CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

0775 Further Mathematics 1

JUNE 2017

ADVANCED LEVEL

Centre Number	
Centre Name	
Candidate Identification No.	
Candidate Name	

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 **"0775 Further Mathematics 1 - Advanced Level".**
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 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 appropriate. 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 ANY.**

1. The general solution of the differential equation $\frac{d^2y}{dx^2} + 25y = 0$ is

A $y = A\cos\sqrt{5}x + B\sin\sqrt{5}x$

B $y = A\cos 5x + B\sin 5x$

C $y = Ae^{-5x} + Be^{5x}$

D $y = Ae^{-\sqrt{5}x} + Be^{\sqrt{5}x}$

2. Given that the vectors p and q are non-parallel and coplanar, then

A $\mathbf{p}.\mathbf{q} = 0$

B $\mathbf{p}.(\mathbf{p}\times\mathbf{q}) = 0$

C $\mathbf{p}.\mathbf{q} = |\mathbf{p}||\mathbf{q}|$

D $\mathbf{p}\times\mathbf{q} = |\mathbf{p}||\mathbf{q}|\cos\theta$

3. The complex number $z = -3 + 3i$ can be expressed in the form $re^{i\theta}$ where $\theta =$

A $\frac{3\pi}{4}$

B $\frac{\pi}{4}$

C $-\frac{\pi}{4}$

D $-\frac{3\pi}{4}$

4. The converse of "If $(x-y)^2 \geq 0$ then $2xy \leq x^2 + y^2$" is

A "if $2xy \leq x^2 + y^2$ then $(x-y)^2 \geq 0$"

B "if $2xy \geq x^2 + y^2$ then $(x-y)^2 \leq 0$"

C "if $2xy \geq x^2 + y^2$ then $(x-y)^2 \geq 0$"

D "if $2xy \leq x^2 + y^2$ then $(x-y)^2 \leq 0$"

5. The function f is defined by

$$f(x) = \begin{cases} \frac{\sin 2x}{x}, & x < 0 \\ \frac{3x^2 + \mu}{2 - \mu}, & 0 \leq x < 2. \end{cases}$$

f is continuous at the point where $x = 0$ if $\mu =$

A 4

B -4

C 6

D 4/3

6. Given that $4\sinh x - 2\cosh x = Ae^x + Be^{-x}$ then A and B are respectively

A 1, -3

B -1, 3

C -1, -3

D 1, 3

7. Given that $\ln(1+x) \approx x - \frac{1}{2}x^2 + \frac{1}{3}x^3$, then $\ln(1-x^3) \approx$

A $\frac{1}{3}x^3 - \frac{1}{6}x^6 + \frac{1}{9}x^9$

B $-x^3 - \frac{1}{6}x^6 + \frac{1}{9}x^9$

C $-x^3 - \frac{1}{6}x^6 + \frac{1}{9}x^9$

D $-x^3 - \frac{1}{2}x^6 - \frac{1}{3}x^9$

8. A force $\mathbf{F} = (2\mathbf{i} - 3\mathbf{j} + \mathbf{k})$N acts through the point with position vector $(\mathbf{i} - 3\mathbf{j} - 2\mathbf{k})$m . The moment of F about the origin in Nm is

A $9\mathbf{i} - 5\mathbf{j} + 3\mathbf{k}$

B $-9\mathbf{i} - 5\mathbf{j} + 3\mathbf{k}$

C $-9\mathbf{i} + 5\mathbf{j} - 3\mathbf{k}$

D $-9\mathbf{i} - 5\mathbf{j} - 3\mathbf{k}$

9. If $y = 3e^{-2x} + 4e^x$ is a solution of the differential equation

$$\frac{d^2y}{dx^2} + a\frac{dy}{dx} + by = 0$$

where a and b are constants then

A $a = 1, b = 2$

B $a = -1, b = -2$

C $a = 1, b = -2$

D $a = 2, b = -1$

10. Using Simpson's rule with 3 ordinates, $\int_0^2 2^x\,dx =$

A $\frac{13}{3}$

B 13

C 3

D 4

11. If $\sum_{r=1}^{\infty}\frac{1}{r^n}$ is convergent then

A $n > 0$
B $n > 1$
C $n = 0$
D $n < 1$

12. $\int \frac{1}{\sqrt{1+9x^2}}dx =$

A $\sinh^{-1}(3x) + k$
B $\cosh^{-1}(3x) + k$
C $\frac{1}{3}\sinh^{-1}(3x) + k$
D $\frac{1}{3}\cosh^{-1}(3x) + k$

13. $\frac{3x-8}{(x+3)(x^2+4)}$ can be expressed in partial fractions, for constants A, B, and C, as

A $\frac{A}{x+3} + \frac{Bx}{x^2+4}$
B $\frac{A}{x+3} + \frac{B}{x^2+4}$
C $\frac{A}{x+3} + \frac{Bx+C}{x^2+4}$
D $\frac{A}{x+3} + \frac{B}{x+2} + \frac{C}{x-2}$

14. The expansion of $\ln(1-2x)$ is valid for

A $-\frac{1}{2} \le x \le \frac{1}{2}$
B $-\frac{1}{2} < x < \frac{1}{2}$
C $-\frac{1}{2} \le x < \frac{1}{2}$
D $-\frac{1}{2} < x \le \frac{1}{2}$

15. The asymptotes of the curve $y = \frac{x^3+1}{x^2-x}$ are:

A $x = 0, x = -1, y = x + 1$
B $x = 0, x = 1, y = x - 1$
C $x = 0, x = 1, y = -x + 1$
D $x = 0, x = 1, y = x + 1$

16. If $z = e^{i\theta}$ where θ is real, then

$z^6 + z^4 - z^{-4} - z^{-6} =$

A $2\cos 4\theta + 2\cos 6\theta$
B $2\sin 4\theta + 2\sin 6\theta$
C $2i\sin 4\theta + 2i\sin 6\theta$
D $2i\cos 4\theta + 2i\cos 6\theta$

17. Given that $(AB)x = y$ where A and B are non-singular square matrices and x, y non-zero column vectors, then x =

A $yA^{-1}B^{-1}$
B $B^{-1}A^{-1}y$
C $yB^{-1}A^{-1}$
D $A^{-1}B^{-1}y$

18. The number $\frac{2}{13}$ expressed as a decimal is 0.153846153846153⋯
The 300th digit is

A 1
B 3
C 5
D 6

19. A particle P moves on a polar curve such that at time t, its polar coordinates (r, θ) are given by the parametric equation

$$r = 3e^t, \theta = \frac{1}{3}(t^2 + t)$$

The transverse component of the velocity when $t = 0$ is

A 1
B 2
C 3
D 4

20. A small sphere moving horizontally with speed 16 m s^{-1} strikes a smooth fixed wall in a direction making an angle of 60^o with the plane of the wall. The coefficient of restitution between the sphere and the wall is ¼ . The component of the velocity of the sphere parallel to the wall after impact is:

A 2 m s^{-1}
B 4 m s^{-1}
C 8m s^{-1}
D 12 m s^{-1}

21. A random variable X has a Poisson distribution with parameter 3. $P(X < 2) =$

A $1 - 4e^{-3}$

B $1 + 4e^{-3}$

C $\frac{9}{2}e^{-3}$

D $4e^{-3}$

22. Given that $I_1 = 1$ and $I_{n+1} = \frac{1}{2}I_n$. The limiting value of I is:

A 0

B 1

C 2

D ∞

23. The function $f(x) = \tanh x$ has domain and range given respectively by

A $(-\infty,\infty),(0,1)$

B $(-\infty,\infty),(-1,1)$

C $(-1,1),(-\infty,\infty)$

D $(0,\infty),(0,1)$

24. The function f is given by

$$f(x) = \begin{cases} 1 - x^3, 0 \leq x < 1 \\ x - 1, 1 \leq x \leq 3 \\ 1, x > 3. \end{cases}$$

f is discontinuous at $x =$

A 0

B 1

C 2

D 3

25. The root mean square value of $y = x^2$ in the interval $0 \leq x \leq 2$ is:

A $\frac{32}{5}$

B $\frac{16}{5}$

C $\frac{4\sqrt{5}}{5}$

D $\frac{4\sqrt{10}}{5}$

26. The volume of the tetrahedron $OABC$ where A, B, C are the points $(2,0,1),(3,1,2),(-1,3,0)$ respectively and O is the origin is:

A 1/3

B 2/3

C 2

D 4

27. The rate of decay of a radioactive substance is λx where x is the amount of the substance remaining at time t and λ is a positive constant. If the initial amount of substance is x_o, the amount left after time $\frac{1}{\lambda}\ln(\frac{3}{2})$ is:

A $\frac{2}{3}x_o$

B $\frac{1}{2}x_o$

C $\frac{3}{2}x_o$

D $\frac{1}{3}x_o$

28. The equation $4\frac{d^2x}{dt^2} + 12\frac{dx}{dt} + 13x = 0$ represents a damped harmonic motion. The period of the motion is:

A $\frac{2\pi}{5}$

B π

C $\frac{\pi}{2}$

D 2π

29. Which two of the following planes are perpendicular to each other

A $x + 2y + z = 3$ and $x - y = 0$

B $x = 0$ and $y = 0$

C $x + y = 0$ and $x + z = 0$

D $x - y = 0$ and $x - z = 0$

30. A force **F** displaces a particle from a point with position vector **p** to a point with position vector **q**. The work done by **F** is

A **F** × (**p** - **q**)

B **F** × (**q** - **p**)

C **F** • (**q** - **p**)

D **F** • (**p** - **q**)

31. Using Pappus' theorem, the value of the y-coordinate of the centroid of a uniform semi-circular lamina of radius a is

A $\frac{3a}{4\pi}$

B $\frac{4a}{3\pi}$

C $\frac{2a}{3\pi}$

D $\frac{3a}{2\pi}$

32. When n is odd

$$I_n = \int_0^{\frac{\pi}{2}} \sin^n dx = \left(\frac{n-1}{n}\right)\left(\frac{n-3}{n-2}\right)\ldots 1.$$

$I_5 =$

A $\frac{8}{15}$

B $\frac{16}{35}$

C $\frac{4\pi}{15}$

D 0

33 One of the solutions of the congruence equation $x + 3 \equiv 1 (\bmod 5)$ is

A 1
B 2
C 3
D 4

34. The set of integers $\mathbb{Z}$, forms a group under the operation $*$, defined by $a * b = a + b + 1$ for all $a, b, c \in \mathbb{Z}$. The identity element is

A -2
B -1
C 1
D 2

35. If the Diophantine equation $mx + ny = c$ has a solution, then for positive natural number a, which one of the following is true?

A $\gcd(m,n) = a$ and $a | c$
B $\gcd(m,n) = a$ and $c | a$
C $\gcd(m,c) = a$ and $a | c$
D $\gcd(c,n) = a$ and $a | c$

36. The energy equation of a compound pendulum is reduced to the form $a\left(\frac{d\theta}{dt}\right)^2 = 8g\cos\theta$ where a and g are constants. The periodic time of swing is:

A $\frac{\pi}{2}\sqrt{\frac{a}{g}}$

B $\pi\sqrt{\frac{a}{2g}}$

C $2\pi\sqrt{\frac{a}{g}}$

D $\pi\sqrt{\frac{a}{g}}$

37. Which one of the polar curves is symmetrical about the initial line only?

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

38. Given that the vectors $\mathbf{a} = 2\mathbf{i} + \mathbf{j} + 2\mathbf{k}$ and $\mathbf{b}$ are parallel and $\mathbf{a}.\mathbf{b} = 6$. The magnitude of $\mathbf{b}$ is:

A 1
B 2
C 3
D 6

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

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

40. A sequence $(x_n)_{n\geq 1}$ is defined recursively as $x_{n+1} = (4 - x_n), x_1 = 2$. The sequence $(x_n)_{n\geq 1} = (x_1, x_2, x_3, \ldots)$ is

A increasing
B decreasing
C oscillating
D constant

41. A square of sides 4 units is rotated completely about one of its sides. The volume of the solid generated is

A 64π
B 32π
C 16π
D 4π

42. $\left(\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{2}}i\right)^4 =$

A $\frac{1}{2}$
B ¼
C 4
D -1

43. A particle moving with velocity i m s^{-1} receives an impulse which changes its velocity to (i + k) m s^{-1}. The particle's direction of motion is deflected through an angle

A $\frac{\pi}{4}$
B $\tan^{-1}\left(\frac{1}{2}\right)$
C $\frac{\pi}{3}$
D $\cos^{-1}\left(\frac{1}{2}\right)$

44. The inverse of permutation $\begin{pmatrix}1 & 2 & 3\\ 3 & 1 & 2\end{pmatrix}$ is

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

45. The line $y = mx + c$ is an oblique asymptote to the curve $y = mx + c + h(x)$ provided

A $\lim_{x\to 0} h(x) = 0$
B $\lim_{x\to \infty} h(x) = 1$
C $\lim_{x\to \infty} h(x) = 0$
D $\lim_{x\to 0} h(x) = 1$

46. The line $x = y + 1 = z - 1$ meets the plane $z = 0$ at the point

A $(-1,-2,0)$
B $(1,2,0)$
C $(0,-1,1)$
D $(0,1,-1)$

47. The moment of inertia of a uniform solid sphere of mass m about an axis along the diameter is $m\lambda^2$ where $\lambda > 0$. The radius of gyration of the sphere about an axis distant x from this diameter is:

A $x + \lambda$
B $\sqrt{x^2 + \lambda^2}$
C $x^2 + \lambda^2$
D $\sqrt{x + \lambda}$

48. Let a, b, k be integers such that $b = ka$. Which one of the following is true?

A b divides k
B b divides a
C k divides a
D k divides b

49. A particle P performs simple harmonic motion between points which are 10 metres apart. When P passes through the equilibrium position its speed is 15 m s^{-1}. The period of motion, in seconds, is.

A $\frac{2\pi}{5}$
B $\frac{\pi}{2}$
C $\frac{2\pi}{3}$
D $\frac{\pi}{3}$

50. If $\frac{e^x - 1}{e^x + 1} = p, x \in \mathbb{R}$, then

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

STOP

GO BACK AND CHECK YOUR WORK