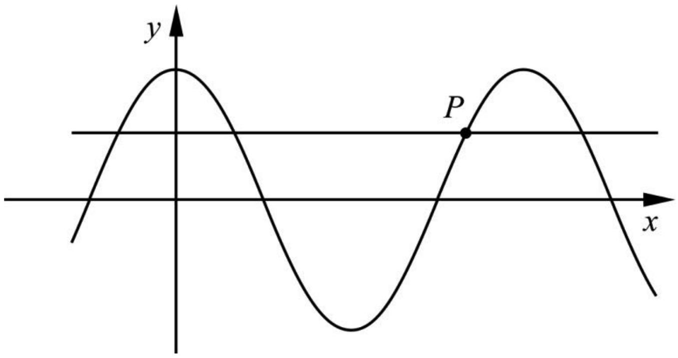
13. Determine the complex number $z = a + b\text{i}$ so that $\bar{z} + 3z = \text{i}z + 9$ (1/1/0)

14. Given the equation $x^3 + 2x^2 + x - 18 = 0$

a) Show that $x = 2$ is a root of the equation. (1/0/0)

b) Find the rest of the roots of the equation. (0/2/0)

15. The figure below shows the curve $y = \cos 2x$ and the line $y = \frac{1}{2}$



Find the x-coordinate of the intersection point P (1/2/0)

16. Solve the equation $z^3 + 27\text{i} = 0$ (0/3/0)

17. It holds for the complex numbers z_1 and z_2 that $z_2 = z_1 \cdot (1 - \text{i})$ and that z_1 lies within the area $45° < \arg z_1 < 135°$ in the complex plane.

In which area of the complex plane can you find the number z_2? (0/1/1)

18. Evaluate $\int_0^1 f''(x)\,\text{d}x$ when $f(x) = \sin(\pi x^2)$ (0/1/2)

19. Show that the function $f(x) = x^3 + 3x^2 + ax$ has no maximum- or minimum points if $a \geq 3$ (0/1/3)