

GENERAL CERTIFICATE OF EDUCATION (GCE) BOARD
General Certificate of Education Examination

0775 Further Mathematics 1

JUNE 2021

ADVANCED LEVEL

Centre Number	http://www.gcerevision.com
Centre Name	
Candidate Number	
Candidate Name	gcerevision.com

Mobile phones are NOT allowed in the examination room.

MULTIPLE CHOICE QUESTION PAPER

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 the information required in the spaces provided on the answer sheet using your HB pencil: **Candidate Name, Exam Session, Subject Code and Candidate Identification Number.**

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. Calculators are allowed.
8. 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]

9. 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.
10. 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.
11. Do all rough work in this booklet, using the blank spaces in the question booklet.
12. **At the end of the examination, the invigilator shall collect the answer sheet first and then the question booklet. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH IT.**

Turn Over

JUNE 2021/0775/1/C/MCQ
@2021GCEB

1. The general solution of the differential

equation $\cos x \frac{dy}{dx} - y \sin x = \sin x$ is

- A $y = -1 + k \sec x$
- B $y = 1 + k \sec x$
- C $y = (-1 + k) \sec x$
- D $y = (1 + k) \sec x$

2. $\frac{1}{(x+1)(x^2-1)}$, $x \neq \pm 1$ expressed in partial

fractions for some constants p and q is

- A $\frac{p}{x+1} - \frac{\frac{1}{2}}{(x+1)^2} + \frac{\frac{1}{4}}{x-1}$
- B $\frac{\frac{1}{2}}{x+1} + \frac{px+q}{x^2-1}$
- C $\frac{p}{x+1} + \frac{\frac{1}{2}}{(x+1)^2} - \frac{\frac{1}{4}}{x-1}$
- D $\frac{p}{x+1} + \frac{\frac{1}{2}}{(x+1)^2} + \frac{\frac{1}{4}}{x-1}$

3. The value of c for which the function

$$f(x) = \begin{cases} x^2 + \frac{1}{2}c, & x \leq 0 \\ \frac{\sin x}{2x}, & x > 0 \end{cases} \text{ is continuous is}$$

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

4. The function $f(x)$ is such that

$$\frac{\cos x - 1}{x} + 3 \leq f(x) \leq \frac{\sin x}{x} + 2, \lim_{x \rightarrow 0} f(x) =$$

- A 0
- B 1
- C 2
- D 3

5. The polar equation of the hyperbola $xy = 4$ is

- A $r^2 = 8 \operatorname{cosec} \theta$
- B $r^2 = 2 \operatorname{cosec} \theta$
- C $r^2 = 8 \operatorname{cosec} 2\theta$
- D $r^2 = 2 \operatorname{cosec} 2\theta$

6. The equation of motion of a particle performing simple harmonic motion is given by

$$\frac{d^2y}{dx^2} + 18x = 0.$$

The period of the motion is

- A $\frac{\pi\sqrt{2}}{6}$
- B $\frac{\pi\sqrt{2}}{3}$
- C π
- D $\frac{\pi\sqrt{2}}{9}$

7. Given that \mathbf{p} and \mathbf{q} are two non-zero vectors such that $\mathbf{p} = \alpha \mathbf{q}$, where α is a real constant. Which one of the following is true?

- A $\mathbf{p} \cdot \mathbf{q} = 0.$
- B $\mathbf{p} \cdot \mathbf{q} = \alpha.$
- C $\mathbf{p} \times \mathbf{q} = 0.$
- D $|\mathbf{p} \times \mathbf{q}| = \alpha.$

8. The structure (\mathbb{Q}, \times) is **NOT** a group because (\mathbb{Q}, \times)

- A is not closed
- B is associative
- C does not have an identity element
- D does not have inverse elements

9. $x^2 \equiv -1 \pmod{25}$ is equivalent to

- A $x^2 \equiv 1 \pmod{25}$
- B $x^2 \equiv 24 \pmod{25}$
- C $x^2 \equiv 8 \pmod{25}$
- D $x^2 \equiv 5 \pmod{25}$

10. Given that $h \left(\frac{dy}{dx} \right)_n \approx y_{n+1} - y_n$ and

$$\frac{dy}{dx} = \frac{x}{y}, \quad y \neq 0$$

then $y_{n+1} \approx$

- A $h \frac{x_n}{y_n} - x_n$
- B $h \frac{x_n}{y_n} - y_n$
- C $h \frac{x_n}{y_n} + y_n$
- D $h \frac{x_n}{y_n} + x_n$

11. $k \wedge (i + j) =$

- A $j - i$
- B $-j + i$
- C $-j - i$
- D $j + i$

12. If p and q are statements then $\sim (\sim p \Rightarrow \sim q) \equiv$

- A $p \wedge q$
- B $\sim p \wedge q$
- C $p \wedge \sim q$
- D $q \Rightarrow \sim p$

13. The value of x for which $\sinh^{-1}(x) = \ln 2$ is

- A $\frac{4}{3}$
- B $-\frac{1}{4}$
- C $\frac{5}{4}$
- D $\frac{3}{4}$

14. Given that $|z| = 5$, the minimum value of $|z - 3|$ is

- A 1
- B 2
- C 4
- D 8

15. For which of the following intervals is the Taylor series expansion of the function $f(x) = \ln(3 - 2x)$ valid?

- A $]-\frac{3}{2}, \frac{3}{2}]$
- B $[-\frac{3}{2}, \frac{3}{2}]$
- C $]-\frac{3}{2}, \frac{3}{2}[$
- D $[-\frac{3}{2}, \frac{3}{2}[$

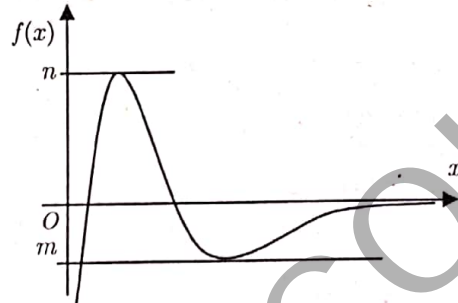
16. If $u_0 = 5$, $u_{n+1} = u_n - 3$, then which one of the following statements is true for U_n ?

- A U_n is a geometric sequence
- B U_n is a decreasing sequence
- C U_n is a has positive terms
- D U_n is an increasing arithmetic sequence

17. $\int_{-2}^2 |x| dx =$

- A 0
- B 1
- C 2
- D 4

18.



From the graph of f , the equation $f(x) = a$, $a \in \mathbb{R}$,

has exactly two roots for

- A $a > 0$
- B $0 \leq a \leq n$
- C $0 < a < n$
- D $m < a < 0$

19. The root mean square value of $\cosh x$, for $1 \leq x \leq 3$ is

- A $\left[\frac{1}{2} \int \cosh^2 x dx \right]^{\frac{1}{2}}$
- B $\frac{1}{2} \left[\int_1^3 \cosh^2 x dx \right]^{\frac{1}{2}}$
- C $\frac{1}{3} \left[\int_1^3 \cosh^2 x dx \right]^{\frac{1}{2}}$
- D $\left[\frac{1}{2} \int_1^3 \cosh^2 x dx \right]^{\frac{1}{2}}$

20. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} a(1 - x^2), & -\frac{1}{3} \leq x \leq \frac{1}{3} \\ 0, & \text{elsewhere} \end{cases}$$

The value of a is

- A $\frac{81}{52}$
- B $\frac{162}{52}$
- C 1
- D $\frac{2}{3}$

21. The domain of the function $g(x) = \frac{x+1}{\sqrt{x^2-4}}$ is

- A $] -2, +\infty[$
- B $] -\infty, 2[$
- C $] -\infty, -2[\cup] 2, +\infty[$
- D $] -2, 2[$

22. A sequence (u_n) is such that $\lim_{n \rightarrow \infty} (u_n) = 2$. Then (u_n) is _____ sequence

- A divergent
- B convergent
- C arithmetic
- D geometric

23. The image of the line $y = x$ under the

transformation matrix $\begin{pmatrix} 1 & 0 \\ 2 & -3 \end{pmatrix}$ is the line

- A $y = x$
- B $y = 2x$
- C $y = -x$
- D $y = 1 - x$

24. $\int_0^1 \frac{1}{\sqrt{x^2+9}} dx =$

- A $\sinh^{-1}\left(\frac{1}{3}\right)$
- B $\cosh^{-1}\left(\frac{1}{3}\right)$
- C $\tanh^{-1}\left(\frac{1}{3}\right)$
- D $\cosh^{-1}(3)$

25. The work done when the point of application of the force F is displaced from r_1 to r_2 is

- A $r_1 \times F$
- B $r_2 \times F$
- C $(r_1 - r_2) \cdot F$
- D $(r_2 - r_1) \cdot F$

26. A smooth sphere is moving with velocity $(3i + j)ms^{-1}$ when it hits a smooth wall parallel to the vector j . If the coefficient of restitution between the sphere and the wall is $\frac{1}{3}$, then the velocity of the sphere after hitting the wall is.

- A $i + j$
- B $i - j$
- C $-i + j$
- D $-i - j$

27. Given that $z, w \in \mathbb{C}$. Then the transformation $w = iz$ is

- A a rotation $\frac{\pi}{2}$ clockwise
- B a rotation $\frac{\pi}{2}$ anticlockwise
- C a rotation $\frac{\pi}{4}$ clockwise
- D a rotation $\frac{\pi}{4}$ anticlockwise

28. If $25 \cosh x + 7 \sinh x \equiv R \cosh(x + \lambda)$, then the value of R is

- A $\sqrt{674}$
- B 24
- C 18
- D 16

29. The moment of inertia of a rigid body of mass $3M$ about a given axis is $\frac{3Ma^2}{4}$. The radius of gyration about the axis is

- A $\frac{a}{2}$
- B $\frac{a}{4}$
- C $\frac{\sqrt{3}}{2}a$
- D $\frac{a^2}{4}$

30. The probability density function of a continuous random variable X is given by

$$f(x) = \begin{cases} a(1-x^2), & -1 \leq x \leq 1 \\ 0, & \text{elsewhere} \end{cases}$$

The value of a is

- A $\frac{4}{3}$
- B 1
- C $\frac{3}{4}$
- D $\frac{2}{3}$

31. The number, n , of bees in a large apiary reduces at a rate equal to thrice the number of bees present at time t . The differential equation that models the number of bees in this apiary is

- A $\frac{dn}{dt} = 3n$
- B $\frac{dn}{dt} = -3$
- C $\frac{dn}{dt} = 3$
- D $\frac{dn}{dt} = -3n$

32. The coordinates of the focus of the parabola

$$(y-4)^2 = 20(x+2), \text{ are}$$

- A $(-2, 7)$
- B $(3, 4)$
- C $(-5, 4)$
- D $(-2, 1)$

33. One of the solutions of the congruent equation

$$x^2 - 3x + 4 \equiv 0 \pmod{7} \text{ is}$$

- A 3
- B 4
- C 5
- D 6

34. The integrating factor of the differential

$$\text{equation } \frac{dy}{dx} + 2y \tanh x = \cos x \text{ is}$$

- A $\cosh x$
- B $\operatorname{sech} x$
- C $\cosh^2 x$
- D $\operatorname{sech}^2 x$

35. The negation of the statement $\sim P \wedge \sim Q$ is

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

36. The work done by a force F in displacing a particle from a point a to the origin is

- A $-a.F$
- B $a.F$
- C $-a \times F$
- D $a \times F$

37. Given that $h \left(\frac{dy}{dx} \right)_n \approx y_{n+1} - y_n$ and $\frac{dy}{dx} = -(x+2)$,

then $y_{n+1} \approx$

- A $y_n + hx_n + 2$
- B $y_n + h(x_n + 2)$
- C $y_n + h(x_n - 2)$
- D $y_n - h(x_n + 2)$

38. The function $f(x) = \frac{(x^2-4)(x+2)(x+3)}{(x-1)(x-2)}$ has a removable discontinuity at $x =$

- A 0
- B 1
- C 2
- D 3

39. A particle moves along the curve $r = 1 - \sin \theta$ with constant angular velocity w . The maximum speed occurs for $\theta =$

- A $\frac{\pi}{2}$
- B π
- C $\frac{3\pi}{2}$
- D 2π

40. For a parameter $t \in \mathbb{R}$, the image of the point $(t, 2t, 3t)$ under the transformation with matrix

$$M = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 4 & 6 \\ 3 & 6 & 9 \end{pmatrix}$$

is

- A $(2t, 3t, t)$
- B $(t, 3t, 2t)$
- C $(t, 2t, 3t)$
- D $(2t, t, 3t)$

Turn Over

41. For what value(s) of n is $\int_0^1 x^n dx = \int_0^1 (1-x)^n dx$

- A $n \in \mathbb{R}$
- B $n = 2k, k \in \mathbb{Z}$.
- C $n = 2k + 1, k \in \mathbb{Z}$
- D $n \notin \mathbb{R}$

42. $z = \cos \frac{\pi}{6} - i \sin \frac{\pi}{6}$, then $|z + \frac{1}{z}| =$

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

43. A binary operation \bullet is defined on \mathbb{R} , by

$$x \bullet y = x + y + 1. \text{ The inverse of 4 is}$$

- A -8
- B -6
- C -4
- D 0

44. The first three terms in the expansion of $e^{\frac{x}{3}}$ are

- A $1 + \frac{1}{3}x + \frac{1}{9}x^2$
- B $1 + \frac{1}{3}x + \frac{1}{18}x^2$
- C $1 + \frac{1}{3}x + \frac{2}{9}x^2$
- D $1 + \frac{1}{3}x + \frac{1}{6}x^2$

45. A sequence (u_n) is defined by $u_0 = 3, u_{n+1} = \frac{1}{6}u_n$.

$$\lim_{n \rightarrow \infty} (u_n) =$$

- A 0
- B $\frac{1}{6}$
- C 1
- D 3

46. The asymptote to the curve $y + 2 = 3^x$ is

- A $x = 0$
- B $y = -2$
- C $y = 2$
- D $x = 1$

47. The arc length of the curve $f(x) = \cosh x$ for

$$0 \leq x \leq \ln 5 \text{ is}$$

- A $\frac{12}{5}$
- B $\frac{5}{4}$
- C $\frac{5}{2}$
- D $\frac{5}{12}$

48. For any three non-singular matrices A, B and C ,

$$A^{-1}(B^{-1}C)^{-1} =$$

- A $A^{-1}C^{-1}B^{-1}$
- B $C^{-1}B^{-1}A^{-1}$
- C $A^{-1}C^{-1}B$
- D $B^{-1}A^{-1}C^{-1}$

49. The moment of momentum about O of a particle of mass m moving with velocity \mathbf{v} through a point with position vector \mathbf{r} is

- A $\mathbf{r} \times m\mathbf{v}$
- B $m\mathbf{v} \times \mathbf{r}$
- C $\mathbf{r} \cdot m\mathbf{v}$
- D $m\mathbf{v} \cdot \mathbf{r}$

50. Which one of the following functions is NOT differentiable in the interval $-1 \leq x \leq 1$

- A $y = |x - 1|$
- B $y = x^2$
- C $y = -x^2$
- D $y = |x| + 1$

GO BACK AND CHECK YOUR WORK