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| Part B | Problems 1–12 which only require answers. |
| Part C | Problems 13–20 which require complete solutions. |
| Test time | 150 minutes for Part B and Part C together. |
| Resources | Formula sheet and ruler. |

The test consists of three written parts (Part B, Part C and Part D). Together they give a total of 60 points consisting of 22 E-, 21 C- and 17 A-points.

Level requirements for test grades

E: 14 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 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.

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

Name: _____

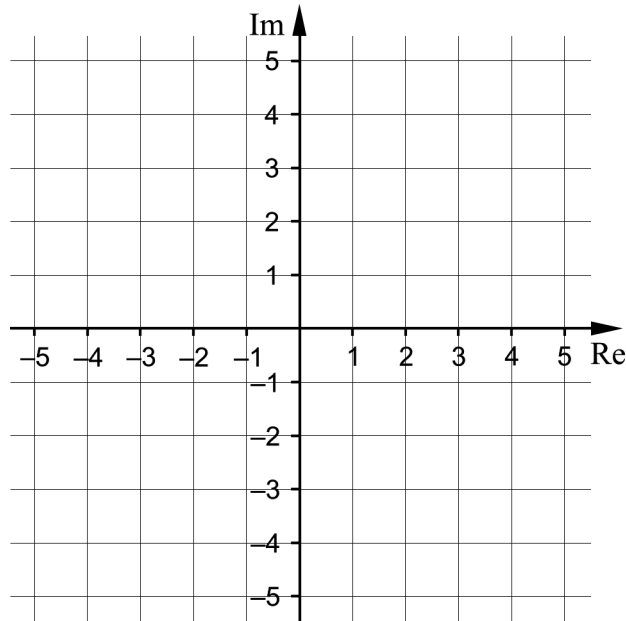
Date of birth: _____

Educational programme: _____

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

1. Write the angle 18° in radians. _____ (1/0/0)

2. In the complex plane, mark one number z for which it holds that $\operatorname{Re}(z) = 0$ and $|z| = 2$



(1/0/0)

3. Solve the equation $z^3 - 6z^2 + 13z = 0$ $z_1 =$ _____
 $z_2 =$ _____
 $z_3 =$ _____ (2/0/0)

4. Write down a complex number z in the form $z = a + bi$ that satisfies the condition $\arg(z) = 135^\circ$ _____ (1/0/0)

5. The complex number $z = 2\left(\cos\frac{2\pi}{7} + i\sin\frac{2\pi}{7}\right)$ is given.
 Determine z^3 _____ (1/0/0)

6. There are many non-real numbers z for which it holds that $z + \bar{z} = -10$
Write down one such non-real number z _____ (1/0/0)

7. The function $f(x) = \frac{x}{x^2 - 9} + \frac{7}{8}$ has two vertical and one horizontal asymptote.
Write down the equations of the three asymptotes. _____

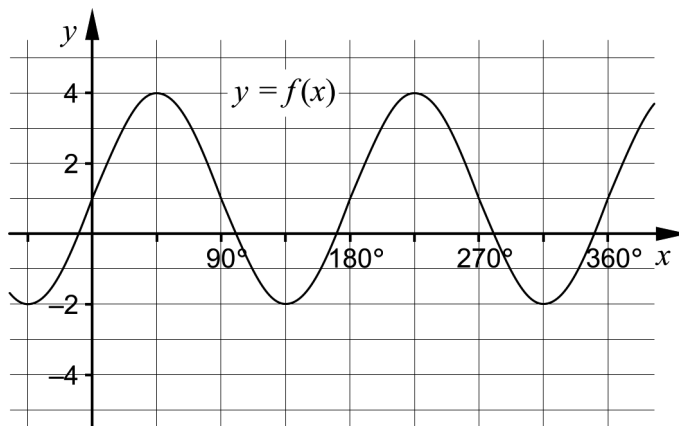
_____ (2/0/0)

8. Differentiate

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

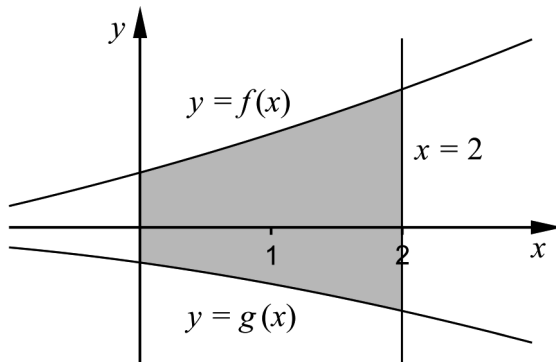
b) $g(x) = \frac{e^x}{x}$ _____ (0/1/0)

9. The figure shows the graph of a trigonometric function f .



- a) The function can be written $f(x) = A \sin(kx) + B$.
Determine the constants A , B and k . $A =$ _____
 $B =$ _____
 $k =$ _____ (1/1/0)
- b) The function can also be written $f(x) = A \cos(kx + v) + B$ where A , B and k have the same values as in task a).
Determine a value of the constant v . $v =$ _____ (0/0/1)

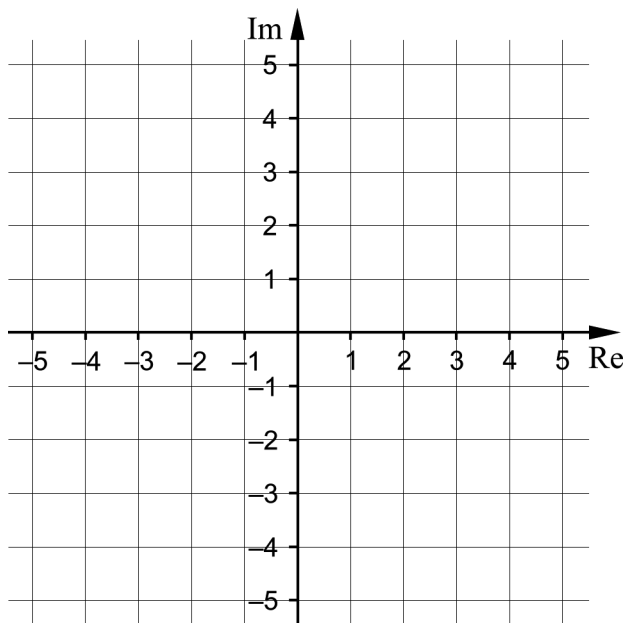
10. The shaded region in the figure is bounded by the graphs of the functions f and g , the line $x = 2$ and the y -axis. The area of the region is 16 a.u.



It holds for the function f that $\int_0^2 f(x) dx = 10$

Evaluate $\int_0^2 g(x) dx$ _____ (0/1/0)

11. In the complex plane, mark all z that satisfy the condition $|z + \bar{z}| = |z - \bar{z}|$.



(0/0/2)

12. Give an example of a trigonometric function f in the form $f(x) = A \sin kx$

that satisfies $\int_0^{2\pi} f(x) dx = 1$ _____ (0/0/1)

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

13. Calculate $\frac{20}{3+i}$ and answer in the form $a + bi$. (2/0/0)
14. Determine the constant a so that $y = 2e^{3x}$ becomes a solution to the differential equation $y' + ay = 0$ (2/0/0)
15. It holds for the angle v that $\sin v = \frac{4}{5}$ and $0^\circ < v < 90^\circ$
Determine the exact value of $\cos(v + 45^\circ)$. (0/3/0)
16. The graph of $f(x) = (2x - 3)^5$ has a tangent at the point where $f(x) = 1$
Determine the equation of the tangent. (0/3/0)
17. Show that $g(x) = \sin^4 x$ is an antiderivative of $f(x) = 2 \sin^2 x \cdot \sin 2x$ (0/2/0)

18. In a microwave oven, there is a circular rotating plate. A glass is placed on the plate according to figure 1.

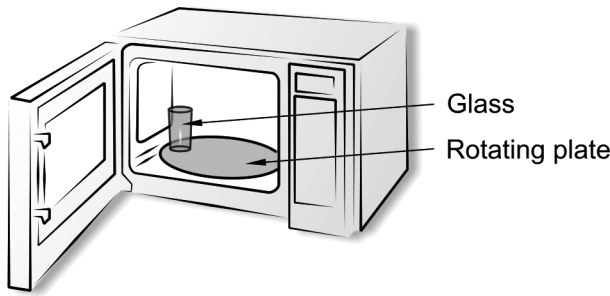


Figure 1

When the microwave oven is running, the plate is rotating at a constant speed. The distance y cm from the centre of the glass to the microwave oven door is described by the function $y(t) = 17.0 - 12.5 \cos\left(\frac{\pi}{6}(t+3)\right)$ where t is the time in seconds. At $t = 0$, the glass is at the far left in the microwave oven, see figure 2.

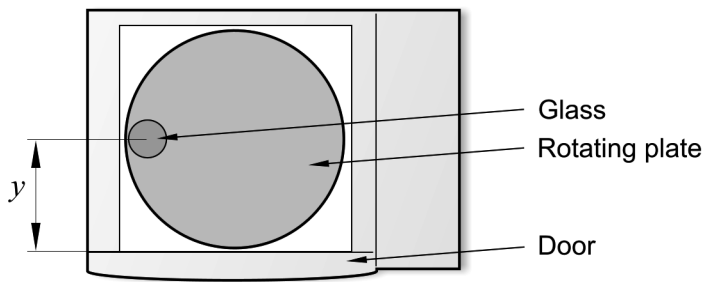


Figure 2 Cross section of microwave oven seen from above. Placement of the glass at $t = 0$

- a) Determine the largest distance from the centre of the glass to the microwave oven door. *Only answer is required* (1/0/0)
- b) Determine how long it takes for the glass to rotate one lap in the microwave oven. (0/1/0)

The glass rotates either clockwise or anti-clockwise. See figure 3.

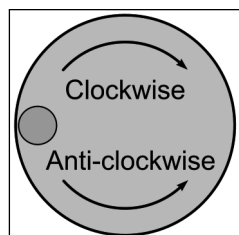


Figure 3

- c) Investigate which way the glass rotates in this microwave oven. (0/0/2)

19. Solve the equation $\tan 2x \cdot \tan x = \tan x$ (0/0/2)

20. Let $f(x) = e^{2x} - e^x + \frac{1}{4}$
Show that $f(x) \geq 0$ for all x . (0/0/2)