Part B	Problems 1-13 which only require answers.
Part C	Problems 14-21 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 59 points consisting of 21 E-, 22 C- and 16 A-points.

Level requirements for test grades
E: 15 points
D: 23 points of which 7 points on at least C-level
C: 30 points of which 12 points on at least C-level
B: 39 points of which 5 points on A-level
A: 47 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 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.

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. Differentiate

a) $f(x) = \sin 2x$ ____________________ (1/0/0)

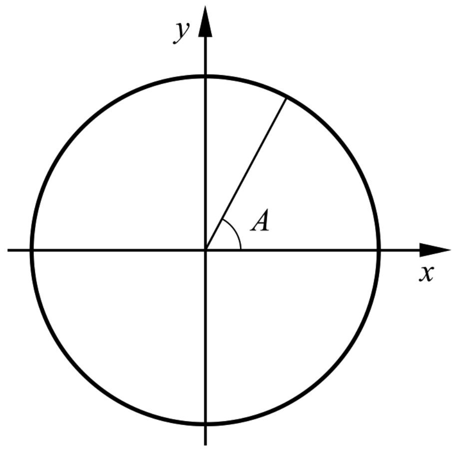
b) $f(x) = x \cdot e^x$ ____________________ (1/0/0)

2. The function f is defined by $f(z) = 2z - z^2$, where z is a complex variable.

a) Find $f(\mathrm{i})$ ____________________ (1/0/0)

b) Find z so that $f(z) = 10$ ____________________ (1/0/0)

3. In the unit circle below, the angle A is marked where $A = 70°$



Find two other angles, v_1 and v_2, in the interval $0° \le v \le 720°$ which have the same cosine value as angle A.

$v_1 =$ ____________________

$v_2 =$ ____________________ (2/0/0)

4. Find

a) $\bar{z}_1$ if $z_1 = -2 - 3\mathrm{i}$ ____________________ (1/0/0)

b) a complex number z_2 so that $\operatorname{Re} z_2 = 3$ and $|z_2| > 4$

____________________ (0/1/0)

5. Write down the smallest possible value the function $g(x) = 3 + |x - 1|$ can assume.

________________________ (1/0/0)

6. Which of the alternatives A-F is equal to $\cos 25°$?

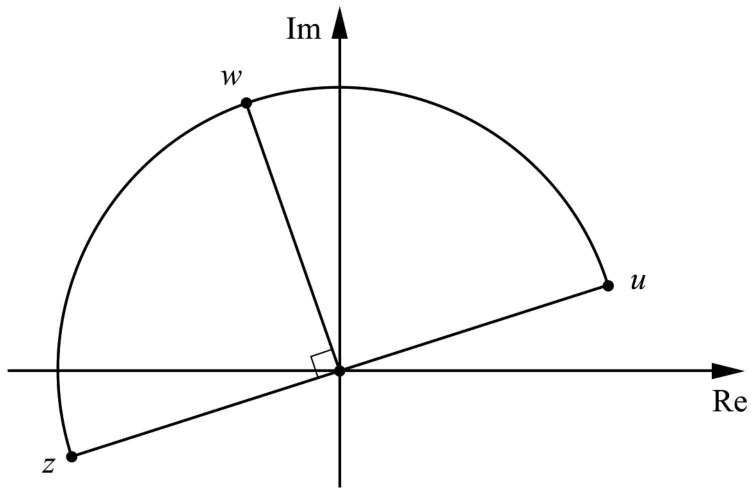
A.	$1 - \sin^2 25°$	B.	$\dfrac{\sin 25°}{\tan 25°}$	C.	$\dfrac{\cos 75°}{3}$
D.	$\cos 75° - \cos 50°$	E.	$\dfrac{\sin 50°}{2\cos 25°}$	F.	$\dfrac{\tan 25°}{\sin 25°}$

________________________ (0/1/0)

7. How many solutions are there to the equation $\tan 2v = 0.7$ within the interval $0° \le v \le 360°$

________________________ (0/1/0)

8. In the figure below, three complex numbers z , u and w are marked on a semi-circle.



Which two of the alternatives A-F describe the number u ?

A.	$\mathrm{i}z$	B.	$\mathrm{i}^2 z$	C.	$\dfrac{z}{\mathrm{i}}$
D.	$\mathrm{i}w$	E.	$\mathrm{i}^2 w$	F.	$\dfrac{w}{\mathrm{i}}$

________________________ (0/1/0)

9. Which two of the alternatives A-F are anti-derivatives to $g(x) = \dfrac{2}{x}$ for $x > 0$?

A. $G(x) = \dfrac{2}{x^2}$ B. $G(x) = 1 - \dfrac{2}{x^2}$ C. $G(x) = -2x^{-2}$

D. $G(x) = 2\ln x + 1$ E. $G(x) = \ln x^2$ F. $G(x) = (\ln x)^2$

_____________________ (0/1/0)

10. Find $\lim\limits_{h \to 0} \dfrac{g(h) - g(0)}{h}$ if $g(x) = 4x^2 + \sin 3x$ _____________________ (0/0/1)

11. Which two of the following lines A-F are asymptotes to $y = \dfrac{x^2 - 2x + 1}{x}$?

A. $x = 0$

B. $y = 0$

C. $x = 1$

D. $y = -2x + 1$

E. $y = x - 2$

F. $y = 2x - 2$ _____________________ (0/0/1)

12. It holds for the complex numbers z_1 and z_2 that $z_1 = 3\text{i}$ and $|z_2| = 7$

What is the smallest possible value that $|z_1 + z_2|$ can assume?

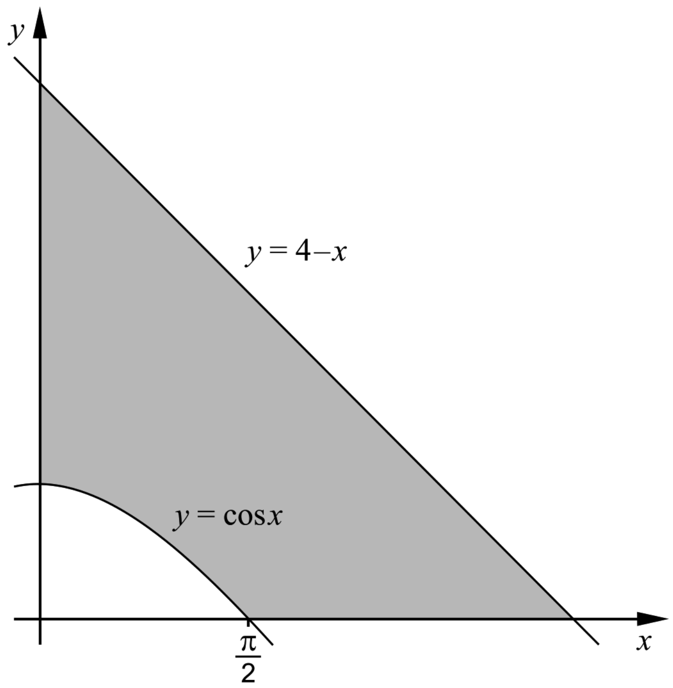
_____________________ (0/0/1)

13. Find an anti-derivative to $f(x) = \cos^2 3x - \sin^2 3x$

_____________________ (0/0/1)

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

14. The figure below shows a shaded region bounded by the curve $y = 4 - x$, the curve $y = \cos x$ and the positive coordinate axes.



Calculate the area of the shaded region. (2/1/0)

15. Show that $\dfrac{\sin 2x}{2\cos x} = \sin x$ for all x where the expressions are defined. (2/0/0)

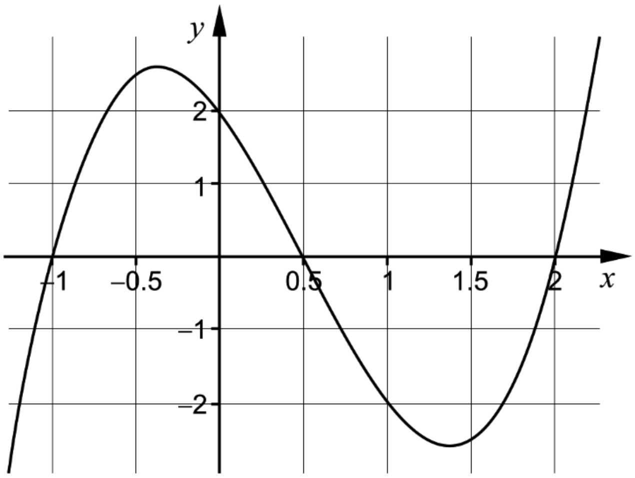
16. Calculate $\dfrac{9+2\mathrm{i}}{2+\mathrm{i}}$ and give the answer in the form $a + b\mathrm{i}$ (2/0/0)

17. Solve the equation $\cos(x - 30°) - \cos(x + 30°) = 1$ (0/2/0)

18. Find any possible maximum- and minimum points to the function f where
$f(x) = -x \ln x, \quad x > 0$ (0/1/1)

19. Find all integers $n > 0$ for which $(1+\mathrm{i})^n$ is a real number. (0/1/1)

20. The figure below shows the graph of the function $y = 2x^3 - 3x^2 - 3x + 2$



Solve the equation $2\cos^3 x - 3\cos^2 x - 3\cos x + 2 = 0$ (0/0/2)

21. A function f has the derivative $f'(x) = 4x + 6\cos\dfrac{x}{2}$

a) Show that the function f cannot have a maximum point. (0/1/1)

b) Investigate whether f has a minimum point. (0/0/2)