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.

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-, 22 C- and 16 A-points.

Level requirements for test grades
E: 15 points
D: 24 points of which 7 points on at least C-level
C: 31 points of which 13 points on at least C-level
B: 40 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 tools are not allowed. *Only answer is required*. Write your answers in the test booklet.

1. Differentiate

a) $f(x) = \sin 5x$ $\quad f'(x) =$ ______________________ (1/0/0)

b) $g(x) = (5x+2)^{10}$ $\quad g'(x) =$ ______________________ (1/0/0)

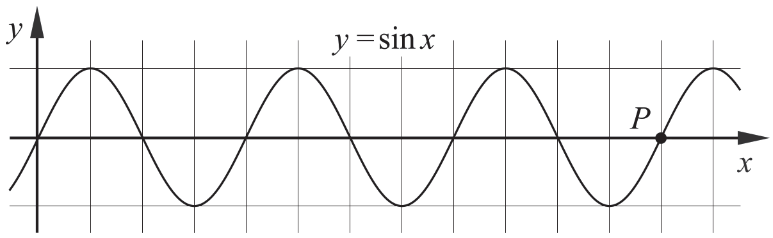
c) $h(x) = x^7 \cdot \mathrm{e}^x$ $\quad h'(x) =$ ______________________ (1/0/0)

2. The function f is given by $f(x) = 2 + 5\cos 4x$.

a) Write down the period of the function. ______________________ (1/0/0)

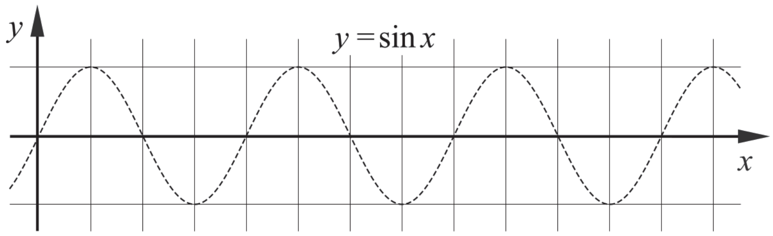
b) Write down the least value of the function. ______________________ (1/0/0)

3. The figure shows the curve $y = \sin x$ and a point P.
The point P lies on the curve and has y-coordinate 0



a) Write down the x-coordinate of the point P.
Give your answer in radians. ______________________ (1/0/0)

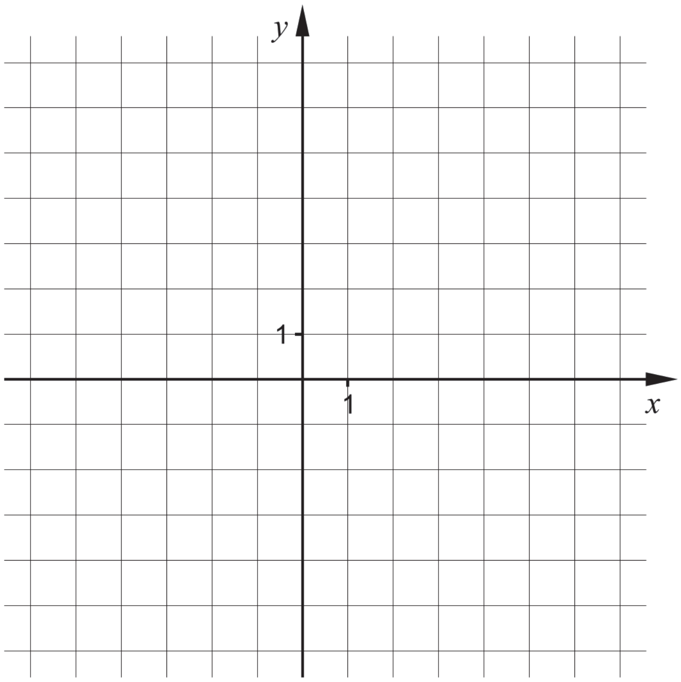
b) Sketch the curve $y = \sin\dfrac{x}{2}$ in the coordinate system. As an aid, the curve $y = \sin x$ has already been drawn.



(1/0/0)

4. A curve is given by $y = \dfrac{3}{x+2} + x - 1$

Draw the asymptotes of the curve in the coordinate system.

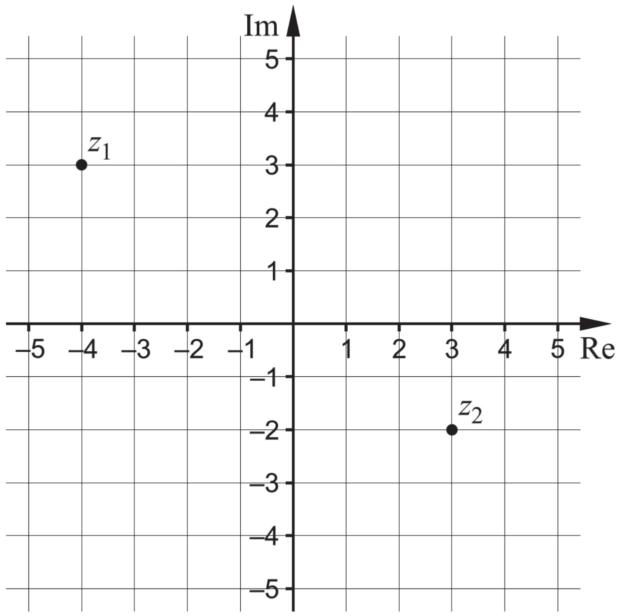


(1/1/0)

5. Determine $\displaystyle\int_0^{\frac{\pi}{2}} (\sin^2 x + \cos^2 x + \sin x)\,dx$. ____________________ (0/1/0)

6. Determine $|z|$ if $z = e^{2+i\pi}$ ____________________ (0/1/0)

7. The figure shows the complex plane with the numbers z_1 and z_2 marked.



a) Determine $\overline{z}_1$ ______________________ (1/0/0)

b) Determine $\arg(z_2 - 1)$ ______________________ (0/1/0)

c) Mark all complex numbers z satisfying $\operatorname{Re} z = \operatorname{Im}(z + z_2)$ (0/0/1)

8. Determine $\int_0^{\pi} (g'(x) \cdot h(x) + g(x) \cdot h'(x))\,\mathrm{d}x$

if $g(x) = \cos x$ and $h(x) = x^2$ ______________________ (0/0/1)

9. Write down a non-real root of the equation $z^{10} - 1 = 0$

______________________ (0/0/1)

10. A region in the first quadrant is bounded by the curve $y = x^{\frac{1}{4}}$, the line $y = 2$ and the y-axis. When this region revolves around the y-axis, a solid of revolution is formed, whose volume is given by $\pi \int_0^2 g(y)\,\mathrm{d}y$.

Write down the function g. $g(y) =$ ______________________ (0/0/1)

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

11. Write $\dfrac{8+6\text{i}}{1+2\text{i}}$ on the form $a+b\text{i}$. (2/0/0)

12. Solve the equation $\sin 4x = \dfrac{\sqrt{3}}{2}$ (2/1/0)

13. Show that $\dfrac{z-\overline{z}}{2\text{i}} = \operatorname{Im} z$ for all complex numbers z. (2/0/0)

14. The functions f and g are given by $f(z) = z^4 + 2z^3 + 9z^2 - 2z - 10$ and $g(z) = z^2 - 1$

a) Show that $f(z)$ is divisible by $g(z)$. (0/1/0)

b) Solve the equation $f(z) = 0$ (0/2/0)

15. Show that $\dfrac{\sin x}{\cos x - \sin x} + \dfrac{\sin x}{\cos x + \sin x} = \tan 2x$. (0/2/0)

16. The angle v satisfies the following conditions:

- $\sin^2 v = \dfrac{8}{9}$
- $90° < v < 180°$

Determine $\tan v$. (0/3/0)

17. The function f is given by $f(x) = \dfrac{ax+b}{x+1}$

Determine the constants a and b so that $f(1) = 4$ and $f'(1) = 3$ (0/3/0)

18. Show that the equation $\sin v \cos 40° = \sin v + \cos v \sin 40°$ has no solutions in the interval $0° \leq v \leq 90°$ (0/0/2)

19. The function f has a primitive function $F(x) = 3x \ln x$ and the function g has a primitive function $G(x) = x(\ln x)^2 + 3x$.

Determine the roots of the equation $f(x) = g(x)$. (0/0/2)