Further Mathematics 1
0775

GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2025 **ADVANCED LEVEL**

Centre Number	
Centre Name	
Candidate Number	
Candidate Name	

Mobile phones are NOT allowed in the examination room.

MULTIPLE CHOICE QUESTION PAPER

Duration: One and a Half Hours

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you start answering the questions in this paper. Make sure you have a soft HB pencil and an eraser for this examination.

1. USE A SOFT HB PENCIL THROUGHOUT THE EXAMINATION.
2. DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Before the examination begins:

3. Check that this question booklet is headed "**Advanced Level – 0775 Further Mathematics 1**".
4. Fill in the information required in the spaces above.
5. Fill in the information required in the spaces provided on the answer sheet using your HB pencil:

Candidate Number and Name, Centre Number and Name.
Take care that you do not crease or fold the answer sheet or make any marks on it other than those asked for in these instructions.

How to answer the questions in this examination

6. Answer **ALL** the **50** questions in this Examination. All questions carry equal marks.
7. Noiseless non-programmable calculators are allowed
8. Formulae booklets published by the G.C.E. Board are allowed.
9. Each question has FOUR suggested answers: **A, B, C** and **D**. Decide on which answer is correct. Find the number of the question on the Answer Sheet and draw a horizontal line across the letter to join the square bracket for the answer you have chosen.

For example, if **C** is your correct answer, mark **C** as shown below:

[A] [B] [~~C~~] [D]

10. Mark only one answer for each question. If you mark more than one answer, you will score a zero for that question. If you change your mind about an answer, erase the first mark carefully, then mark your new answer.
11. Avoid spending too much time on any one question. If you find a question difficult, move on to the next question. You can come back to this question later.
12. Do all rough work in this booklet, using, where necessary, the blank spaces in the question booklet.
13. **At the end of the examination, the invigilator shall collect the answer sheet first and then the question booklet after. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH ANY OF THEM.**

1. $\dfrac{1}{(x+1)(x^2-x+1)}, x \neq -1$, expressed in partial fractions where A, B and C are real constants is

A $\dfrac{A}{x+1}+\dfrac{Bx+C}{x^2-x+1}$

B $\dfrac{A}{x+1}+\dfrac{B}{x^2-x+1}$

C $\dfrac{A}{x+1}+\dfrac{Bx}{x^2-x+1}$

D $\dfrac{A}{x+1}+\dfrac{B}{x^2-x+1}+\dfrac{C}{x^2-x+1}$

2. The integrating factor for the differential equation $x^2\dfrac{dy}{dx}+4xy=e^x$ is

A $4x$

B e^{4x}

C x^4

D $\frac{4}{e^x}$

3. If $f(x)=3\cosh 3x-2$, then the minimum value of $f(x)$ is

A -2

B -1

C 1

D 2

4. Given that $y=|x|+x-x|x|$, if $x<0$, then $y=$

A x^2

B $-x^2$

C $2x+x^2$

D $2x-x^2$

5. The range of values of x for which the Taylor's expansion about $x=0$ of $\ln\left(\dfrac{1-2x}{(1+2x)^2}\right)$ is valid is

A $-\dfrac{1}{2}<x<\dfrac{1}{2}$

B $-\dfrac{1}{2}<x\leq\dfrac{1}{2}$

C $-\dfrac{1}{2}\leq x<\dfrac{1}{2}$

D $-\dfrac{1}{2}\leq x\leq\dfrac{1}{2}$

6. The conjugate of the complex number $1+e^{i\theta}$ is

A $1+e^{i\theta}$

B $1-e^{i\theta}$

C $1-e^{-i\theta}$

D $1+e^{-i\theta}$

7. Given the truth table below

p	q	$p \vee q$	$(p \vee q) \Rightarrow q$
T	T	T	T
T	F	a	T
F	T	T	T
F	F	F	b

The truth values of a and b are respectively

A T,T

B T,F

C F,T

D F,F

8. To establish a reduction formula for the integration of $\tan^n\theta$, it can be expressed as;

A $\int \sec\theta\tan^n\theta d\theta$

B $\int \tan\theta\tan^{n-1}\theta d\theta$

C $\int \tan^2\theta\tan^{n-2}\theta d\theta$

D $\int \sec\theta\tan^{n-2}\theta d\theta$

9. The root mean square value of $\dfrac{1}{x}$ in the interval $1\leq x\leq 4$ is

A $\sqrt{\frac{1}{3}\ln 4}$

B $\frac{1}{2}$

C $\sqrt{\frac{1}{3}\ln 3}$

D $\frac{1}{4}$

10. The polar equation of the curve $x^2+y^2=2x$ is

A $r^2=2\cos\theta$

B $r=2\sin\theta$

C $r^2=2\sin\theta$

D $r=2\cos\theta$

11. The coordinates of the focus of the parabola $x^2 = 16(y+1)$ is

A (4, 0)
B (0, 4)
C (0, 3)
D (3, 0)

12. Given that $(\lambda\mathbf{i} - 4\mathbf{k}) \times (2\mathbf{i} - \mathbf{j} - \mathbf{k}) = -4\mathbf{i} + 8\mathbf{j} - 16\mathbf{k}$, the value of λ is

A 0
B 4
C 8
D 16

13. Given that $\begin{vmatrix} 1 & 1 & 4 \\ 3 & 5 & 1 \\ 1 & 2 & 0 \end{vmatrix} = 3$, then $\begin{vmatrix} 3 & 5 & 1 \\ 1 & 1 & 4 \\ 1 & 2 & 0 \end{vmatrix} =$

A -3
B 3
C 6
D 9

14. Given that $\left(\{x, x^2, x^3, x^4\}, *\right)$ in the table below, is a group, then the identity element is

$*$	x	x^2	x^3	x^4
x	x^2	x^3	x^4	x
x^2	x^3	x^4	x	x^2
x^3	x^4	x	x^2	x^3
x^4	x	x^2	x^3	x^4

A x^4
B x^3
C x^2
D x

15. Which one of the following linear congruencies has no solution?

A $15x \equiv 6 \pmod{21}$
B $15x \equiv 6 \pmod{40}$
C $15x \equiv 6 \pmod{36}$
D $15x \equiv 6 \pmod{81}$

16. All the asymptotes to the curve $y = f(x)$, where $f(x) = x + 1 + \ln\left|\frac{x+2}{x+1}\right|$, are

A $x = -1,\ x = -2$
B $y = x + 1,\ x = -2$
C $y = x + 1,\ x = -1$
D $y = x + 1,\ x = -2,\ x = -1$

17. If P and Q are statements, then $\sim (P \Rightarrow Q) \equiv$

A $P \vee Q$
B $P \wedge \sim Q$
C $\sim P \wedge \sim Q$
D $\sim P \wedge Q$

18. A function f is defined by

$$f(x) = \begin{cases} \frac{1}{2}x^2, & 0 \le x < 2 \\ cx + 3, & 2 \le x \le 5 \end{cases}.$$

The value of c for which f is continuous in $0 \le x \le 5$, is

A $\frac{1}{2}$
B 0
C $-\frac{1}{2}$
D $-\frac{3}{2}$

19. The value of x for which $\cosh^{-1}(2x) = \ln 4$ is:

A $\frac{17}{16}$
B $\frac{15}{8}$
C $\frac{15}{16}$
D $\frac{17}{8}$

20. A similarity transformation (similitude) f, on a complex plane is defined by $z' = (1+i)z + 3 - 4i$. Its scale factor is

A 1
B $\sqrt{2}$
C 2
D 5

21. $\int_{-1}^{1}\left(x^7 - x^5 + \frac{\sin x}{\left(1+x^4\right)^2}\right)dx =$

A -1
B 0
C 1
D 2

22. The general solution of the differential equation $\frac{d^2x}{dt^2} + 4x = 0$, where p and q are constants is $x =$

A $pe^t\cos(2t+\lambda)$
B $pe^t\sin(2t+\lambda)$
C $p\cos(2t+\lambda)$
D $p\cos(4t+\lambda)$

23. The mean value of the function $\ln x$ in the interval $1 \le x \le e$ is

A $\frac{1}{e}$
B $e-1$
C $\frac{1}{e+1}$
D $\frac{1}{e-1}$

24. A curve is given in Cartesian form by the equation.

$x^2 + y^2 - 2x = (x^2+y^2)^{\frac{1}{2}}$

The polar equation of the curve is

A $r = 1 - 2\cos\theta$
B $r = 1 - 2\sin\theta$
C $r = 1 + 2\cos\theta$
D $r = 1 + 2\sin\theta$

25. If the asymptotes of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{16} = 1$ are perpendicular, then the value of a is

A $\frac{1}{4}$
B $\frac{1}{2}$
C 1
D 4

26. Given that $\mathbf{a}$ and $\mathbf{b}$ are two vectors, which one of the following compound statements is true?

A $\mathbf{a}\times\mathbf{b} = \mathbf{0}$ if $\mathbf{a} \parallel \mathbf{b}$
B $\mathbf{a}\times\mathbf{b} = \mathbf{0}$ if $\mathbf{a} \perp \mathbf{b}$
C $\mathbf{a}\times\mathbf{b} = \mathbf{c}\times\mathbf{d} \Rightarrow \mathbf{a} = \mathbf{c}$ and $\mathbf{b} = \mathbf{d}$
D $\mathbf{a}\times\mathbf{b} \parallel \mathbf{a}$ if $\mathbf{a} \perp \mathbf{b}$

27. For what value of p is the matrix $\begin{pmatrix} p & 5 & 6 \\ 4 & 3 & 3 \\ 6 & 7 & 9 \end{pmatrix}$ non-invertible?

A 0
B 5
C 7
D 9

28. A necessary and sufficient condition to show that a group is Abelian is

A Closure
B Existence of identity element
C Associativity
D Commutativity

29. The number of solutions to the congruence $6x \equiv 15 \pmod{21}$ is

A 1
B 2
C 3
D 4

30. The solutions of $z^3 = 8$ are $z =$

A $\{2, -2 \pm i\sqrt{3}\}$
B $\{2, 1 \pm i\sqrt{3}\}$
C $\{2, 2 \pm i\sqrt{3}\}$
D $\{2, -1 \pm i\sqrt{3}\}$

31. The general solution to the differential equation $3\frac{d^2y}{dx^2} - 4\frac{dy}{dx} = 0$, for constants A, B is $y =$

A $(A+Bx)e^{\frac{4}{3}x}$
B $A + Be^{\frac{4}{3}x}$
C $A + Bxe^{\frac{4}{3}x}$
D $A + Be^{\frac{3}{4}x}$

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32. For any constant k, $\int \frac{1}{\sqrt{x^2-9}}dx =$

A $\sin^{-1}\left(\frac{x}{3}\right)+k$

B $\sinh^{-1}\left(\frac{x}{3}\right)+k$

C $\cos^{-1}\left(\frac{x}{3}\right)+k$

D $\cosh^{-1}\left(\frac{x}{3}\right)+k$

33. The equation $\frac{x^2}{2-a}+\frac{y^2}{a-5}=-1$ represents an ellipse if

A $a>2$
B $a>5$
C $2<a<5$
D $a<2$

34. Given that $M=\begin{pmatrix}1&2&3\\2&3&1\end{pmatrix}$ and $N=\begin{pmatrix}1&2&3\\3&2&1\end{pmatrix}$ are elements of S_3, the symmetric group of permutations of $A=\{1,2,3\}$, the composition $M\circ N=$

A $\begin{pmatrix}1&2&3\\1&2&3\end{pmatrix}$

B $\begin{pmatrix}1&2&3\\1&3&2\end{pmatrix}$

C $\begin{pmatrix}1&2&3\\3&2&1\end{pmatrix}$

D $\begin{pmatrix}1&2&3\\2&1&3\end{pmatrix}$

35. The rate of cooling of a liquid is proportional to the difference between its temperature, θ and the temperature of the room α. The differential equation which models this process, for some positive k, is

A $\frac{d\theta}{dt}=\theta-\alpha$

B $\frac{d\theta}{dt}=k(\theta-\alpha)$

C $\frac{d\theta}{dt}=-k(\theta-\alpha)$

D $\frac{d\theta}{dt}=-k(\alpha-\theta)$

36. Using the approximation $y_{n+1}\cong y_n+h\left(\frac{dy}{dx}\right)_n$ and a step length of 0.2, the approximate value of y, when $x=1.2$, given that $\frac{dy}{dx}=x+y$ and $y=0$ when $x=1$ is

A 1.2
B 1.68
C 1.4
D 0.2

37. A particle performing simple harmonic motion has a speed of $4ms^{-1}$ when it is 1m from the centre of oscillations. If the period of oscillations is $\sqrt{2}\pi s$, its amplitude is

A $4m$
B $3m$
C $2.5m$
D $2\,m$

38. The moment of inertia of a uniform rod of mass $2m$ and length l about an axis through its centre and perpendicular to the rod is

A $\frac{1}{3}ml^2$

B $\frac{1}{4}ml^2$

C $\frac{1}{6}ml^2$

D $\frac{1}{8}ml^2$

39. The line of action of a force $\mathbf{F}$ with point of application P, such that $\mathbf{OP}=\mathbf{r}$ is $\mathbf{r}+\lambda\mathbf{F}$. Which one of the following statements is **NOT** true?

A $\mathbf{r}\times\mathbf{F}$ is the moment of $\mathbf{F}$ about O
B $\mathbf{r}\times\mathbf{F}$ is equal to $(\mathbf{r}+\lambda\mathbf{F})\times\mathbf{F}$
C $\mathbf{r}\times\mathbf{F}$ is less than $(\mathbf{r}+\lambda\mathbf{F})\times\mathbf{F}$
D $(\mathbf{r}-\mathbf{a})\times\mathbf{F}$ is the moment of $\mathbf{F}$ about the point with position vector $\mathbf{a}$.

40. A particle P moves with constant angular speed ω on a curve whose polar equation is $r=(1+\cos\theta)$, the traverse component of its acceleration is

A $-2\omega\sin\theta$
B $2\omega\sin\theta$
C $2\omega^2\sin\theta$
D $-2\omega^2\sin\theta$

41. When two elastic objects collide obliquely, which one of the following statements is **NOT** true?

A Their velocities perpendicular to the line of centres do not change

B They move in opposite directions after impact

C Equal and opposite impulses act on each of them

D The total kinetic energy sometimes decreases.

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42. The value of k for which

$$p(x) = \begin{cases} k(x+2), & x = 0,1,2,3,4 \\ 0, & \text{otherwise} \end{cases}$$

is a discrete probability density function is

A $\frac{1}{20}$

B $\frac{1}{15}$

C $\frac{14}{9}$

D $\frac{8}{3}$

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43. A liquid is leaking from a container at the rate of $\frac{2}{x}$ litres per second where x is the quantity in litres, of liquid remaining in the container after time t seconds. If initially there are 20 litres of liquid in the container, the time in which the quantity of the liquid reduces from 20 litres to 10 litres in seconds is

A -125

B -75

C 75

D 125

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44. Given that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$, the first three terms in the series expansion of y in ascending powers of x is

A $1 + x + \frac{1}{2}x^2$

B $1 + x + x^2$

C $1 + x - \frac{1}{2}x^2$

D $1 + x - x^2$

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45. A particle oscillates through a distance $0.4\,m$ on either side of its equilibrium position with period of 4 seconds. The maximum speed of the particle is

A $0.2\pi ms^{-1}$

B $3.2\pi ms^{-1}$

C $32\pi ms^{-1}$

D $0.4\pi ms^{-1}$

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46. If the moment of inertia of a square lamina of side a and mass m about an axis through its centre and perpendicular to its plane is I, then its moment of inertia about an axis through an edge in the plane of the lamina is

A $\frac{1}{2}I + \frac{1}{2}ma^2$

B $I + \frac{1}{2}ma^2$

C $I + \frac{1}{4}ma^2$

D $\frac{1}{2}I + \frac{1}{4}ma^2$

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47. A force $\mathbf{F} = (2\mathbf{i} + \mathbf{j} + \mathbf{k})N$ acts on a particle giving it a displacement of $(\mathbf{i} + \mathbf{j} + 2\mathbf{k})m$. The work done by $\mathbf{F}$ is

A $5J$

B $\sqrt{35}J$

C $-3J$

D $9J$

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48. A particle is moving round the polar curve $r = a\cos\theta$ with constant angular velocity ω. The transverse component of its velocity when $\theta = \frac{\pi}{3}$ is:

A $\frac{1}{2}a\omega$

B $\frac{\sqrt{3}}{2}a\omega$

C $a\omega$

D 0

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49. A smooth sphere moving in space impinges on a similar sphere and its velocity changes from $(2\mathbf{i} - \mathbf{j} + 3\mathbf{k})ms^{-1}$ to $(3\mathbf{i} + \mathbf{j} - \mathbf{k})ms^{-1}$. The direction of the line of centres is

A $(5\mathbf{i} + 2\mathbf{k})$

B $(-\mathbf{i} - 2\mathbf{j} + 4\mathbf{k})$

C $(\mathbf{i} - 2\mathbf{j} + 4\mathbf{k})$

D $(3\mathbf{i} + \mathbf{j} - \mathbf{k})$

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50. The equivalent of $P(|z| > a)$ is

A $2\Phi(a) - 1$

B $2(1 - \Phi(a))$

C $1 - 2\Phi(a)$

D $1 - \Phi(a)$

STOP

GO BACK AND CHECK YOUR WORK