0775/1/2022
F. MATHSA/L

# 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

……………………………………………………………………

**Subject Title**

CANDIDATE NUMBER

……………………………………………………………………

**FURTHER MATHEMATICS**

CENTRE NUMBER

……………………………………………………………………

ADVANCED LEVEL

**DATE** **04/04/2022**

**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 below:

[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**

The general solution of the differential equation $(x^2+1)\frac{dy}{dx}+2xy=2x$ is

A) $y=x^2+k$

B) $y=\frac{x^2+k}{x^2+1}$

C) $y=\frac{2x-2xy}{x^2+1}+k$

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

2 The particular integral solution of $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=3e^{-2x}$ could be

A) $y=Ae^{-2x}$

B) $y=Axe^{-2x}$

C) $y=Ae^{2-2x}$

D) $y=Axe^{-2x}+Be^{-2x}$

3 The partial fraction form of $\frac{2x}{x^2(x+3)x}$, where A, B, C and D are constants is

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

B) $\frac{Ax}{x^2}+\frac{B}{x+3}+\frac{C}{x}$

C) $\frac{A}{x}+\frac{B}{x}+\frac{C}{x^3}+\frac{D}{x+3}$

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

4 $\lim_{x\to a^-}\left(\frac{x-a}{|x-a|}\right)=$

A) 0

B)

C) $-1$

D) $\infty$

5 Given that $f(x)$ is a continuous even function, then $\int_{-a}^{a}f(x)=$

A) 0

B) $\int_0^a f(x)dx$

C) $2\int_{-a}^{a} f(x)dx$

D) $2\int_0^a f(x)dx$

6 Given that $[x]$ is the greatest integer function and $|x|$ is the absolute value function, then in the interval $0\le x<1$,

A) $[x]>|x|$

B) $[x]=|x|$

C) $[x]\le |x|$

D) $[x]^2=|x|$

7 Given that $f(x)=\begin{cases} x^2, & for\ x<1 \\ 2x-1, & for\ 1\le x\le 3, \\ 7-x, & for\ x>3 \end{cases}$

a value of $x$ for which f($x$) is discontinuous is

A) 0

B) 1

C) 3

D) 2

8 The polar equation of the curve described by the complex equation $|z|=4$ is

A) $r=2$

B) $r=4$

C) $r=16$

D) $r^2=16$

9 The line $r=4sec\left(\theta-\frac{\pi}{6}\right)$ meets the initial line at G and the part – line $\theta=\frac{\pi}{2}$ at H. The area of triangle GOH, where O is the pole, is

A) $\frac{64\sqrt{3}}{3}$

B) $\frac{32\sqrt{3}}{3}$

C) $\frac{128\sqrt{3}}{3}$

D) $\frac{16\sqrt{3}}{3}$

10 For any two vectors $\boldsymbol{a}$ and $\boldsymbol{b}$, $\boldsymbol{a}.(\boldsymbol{a}\wedge\boldsymbol{b})=$

A) $\boldsymbol{0}$

B) $\boldsymbol{a}.\boldsymbol{b}$

C) $\boldsymbol{a}^2\boldsymbol{b}$

D) $\boldsymbol{a}^2+\boldsymbol{ab}$

11 The volume of the tetrahedron OABC, where A, B and C are the points (2,0,1), (3,1,2) and (−1,3,0) respectively, is

A) $\frac{1}{3}$

B) $\frac{2}{3}$

C) 4

D) 2

12 The random variable X has a probability density function f(x) given by $f(x)=\begin{cases}\frac{x}{2}, & 0\le x\le 3 \\ 0, & elsewhere\end{cases}$

The value of $P(1 \leq x \leq 2)$ is

A) $\frac{7}{9}$

B) $\frac{7}{27}$

C) $\frac{5}{9}$

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

13 If the random variable X is such that $X \sim B(100, 0.2)$, then the normal approximation to $X$ is

A) $X \sim N(20, 0.2)$
B) $X \sim N(20, 20)$
C) $X \sim N(20, 16)$
D) $X \sim N(100, 0.2)$

14 The variance of a poison distribution is 4. The probability of having exactly 5 successes is

A) $\frac{2^5}{5!}e^{-2}$
B) $\frac{4^5}{4!}e^{-4}$
C) $\frac{4^5}{5!}e^{-4}$
D) $\frac{5^4}{4!}e^{-5}$

15 A particle executes simple harmonic motion between two points which are 10 meters apart such that its speed, when it is 4 meters from the centre of its path is $6\text{ms}^{-1}$. The period of motion of the particle is
A) 2
B) $\pi$
C) $\frac{\pi}{2}$
D) 4

16 A particle is performing simple harmonic motion with centre Osuch that its speed, $v\text{ms}^{-1}$ when its distance from O is $x$ mis given by the equation $v^2 = 64 - 2x^2$. The maximum velocity of the particle is
A) $8\text{ ms}^{-1}$
B) $8\sqrt{2}\text{ms}^{-1}$
C) $16\text{ ms}^{-1}$
D) $16\sqrt{2}\text{ ms}^{-1}$

17 A particle of mass 3 m is attached to one end of a light elastic string of natural length $2a$ and modulus 2mg, whose other end is fixed to some point O. If the particle is allowed to fall from rest at O, then its acceleration when the extension in the string is $a$ m is

A) $\frac{2g}{3}$
B) 2g

C) $\frac{3}{2g}$

D) $2g$

18 A group $G$ has subgroups $\{a, b\}$, $\{a, b, c, d, f\}$ and $\{a, d, e\}$. The least possible order of the group is

A) 10
B) 15
C) 30
D) 6

19 A mapping $\theta: (G, *) \rightarrow (H, \circ)$, with $g, g_1, g_2 \in G$, is a group homomorphism if

A) $\theta(g) = \theta(h), \quad h \in H$
B) $\theta(g_1 * g_2) = \theta(g_1) \circ \theta(g_2)$
C) $\theta(g_1 * g_2) = \theta(g_1 \circ g_2)$
D) $\theta(g) = h, \quad h \in H$

20 Given the group $(\mathbb{Z}_4, +_4)$ where $\mathbb{Z}_4 = \{0,1,2,3\}$ and $+_4$ means addition modulo 4, the inverse of the element 3 is
A) 0
B) 1
C) 2
D) 3

21 The first two non-zero terms in the Taylor series expansion of the differential equation $\frac{dy}{dx} = 2xy^2$, where $y = 1$ when $x = 0$ are
A) $1 - x^2$
B) $1 - 2x^2$
C) $1 + x^2$
D) $1 + 2x^2$

22 Using the approximation $y_{n+1} \approx y_n + h\left(\frac{dy}{dx}\right)_n$ and a step length of 0.1, the value of $y$ when $x = 0.2$, given that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$ is
A) 1.11
B) 1.12
C) 1.22
D) 1.23

23 The solution of $artanh\left(\frac{x^2-1}{x^2+1}\right) = \ln 2$ is

A) $\ln 2$

B) $2$

C) $-2$

D) $\pm 2$

24 The function $f(x) = \cosh x$ is

A) an even function

B) an odd function

C) a periodic function

D) a discontinuous function

25 The number of solutions of the equation $3cosh(2x-1) = 3$ is

A) 0

B) 1

C) 2

D) 3

26 Under the transformation $w = \frac{z}{z+i}$, the image of $1-2i$ is

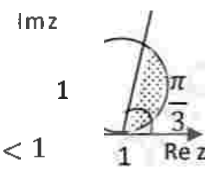
A) $-\frac{1}{2}-\frac{1}{2}i$

B) $\frac{3}{2}-\frac{1}{2}i$

C) $-\frac{1}{2}-\frac{3}{2}i$

D) $\frac{3}{2}-\frac{3}{2}i$

27 Which of the following can best describe the shaded region in Fig. 1 to the right?




A) $arg\ (z) < \frac{\pi}{3}$ and $|z| < 1$

B) $arg\ (z) \leq \frac{\pi}{3}$ and $|z| \leq 1$

C) $arg\ (z-1) < \frac{\pi}{3}$ and $|z-(1+i)| < 1$

D) $arg\ (z-1) \leq \frac{\pi}{3}$ and $|z-(1+i)| \leq 1$

28 If $|z-1+2i| = 3$, then the least value of $|z+2-2i|$ is

A) 7

B) 3

C) 2

D) 1

29 Which of the following series is convergent?

A) $\sum_{r=1}^{\infty}(-1)^r$

B) $-\frac{1}{2}+\frac{3}{4}-\frac{4}{5}+\cdots$

C) $\sum_{k=0}^{\infty}\frac{1}{3^k+1}$

D) $S_n = n^2 + n$

30 Given that $(a+bx)e^x \cong 4+5x+cx^2$, then the values of a, b and c are respectively

A) 4, 1, 3

B) 1, 3, 4

C) $-4$, 3,1

D) 0, 1, 4

31 The sequences $(u_n)$ and $(v_n)$ are defined as

$(u_n)$: $u_0 = 1$, $u_{n+1} = \frac{1}{2}(u_n + v_n)$

$(v_n)$: $v_0 = 12$, $v_{n+1} = \frac{1}{3}(u_n + 2v_n)$

If another sequence $(w_n)$ is defined as $w_n = v_n - u_n$, then which of the following true

A) $\frac{w_{n+1}}{w_n} = \frac{1}{2}$

B) $\frac{w_{n+1}}{w_n} = \frac{1}{12}$

C) $\frac{w_{n+1}}{w_n} = \frac{1}{6}$

D) $w_n$ is an arithmetic sequence

32 If $\int_0^a f(x)dx = \int_0^a f(a-x)dx$, then $\int_0^{\pi} xf(sinx)dx =$

A) $\frac{\pi}{2}\int_0^{\frac{\pi}{2}} f(sinx)\,dx$

B) $\pi\int_0^{\pi} f(sinx)dx$

C) $\pi\int_0^{\pi} xf(cosx)dx$

D) $\frac{\pi}{2}\int_0^{\pi} f(sinx)\,dx$

33 $\int_0^1 x(1-x)^n\,dx =$

A) $\frac{2n+3}{(n+1)(n+2)}$

B) $\frac{1}{n+1}$

C) $\frac{1}{n+2}$

D) $(n+1)(n+2)$

34 If for any integer n, $\int_n^{n+1} f(x)dx = n^2$, then $\int_2^4 f(x)dx =$

A) 16

B) 13

C) 21
D) 19

35 $\int \frac{1}{\sqrt{x^2-16}} dx=$

A) $cos^{-1}\left(\frac{x}{4}\right)+k$
B) $sin^{-1}\left(\frac{x}{4}\right)+k$
C) $cosh^{-1}\left(\frac{x}{4}\right)+k$
D) $sinh^{-1}\left(\frac{x}{4}\right)+k$

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

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

37 Which one of the following is not true about determinants?

A) The sign of the value of the determinant changes when two rows are interchanged

B) The value of the determinant changes when a row or column is added to another row or column

C) The value of the determinant remains constant when a multiple of a row is added to or subtracted from another row or column.

D) The value of the determinant is zero if any two rows or columns are identical

38 The matrix of the transformation T given by $T(x,y)=(x-y,\ 3x)$ is

A) $\begin{pmatrix}1 & -1\\ 3 & 0\end{pmatrix}$

B) $\begin{pmatrix}1 & 3\\ -1 & 0\end{pmatrix}$

C) $\begin{pmatrix}1 & 3\\ 0 & -1\end{pmatrix}$

D) $\begin{pmatrix}1 & -1\\ 0 & 3\end{pmatrix}$

39 The transformation matrix $\begin{pmatrix}1 & 2 & 0\\ -2 & -4 & -2\\ 1 & 2 & 1\end{pmatrix}$ maps the $xyz$ space onto

A) a line
B) a plane
C) the origin
D) space

40 A smooth sphere travelling on a smooth horizontal surface impinges obliquely on a vertical wall and rebounds at right angles to its original direction of motion. If the sphere is moving at an angle of $60°$ to the wall before impact, then the value of e is

A) $\frac{\sqrt{3}}{2}$

B) $\frac{1}{\sqrt{3}}$

C) $\frac{2}{\sqrt{3}}$

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

41 If a flywheel loses kinetic energy amounting 640 J when its angular velocity drops from $5\ \text{rads}^{-1}$ to $3\ \text{rads}^{-1}$, then the moment of inertia of the flywheel is

A) 40 $\text{kgm}^2$

B) 80 $\text{kgm}^2$

C) 320 $\text{kgm}^2$

D) 640 $\text{kgm}^2$

42 Given that the moment of inertia of a rod of mass $m$ and length $2l$ about an axis through its centre and perpendicular to the rod is $I$, then the moment of inertia about a perpendicular axis on the rod distant $x$ from the centre of the rod is

A) $I-mx^2$

B) $I+mx^2$

C) $\frac{4}{3}ml^2+mx^2$

D) $\frac{1}{3}I+mx^2$

43 The rate of destruction of a colony of bacteria is $kx$, where $x$ is the number of bacteria present at time t and k a positive constant. The number of bacteria is

found to decrease from 6000to 2000 in 4 hours. The value of $k$ is

A) $\frac{1}{4}\ln\left(\frac{1}{3}\right)$

B) $4\ln\left(\frac{1}{3}\right)$

C) $4\ln 3$

D) $\frac{1}{4}\ln 3$

44 A particle $P$ is moving on the curve with polar equation $r = 4e^{\theta}$. If the radial velocity of $P$ is $\frac{3}{r}$, then the angle between the velocity of P and the radius vector $OP$, where $O$ is the pole is

A) $\frac{\pi}{6}$

B) $\frac{\pi}{2}$

C) $\frac{\pi}{3}$

D) $\frac{\pi}{4}$

45 The major axis of an ellipse is vertical and of length 8. The minor axis is of length 4 and the centre is at the point $(0,1)$. The equation of the ellipse is

A) $\frac{x^2}{16}+\frac{(y-1)^2}{4}= 1$

B) $\frac{x^2}{4}+\frac{(y-1)^2}{16}= 1$

C) $\frac{(x-1)^2}{16}-+\frac{y^2}{4}=1$

D) $\frac{(x-1)^2}{4}-+\frac{y^2}{16}=1$

46 If $p$ :*"If $x$ is a real number, then $x^2$ is positive"*. Then the contrapositive of the statement $p$ is

A) If x is not a real number, then $x^2$ is not positive
B) If x is a real number, then $x^2$ is not positive
C) If $x^2$ is not positive, then x is not a real number
D) If $x^2$ is positive, then x is not a real number

47 The solution set of the inequality $x^2 + 1 < |x^2 - 2|$ is

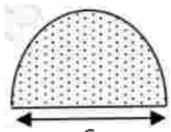
A) $-\frac{1}{\sqrt{2}} < x < \frac{1}{\sqrt{2}}$

B) $-\frac{1}{2} < x < \frac{1}{2}$

C) $-\sqrt{2} < x < \sqrt{2}$

D) $x < -\sqrt{2}\ or\ x > \sqrt{2}$

48 Figure 6 shows a semicircular lamina with diameter $6a$. Using the theorem of Pappus, the distance of the centroid from the diameter is



6a
Fig.

A) $\frac{8a}{\pi}$

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

C) $\frac{4a}{3\pi}$

D) $\frac{8a}{3\pi}$

49 The number of distinct solutions of the congruence equation $2x \equiv 4(mod 6)$ is

A) 1

B) 3

C) 0

D) 2

50 $x^2 \equiv -1(mod 25)$isequivalentto

A) $x^2 \equiv 1(mod\ 25)$

B) $x^2 \equiv 5(mod\ 25)$

C) $x^2 \equiv 24(mod\ 25)$

D) $x^2 \equiv 8\ (mod\ 25)$

**GO BACK AND CHECK YOUR WORK**