CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD
General Certificate of Education Examination

775 Further Mathematics 1

JUNE 2015 ADVANCED LEVEL

Centre Number	
Centre Name	
Candidate Number	
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 **"Advanced Level – 775 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. 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 where necessary, 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 after. DO NOT ATTEMPT TO LEAVE TIIE EXAMINATION HALL WITH IT.**

1. $f(x) = \dfrac{x^2}{(x^2+1)^2}$ in partial fractions where P, Q, R and S are real constants is

   A. $\dfrac{Px+Q}{x^2+1} + \dfrac{Rx+S}{(x^2+1)^2}$

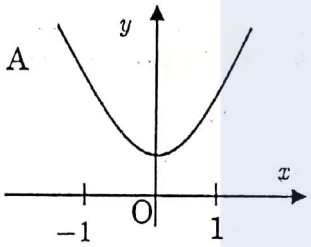
   B. $\dfrac{Px+Q}{x^2+1} + \dfrac{Rx^2+S}{(x^2+1)^2}$

   C. $\dfrac{Px}{x^2+1} + \dfrac{Q}{x^2+1} + \dfrac{Rx+S}{(x^2+1)^2}$

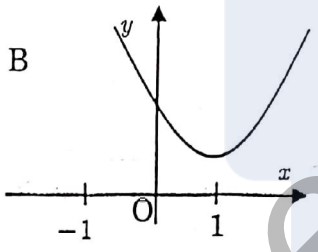
   D. $\dfrac{P}{x+1} + \dfrac{Qx}{x^2+1} + \dfrac{Rx+S}{(x^2+1)^2}$

2. Which of the following is the graph of $y = \cosh(x+1)$?

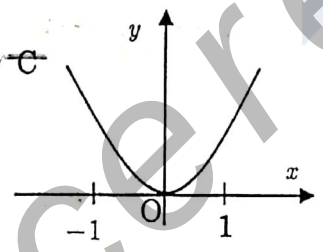
   A



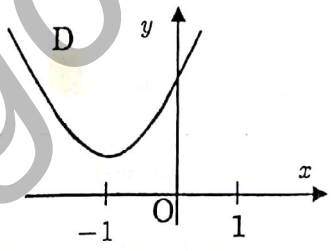
   B



   C



   D



3. $\int \sinh^2\theta\, d\theta =$

   A. $\frac{1}{4}(\cosh 2\theta + 2\theta) + k$

   B. $\frac{1}{2}(\sinh 2\theta + \theta) + k$

   C. $\frac{1}{4}(\sinh 2\theta + 2\theta) + k$

   D. $\frac{1}{4}(\sinh 2\theta - 2\theta) + k$

4. The general solution of the differential equation $\dfrac{d^2y}{dx^2} + 3\dfrac{dy}{dx} - 4y = 0$, where P, Q and ε are real constants is

   A. $P\cos 4x + Q\sin x$

   B. $Pe^x \cos(4x+\varepsilon)$

   C. $Pe^x + Qe^{-4x}$

   D. $(P+Qx)e^{-4x}$

5. A group G has subgroups $\{a,b\}, \{a,b,c,d,f\}$ and $\{a,d\}$. The identity element of G is

   A. d

   B. c

   C. b

   D. a

6. Which of the following defines an equation of a plane curve that does **NOT** have a vertical asymptote?

   A. $y = \dfrac{x^2+3x}{x+3}$

   B. $y = \dfrac{x^2+x}{x+3}$

   C. $y = \dfrac{x^2-x-6}{x+3}$

   D. $y = \dfrac{x^2-x}{x+3}$

7. The modulus of the complex number $z = 1 - e^{i\theta}$ is

   A. $2\sin\left(\frac{1}{2}\theta\right)$

   B. $2\cos\left(\frac{1}{2}\theta\right)$

   C. 2

   D. 1

8. Which one of the following series is convergent?

A. $\sum_{r=0}^{\infty}(1-r)^r$

B. $\sum_{r=0}^{\infty} r(1+r)$

C. $\sum_{r=1}^{\infty}\frac{1}{r}$

D. $\sum_{r=0}^{\infty}\frac{3^r}{r!}$

9. If $f(x)=\int_a^x \frac{t^2}{\sqrt{t^2+1}}dt$, then for $a \geq 0$, f

A. is monotone increasing
B. has a turning point
C. is monotone decreasing
D. is concave downwards

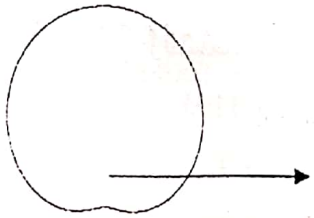
10. Given the statements P : $\cosh x = \cosh y$ and $Q : x = y$. Which of the following is true?

A. $P \Rightarrow Q$
B. $Q \Leftrightarrow P$
C. $Q \Rightarrow P$
D. $Q \not\Rightarrow P$

11. The area under the curve with parametric equations $x = 1 + t^2$, $y = t(2 - t)$ in the interval $0 \leq t \leq 1$ is

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

12.



The equation of the polar curve above is

E. $r = 3 + 2\sin\theta$
F. $r = 3 - 2\sin\theta$
G. $r = 3 + 2\cos\theta$
H. $r = 3 - 2\cos\theta$

13. The equation $25x^2 + y^2 - 100x - 2y + 76 = 0$ represents

A. a parabola
B. a circle
C. an ellipse
D. a hyperbola

14. Given that a and b are two vectors, then the vector $(\mathbf{a}+\mathbf{b})\times(\mathbf{a}-\mathbf{b})$ is

A. perpendicular to $(\mathbf{a}-\mathbf{b})$
B. parallel to $(\mathbf{a}-\mathbf{b})$
C. parallel to $(\mathbf{a}+\mathbf{b})$
D. equal to $(2\mathbf{a}-\mathbf{b})$

15. A linear transformation $T : \mathbb{R}^3 \to \mathbb{R}^3$ is defined by $T(x,y,z) = (x + 2y - z,\ y + z,\ x + y - 2z)$, then $T(1,1,0)$ is

A. $(1,2,3)$
B. $(1,1,0)$
C. $(2,1,2)$
D. $(3,1,2)$

16. Which of the following congruencies has NO solution?

A. $24x \equiv 18 \pmod{39}$

B. $5x \equiv 4 \pmod{10}$

C. $15x \equiv 6 \pmod{21}$

D. $15x \equiv 6 \pmod{36}$

17. Given that $\lambda x \sin x$ is a particular integral of the differential equation $y'' + y = \cos x$, the value of λ is

A. -1

B. 1

C. $\frac{1}{2}$

D. 2

18. Given that the equation of motion along Ox after time t is $\frac{d^2x}{dt^2} + 4x = 0$, the period of the motion is

A. π

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

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

D. $\frac{\pi}{8}$

19. If a force **F** acts through a point with position vector **a**, then its moment about a point with position vector **b** is

A. $\mathbf{a} \times \mathbf{F}$

B. $(\mathbf{b} - \mathbf{a}) \times \mathbf{F}$

C. $\mathbf{0}$

D. $(\mathbf{a} - \mathbf{b}) \times \mathbf{F}$

20. Given that P and Q are mathematical statements, then the statement $\sim P \Rightarrow Q \equiv$

A. $Q \Rightarrow \sim P$

B. $Q \Rightarrow P$

C. $\sim Q \Rightarrow P$

D. $\sim Q \Rightarrow \sim P$

21. $f(x) = \begin{cases} \frac{x^2 - 9}{x - 3}, & x \neq 3 \\ 3, & x = 3 \end{cases}$

which of the following is true about f?

A. $f(x)$ is continuous at $x = 3$

B. $f(x)$ is not defined at $x = 3$

C. $\lim_{x \to 3} f(x) = 3$

D. $f(x)$ is defined at $x = 3$

22. Given that $\sinh x = \frac{3}{4}$, the value of $\cosh x$ is

A. $\pm\frac{5}{4}$

B. $\frac{25}{16}$

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

D. $-\frac{5}{4}$

23. If $\frac{dy}{dx} - 2xy = 1$, $y = 0$ when $x = 0$, the first 2 non-zero terms in the series solution for y are

A. $1 + x$

B. $x - \frac{x^2}{2}$

C. $x - x^2$

D. $x + \frac{2x^3}{3}$

24. A particle moves round the polar curve $r = a(1 + \cos\theta)$ with constant angular velocity ω. The transverse component of its velocity is

A. ω

B. $a\omega(1 + \cos\theta)$

C. $-a\omega \sin\theta$

D. $a\omega(1 - \sin\theta)$

25. A smooth sphere travelling with a speed of 2m/s on a smooth horizontal floor hits a vertical wall at an angle of 45^0. Given that the coefficient of restitution is $\frac{1}{4}$, then its speed after impact is

A. $\frac{1}{4}\sqrt{34}$

B. $\frac{1}{2}\sqrt{2}$

C. $\frac{3}{4}\sqrt{2}$

D. $\frac{1}{4}\sqrt{3}$

26. The series $\sum_{n=1}^{\infty}\left(\frac{5}{2n}\right)^r$ converges when

A. $r > 1$

B. $r < 1$

C. $r = 1$

D. $r = 0$

27. If the probability density function of X is

$$f(x) = \begin{cases} \frac{3x^2}{a^3}, & 0 \le x \le a \\ 0, & \text{otherwise.} \end{cases}$$

then $E(X)$ is

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

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

C. $\frac{3a^2}{4}$

D. $\frac{3x^3}{a^3}$

28. Given that f is a probability density function,

where $f(x) = \begin{cases} \frac{3x^2}{k}, & 0 \le x \le 2 \\ 0, & \text{elsewhere.} \end{cases}$

the value of k is

A. 27

B. 8

C. 2

D. 1

29. If $w = iz$ is a transformation from the z to the w complex planes, then the invariant point is

A. -1

B. 1

C. i

D. 0

30. For P, Q, R and S real constants, $\frac{5x^3}{(x^2+x+1)(x-2)}$ in partial fractions is

A. $\frac{P}{x^2+x+1} + \frac{Q}{x-2} + S$

B. $\frac{Px}{x^2+x+1} + \frac{Q}{x-2} + S$

C. $\frac{Px+Q}{x^2+x+1} + \frac{R}{x-2} + S$

D. $\frac{Px+Q}{x^2+x+1} + \frac{R}{x-2}$

31. If $P = \begin{pmatrix} a & b & c & d \\ c & d & a & b \end{pmatrix}$, $Q = \begin{pmatrix} a & b & c & d \\ b & a & d & c \end{pmatrix}$ are permutations of the elements (a,b,c,d), then $QP =$

A. $\begin{pmatrix} a & b & c & d \\ d & c & b & a \end{pmatrix}$

B. $\begin{pmatrix} a & b & c & d \\ b & c & a & d \end{pmatrix}$

C. $\begin{pmatrix} a & b & c & d \\ a & b & c & d \end{pmatrix}$

D. $\begin{pmatrix} a & b & c & d \\ b & c & d & a \end{pmatrix}$

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

A. $(0,0)$

B. $(-2,0)$

C. $(2,0)$

D. $(0,2)$

33. The particular solution of the differential equation $\frac{d^2y}{dx^2} + 9y = \sin 3x$ where a and b are constants Is of the form

A. $y = a\sin x + b\cos x$

B. $y = a\sin 3x + b\cos 3x$

C. $y = ax\cos 3x$

D. $y = ax\sin x$

34. The moment of inertia of an object of mass $2m$ is $\frac{8ma^2}{3}$, its radius of gyration is

A. $\frac{2a}{3}\sqrt{3}$

B. $\frac{a}{3}\sqrt{3}$

C. $\frac{4a^2}{3}$

D. $\frac{1}{2a}\sqrt{3}$

35. The work done by a force $\mathbf{F}$ in moving a particle of mass m from a point A with position vector a to point B with position vector b is

A. $m\mathbf{F}.(\mathbf{b}-\mathbf{a})$

B. $\mathbf{F}.(\mathbf{b}-\mathbf{a})$

C. $\mathbf{F}\times(\mathbf{b}-\mathbf{a})$

D. $m\mathbf{F}\times(\mathbf{b}-\mathbf{a})$

36. A substitution that transforms the differential equation $\frac{dy}{dx}+\frac{y}{x}=x$, to the differential equation $\frac{du}{dx}+\frac{2u}{x}=1$ is

A. $y=\frac{x}{u}$

B. $y=\frac{u}{x}$

C. $y = ux$

D. $y=u^2x$

37. The Cartesian equation of the polar curve $r^2 = 2a^2\sin 2\theta$ is

A. $x^2 + y^2 = 4a^2xy$

B. $\left(x^2 + y^2\right)^2 = a^2xy$

C. $x^2 + y^2 = 4xy$

D. $\left(x^2 + y^2\right)^2 = 4a^2xy$

38. The range of the function $y = \frac{x}{x^2+1}, x \in \mathbb{R}$ is

A. $-\frac{1}{2} \le y \le \frac{1}{2}$

B. $-\frac{1}{2} < y < \frac{1}{2}$

C. $y \le -\frac{1}{2},\ y \ge \frac{1}{2}$

D. $y < -\frac{1}{2},\ y > \frac{1}{2}$

39. The vertices A, B, C of a triangle have position vectors a, b, c respectively. The area of this triangle is

A. $\left|(\mathbf{b}-\mathbf{a})\times(\mathbf{b}-\mathbf{c})\right|$

B. $\frac{1}{2}\left|\mathbf{b}\times\mathbf{c}\right|$

C. $\left|\mathbf{a}\times\mathbf{b}\cdot\mathbf{c}\right|$

D. $\frac{1}{2}\left|(\mathbf{b}-\mathbf{a})\times(\mathbf{c}-\mathbf{b})\right|$

40. If $T = \begin{pmatrix}1 & -1\\ 2 & 1\end{pmatrix}$, the image of the line $y = -2x$ under T is

A. $x = 0$

B. $y = 0$

C. $y = 3x$

D. $y = \frac{x}{3}$

41. Given that P and Q are 3×3 invertible matrices then $\left(A^{-1}B\right)^{-1} =$

A. AB^{-1}

B. $B^{-1}A$

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

D. BA^{-1}

42. Given that $\lim_{x\to 0}\frac{\sqrt{1+f(x)}}{x} = l$, then $\lim_{x\to 0}\frac{\sqrt{1+f(3x)}}{x} =$

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

43. If the period of a periodic function $f(x)$ is T. Then the period of $f(2x+k), k \in \mathbb{R}$ is

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

44. The parametric equation of the rectangular hyperbola $x(y+1) = c^2$ is

A. $x = ct,\ y = \frac{c}{t} - 1$
B. $x = 1 + ct,\quad y = \frac{c}{t}$
C. $x = ct,\ y = \frac{c}{t}$
D. $x = ct,\ y = \frac{c}{t} + 1$

45. The mean value of $\frac{1}{1+4x^2}$ for $0 \le x \le \frac{1}{2}$ is

A. $\frac{\pi}{16}$
B. $\frac{\pi}{8}$
C. $\frac{\pi}{4}$
D. $\frac{\pi}{2}$

46. If $\tanh A = \frac{1}{2}$ and $\tanh B = \frac{1}{3}$, then $A - B$ is

A. $\tanh^{-1}\left(\frac{1}{7}\right)$
B. $\tanh^{-1}\left(\frac{1}{5}\right)$
C. $\tanh^{-1}\left(\frac{5}{7}\right)$
D. $\tanh^{-1}(1)$

47. $\sum_{k=1}^{2n}(-1)^k =$

A. ∞
B. 1
C. -1
D. 0

48. The equation of the asymptote of the curve $x^3 + y^3 - 6x^2 = 0$ is

A. $y = x$
B. $y = -x$
C. $y = -x + 2$
D. $y = x + 2$

49. $\int_0^{\ln 2} e^{\cosh x}\sinh x\,dx =$

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

50. Given the functions $f(x) = x^2 + 2x$ and $g(x) = 3x^3 + 6x^2,\ x > 0$, the greatest common divisor (gcd) for f and g is

A. $x^2 + 2x$
B. $3x + 6$
C. $x + 2$
D. x

STOP

NOW GO BACK AND CHECK YOUR WORK