SOUTH WEST REGIONAL MOCK EXAMINATION
GENERAL EDUCATION

The Teachers' Resource Unit (TRU) in collaboration with the Regional Pedagogic Inspectorate for Science Education and the South-West Association of Mathematics Teachers (SWAMT)	Subject Code 0775	Paper Number 1
CANDIDATE NAME ..... CANDIDATE NUMBER ..... CENTRE NUMBER	Subject Title FURTHER MATHEMATICS	
ADVANCED LEVEL	DATE: MONDAY 27/03/2023-AFTERNOON	

Time Allowed: One hour thirty minutes

INSTRUCTIONS TO CANDIDATES:

1. USE A SOFT HB PENCIL THROUGHOUT THIS 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, Paper 1".**
4. Insert the information required in the spaces provided above.
5. Without opening the booklet, pull out the answer sheet carefully from inside the front cover of this booklet. 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.
6. Insert the information required in the spaces provided on the answer sheet using your HB pencil:
   Candidate Name, Centre Number, Candidate Number, Subject Code Number and Paper Number.

How to answer questions in this examination:

7. Answer ALL the 50 questions in this examination. All questions carry equal marks.
8. Non-programmable calculators are allowed.
9. For each question there are four suggested answers, A, B, C, and D. Decide 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 brackets for the answer you have chosen. For example, if C is your correct answer, mark C as shown [A] [B] [C] [D]
10. Mark only one answer for each question. If you mark more than one answer, you will score zero for that question. If you change your mind about an answer, erase the first mark carefully, and then mark your new answer.
11. Avoid spending much time on any question. If you find a question difficult, move 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. Mobile phones are **NOT ALLOWED** in the examination room.
14. **You must not take this booklet and answer sheet out of the examination room. All question booklets and answer sheets will be collected at the end of the examination**

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1. The general solution of the differential equation $\frac{d^2y}{dx^2} - y = 0$, where p and q are arbitrary constants, is;

A $pcosx + qsinx$
B $pe^{-x} + qe^{x}$
C $(p + qx)e^{x}$
D $e^{x}(pcosx + qsinx)$

2. 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 $1+e^{-i\theta}$

3. $f(x) = \frac{x^2}{(x+1)(x^2-4)}$. If P, Q, and R are real constants then $f(x)$ expressed in partial fractions is

A $\frac{P}{x+1} + \frac{Qx+R}{x^2-4}$
B $\frac{P}{x+1} + \frac{Q}{x^2-4}$
C $\frac{P}{x+1} + \frac{Q}{x+2} + \frac{R}{x-2}$
D $\frac{P}{x+1} + \frac{Q}{x-4} + \frac{R}{x+4}$

4. The series $\sum_{r=1}^{\infty} \frac{1}{r(p+1)}$, converges when

A $p > 0$
B $p > -1$
C $p < -1$
D $p = 1$

5. Given the vectors a = i − j +k and b= 2i + j -2k, the value of a.b is

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

6. The root mean square value of $\sqrt{x}$ over the Interval $0 \leq x \leq 2$ is

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

7. A tangent at the pole to the curve $r = a(1 - 2cos2\theta)$, $a > 0$, is

A $\frac{4\pi}{3}$
B $\frac{\pi}{3}$
C $\frac{5\pi}{6}$
D $\frac{\pi}{12}$

8. The focus of the parabola $y^2 = 8(x-2)$ is at the point

A (0, 0)
B (2, 0)
C (-2, 0)
D (4, 0)

9. The coefficient of the term in x^2 in the Maclaurine series expansion of $ln(1-2x)$ is

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

10. Given that $a * b = a - ab + b$, where $*$ is a binary operation in $\mathbb{R} - \{1\}$, the identity element of $*$ is

A -1
B 1
C 0
D 2

11. The value of a for which

$$f(x) = \begin{cases} a(2-x), & 0 \leq x \leq 2 \\ 0, & otherwise, \end{cases}$$

is a probability function is

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

12. The number of bacteria, x, in a culture

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reduces at a rate equal to twice the number present at time t. The differential equation describing this situation is $\frac{dx}{dt}$ =

A -2
B 2
C $-2x$
D $2x$

13. The equation $\frac{d^2x}{dt^2} + 2k\frac{dx}{dt} + n^2x = 0$, represents oscillatory motion when

A $k^2 > n^2$
B $k^2 < n^2$
C $k^2 = n^2$
D $4k^2 > n^2$

14. If $g(x) = 1 - 2x + x^2$, then the equation $g(x) = 0$ has a solution in the interval

A $[-2, -1]$
B $[-1, 0]$
C $[0, 1]$
D $[1, 2]$

15. Given that $f(x) = \begin{cases} sin\left(\frac{x}{3}\right), & x \neq 0 \\ k, & x = 0, \end{cases}$ is continuous at $x = 0$, the value of the constant k, is

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

16. A force F = (2i- j + 2k) N acts on a particle, moving it from a point A(1 , 2 , -1) to a point B(3 , -3 , 0). The work done by F, in joules is

A 11
B 1
C -11
D 7

17. The center of symmetry of the curve $y = \frac{x}{x^2-1}$, is

A $(0, 1)$
B $(1, 0)$
C $(0, 0)$
D $(1, \frac{1}{2})$

18. The negation of the statement $\sim p$ and q is

A p or $\sim$ q
B p and $\sim$q
C p or $\sim$ q
D $\sim p$ *or* q

19. The velocities of a sphere before and after impact are $-3i + 4j - k$ and $i + j + \gamma k$. If after the impact the sphere moves at right angles to its direction before the impact, then the value of γ is

A 2
B 1
C -1
D -2

20. If $y = |x+1| - |x| + 2$, then for $-1 < x < 0$, y =

A -1
B $2x + 3$
C $-2x + 1$
D 1

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

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

22. Let forces $F_1, F_2, F_3, \ldots, F_n$ act at points with position vectors $r_1, r_2, r_3, \ldots, r_n$, respectively. If the system of forces reduces to a couple, then

A $\sum(F) = 0$, and $\sum(r \times F) = 0$
B $\sum(F) \neq 0$, and $\sum(r \times F) = 0$
C $\sum(F) = 0$, and $\sum(r \times F) \neq 0$
D $\sum(F) \neq 0$ and $\sum(r \times F) \neq 0$

23. Given that

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$f(x) = \begin{cases} 3cosh2x, & x < 0, \\ sinh2x, & x \geq 0. \end{cases}$

Then the $\lim_{x \to 0} f(x)$ is

A 3
B 0
C 1
D does not exist

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24. Given that $\frac{dy}{dx} = xy$, and $y = 1$ when $x = 0$, then using the approximation $0.1(\frac{dy}{dx})_n \cong y_{n+1} - y_n$, the value of y When $x = 0.2$ is

A 1
B 1.01
C 1.03
D 1.1

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25. The eccentricity of the ellipse $4x + 9y^2 = 36$ is

A $\frac{5}{4}$
B $\frac{5}{9}$
C $\frac{\sqrt{5}}{3}$
D $\frac{\sqrt{13}}{2}$

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26. If $coshx = \frac{5}{3}$, then the value of $\cosh\frac{x}{2} =$

A $\frac{4}{3}$
B $\frac{2}{3}$
C $\frac{2\sqrt{3}}{3}$
D $\frac{5}{6}$

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27. Given that $X \sim P0\ (4)$, the value of $P(X = 0)$ is

A 4
B e^{-4}
C e^4
D $4e^{-4}$

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28. The moment of inertia of a uniform rod of length 3l and mass m about an axis through one end and perpendicular to the rod is :

A $3ml^2$
B $\frac{3}{4}ml^2$
C $9ml^2$
D ml^2

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29. The unit digit of the number $19^{302} + 11^{1980} + 9^{1930}$ is

A 1
B 3
C 7
D 9

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30. The distance between the planes $2x + y - 2z = 3$ and 2x+ y -2z =6 is

A 3 units
B 1 unit
C 6 units
D 2 units

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31. A particle is moving round the polar curve $r = 1 - 2cos\theta$, with constant angular velocity w. The maximum speed of the particle is

A $\sqrt{5}w$
B w
C $\sqrt{13}w$
D $2w$

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32. The function $f(x) = \begin{cases} x^2, & 0 \leq x < 2 \\ x + 2, & 2 \leq x < 5, \\ 7, & x \geq 5 \end{cases}$ has a removable discontinuity at $x =$

A 0
B 2
C 5
D 1

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33. The argument of the complex number $z = 1 + e^{-2i\theta}$ is

A θ
B $-\theta$
C 2θ
D -2θ

34. The integrating factor of the differential equation $x\frac{dy}{dx} - y = x^2$ is

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A x

B $\frac{1}{x}$

C $-x$

D $-\frac{1}{x}$

35. The centre of symmetry of the curve $y = \frac{x}{x^2+1}$ is at the point

A $(0, 0)$

B $(1, \frac{1}{2})$

C $(-1, -\frac{1}{2})$

D $(2, 0)$

36. Using the approximation $h(\frac{dy}{dx})_n \approx y_{n+1} - y_n$ and given that $\frac{dy}{dx} = 1$ and $y = 1$ when $x = 0$, then $y_1 =$

A $h - 1$

B $h + 1$

C $1 - h$

D h

37. The real function which is continuous on $\mathbb{R}$, the set of real numbers is

A $\sqrt{x-1}$

B $\log_2 x$

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

D $\tan x$

38. $\frac{d(\ln\cosh 2x)}{dx} =$

A $\tanh 2x$

B $\coth 2x$

C $2\tanh 2x$

D $2\coth 2x$

39. $\frac{3x^2}{x^2-9}$, expressed in partial fractions, where A, B, and C are constants, with $x \neq \mp 3$, is

A $\frac{A}{x+3} + \frac{B}{x-3}$

B $A - \frac{B}{x+3} + \frac{C}{x-3}$

C $\frac{A}{x-3} - \frac{B}{(x-3)^2}$

D $A - \frac{B}{x-3} - \frac{C}{(x-3)^2}$

40. A particle is executing simple Harmonic motion 0f period $\frac{\pi}{2}$. If it's speed at a point 3 m from it's centre of motion is 6 m/s, then the amplitude of the motion is

A $\frac{3\sqrt{5}}{2}$ m

B $\frac{45}{4}$ m

C 4 m

D $3\sqrt{5}$ m

41. The remainder when -91 is divided by 8 is

A 5

B -5

C 3

D -3

42. The work done when a force F moves a particle from a point with position vector r_0 to a point with position vector r_1 is

A $(r_1 - r_0) \times F$

B $(r_0 - r_1) \times F$

C $(r_1 - r_0) \cdot F$

D $(r_0 - r_1) \cdot F$

43. Given that $F(x) = \int_x^{x^2} f(t)dt$, then $F'(x) =$

A $f(x^2)$

B $f(x^2) - f(x)$

C $2f(x^2)$

D $2f(x^2) - f(x)$

44. A tangent at the pole to the polar curve $r = \sqrt{2} - 2\sin\theta$ is $\theta =$

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

B $\frac{\pi}{6}$

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

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

45. A point moves on the locus $r = 3 + \cos\theta$ in plane polar coordinates with constant angular velocity w. Then $\frac{d^2r}{dt^2}$ in terms of w is

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A $-w^2r$
B $(r-3)w^2$
C $(3-r)w^2$
D w^2r

46. If $[x]$ is the greatest integer function of x then $\int_0^2 (1+[x])dx =$
A 0
B 1
C 3
D 4

47. The moment of the force $F = 2i - j + 2k$ acting at the point with position vector $r = i - k$ is
A $-i - 4j - k$
B $i - k$
C $-i - k$
D $i + k$

48. The rate at which insects are born in a certain colony of insects is proportional to the number present. If N is the number present and k a constant, then this can be modeled by the differential equation $\frac{dN}{dt} =$
A $\frac{k}{N}$
B $2kN$
C kN
D $\frac{k}{2N}$

49. Given that the moment of inertia of a rod of mass 2m and length l about an axis through it's centre and perpendicular to the rod, is I, then the moment of inertia of the rod about a perpendicular axis on the rod, x units from the centre is
A $I + mx^2$
B $I - mx^2$
C $I + 2mx^2$
D $I - 2mx^2$

50. The generator of the cyclic group $G = \{-1, i, -i, 1\}$ under multiplication is
A i
B $-i$
C 1
D -1

END.

GO BACK AND CHECK YOUR WORK.

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