

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

765 Pure Maths with Mechanics 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 – 765 Pure Maths with Mechanics 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 instruction.

6. **Answer All questions.**

7. **Mathematical tables and 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 brackets 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 NO ATTEMPT TO LEAVE THE EXAMINATION HALL WITH IT.**

SECTION A: PURE MATHEMATICS

1. Given that $f(x) = \frac{x-1}{x-2}, x \neq 2$, the range of $f(x)$ is
- A $\{x \in \mathbb{R}, x \neq 2\}$
 B $\{x \in \mathbb{R}, x \neq -1\}$
~~C $\{x \in \mathbb{R}, x \neq 1\}$~~
 D $\{x \in \mathbb{R}, x \neq -2\}$
-
2. The functions f and g are real valued functions. Given that $g(x) = \frac{x-1}{x+2}$ and $g \circ f(x) = \frac{7}{3x-5}$, then $f(x) =$
- A $\frac{x+3}{x+4}$
 B $\frac{x-3}{x-4}$
~~C $\frac{x+3}{x-4}$~~
 D $\frac{x-3}{x+4}$
-
3. The values of x that satisfy the equation $3^{2x} - 10(3^{x+1}) + 3^4 = 0$ is
- A $x = 2$ or $x = 3$
 B $x = 3$ or $x = -1$
 C $x = 1$ or $x = -3$
~~D $x = 1$ or $x = 3$~~
-
4. The solution of the differential equation $y \frac{dy}{dx} = 2x$, given that $y = 1$ when $x = 1$ is
- A $x^2 = y^2 - 2$
 B $2x^2 = y^2 - 1$
 C $x = 2y^2 - 1$
~~D $y^2 = 2x^2 - 1$~~
-
5. In the set $A = \{1, 2, 3, 4, 5\}$, a relation R is defined by $R = \{(x, y) : x, y \in A \text{ and } x < y\}$. Then R is
- A reflexive
 B symmetric
 C transitive
 D Anti-symmetric
-
6. The line segment PQ , where P is the point $(7, 7)$ and Q the point $(-1, 3)$, is the diameter of a circle. The equation of the circle is
- A $(x-7)(x+1) + (y-7)(y-3) = 0$
 B $(x-7)(x-1) + (y-7)(y-3) = 0$
 C $(x+7)(x-1) + (y+7)(y+3) = 0$
 D $(x+7)(x+1) + (y-7)(y+3) = 0$
-
7. When $f(x) = 2x^3 + x^2 - 13x + 6$ is divided by $2x - 1$, the remainder is
- A 13
 B 52
 C $\frac{1}{2}$
~~D 0~~
-
8. The range of values of x for which $|x - 4| \leq 2$ is
- A $x \leq 6$
 B $x \leq 2$ or $x \geq 6$
~~C $2 \leq x \leq 6$~~
 D $x \geq 2$
-
9. Which of the following statements is TRUE?
- A If $x^2 = y^2$, then $x = y$.
 B If $f(a) = 0$, then $x + a$ is a factor of $f(x)$.
 C If $f(x)$ has a maximum value at $x = a$, then $f''(a) > 0$
 D Let $m, n \in \mathbb{Z}$, the set of integers. If m and n are both odd, then $m + n$ is even.

10. Given that $f(x) = \begin{vmatrix} x & x^2 & x^3 \\ 1 & 2x & 3x^2 \\ 0 & 2 & 6x \end{vmatrix}$, $f'(x) =$

A 12

~~B~~ $6x^2$

C $6x$

D $42x^3$

11. Given that f is a periodic function of period 4 and that $f(x) = \begin{cases} x^2, & 0 \leq x < 2 \\ x+2, & 2 \leq x < 4 \end{cases}$, then $f(9)$ is

A 1

B 81

C 11

D 7

12. The volume generated when the area of the finite region enclosed by the x -axis and the curve $y = x - x^2$ is rotated completely about the x -axis is

~~A~~ $\pi \int_0^1 (x - x^2)^2 dx$

B $\pi \int_0^2 (x - x^2)^2 dx$

C $2\pi \int_{-1}^1 (x - x^2)^2 dx$

D $2\pi \int_{-1}^0 (x - x^2)^2 dx$

13. Two consecutive integers between which a root of the equation $x^3 + x - 16 = 10$ lies are

A 1 and 2

B 2 and 3

C 3 and 4

D 4 and 5

14. The vectors \mathbf{a} and \mathbf{b} are such that $|\mathbf{a}| = 3$, $|\mathbf{b}| = 5$ and $\mathbf{a} \cdot \mathbf{b} = -14$, then $|\mathbf{a} - \mathbf{b}| =$

A 62

~~B~~ $\sqrt{62}$

C 44

D $\sqrt{44}$

15. The sum of the first n terms of a series is given by $S_n = 5n^2 + 2n$. The n^{th} term of the series is

A $10n + 7$

~~B~~ $10n - 3$

C $10n + 3$

D $10n - 7$

16. The expansion of $(2 + 3x)^{-1}$ is valid when

~~A~~ $-\frac{2}{3} < x < \frac{2}{3}$

B $-\frac{1}{3} \leq x \leq \frac{1}{3}$

C $-\frac{1}{3} < x < \frac{1}{3}$

D $-\frac{3}{2} < x < \frac{3}{2}$

17. The Cartesian equation of the curve with parametric equation $x = 1 + t^2$, $y = 2t$, where t is a parameter, is

A $y^2 = 4(x - 4)$

~~B~~ $y^2 = 4(x - 1)$

C $y^2 = 4(x + 4)$

D $y^2 = 4(1 - x)$

18. $\lim_{x \rightarrow \pi} \left(\frac{\sin 2x}{\sin x} \right) =$

~~A~~ -1

B 2

C 0

~~D~~ -2

19. $1 + \frac{1}{2} + \frac{1}{2^2} + \frac{1}{2^3} + \dots =$

- A $\frac{31}{16}$
- B $\frac{1}{2}$
- C 7
- D 2

20. The asymptotes of the curve

$$y = \frac{(x-5)^2}{(x+5)(x-3)}$$

are

- A $x = 3, x = -5, y = 5$
- B $x = -3, x = -5, y = -5$
- C $x = 3, x = -5, y = 1$
- D $x = 3, x = -5, y = -1$

21. The values of y corresponding to the values of x are given in the table below.

x	6	9	12	15	18	21
y	0.3	0.8	1.4	2.1	3.0	4.3

Using the trapezoidal rule, the approximate value for $\int_6^{21} y \, dx$ is

- A 9.6
- B 35.7
- C 28.9
- D 28.8

22. The gradient of the implicit function to the curve $x^2 + y^2 = 13$ at the point (2, -3) is

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

23. $\sin 50^\circ + \sin 40^\circ =$

- A $\sqrt{2} \cos 5^\circ$
- B $2 \cos 10^\circ$
- C $2 \cos 5^\circ$
- D $\sqrt{2} \cos 10^\circ$

24. The value of the constant λ , for which the plane $\lambda x - 3y + 4z = 5$ and the line $r = i - 2j - 3k + t(2i + 6j + 3k)$ are parallel is

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

25. $\int \frac{x}{1+x^2} \, dx =$

- A $\ln(1+x^2) + c$
- B $\frac{1}{2} \ln(1+x^2) + c$
- C $\frac{1}{2} \tan^{-1} x + c$
- D $\tan^{-1} x + c$

26. The general solution of the equation

$$\tan\left(2x + \frac{\pi}{3}\right) = \frac{1}{\sqrt{3}}$$

- A $2x = n\pi - \frac{\pi}{6}$
- B $2x = n\pi + \frac{\pi}{3}$
- C $2x = n\pi + \frac{\pi}{6}$
- D $2x = n\pi - \frac{\pi}{3}$

27. Given the vectors \mathbf{a} and \mathbf{b} , where

$\mathbf{a} = 2\mathbf{i} - 2\mathbf{j} + 2\mathbf{k}$ and $\mathbf{b} = 3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ are coplanar vectors, $\mathbf{a} \times \mathbf{b} =$

- A $-2\mathbf{i} - 2\mathbf{j} + 4\mathbf{k}$
- B $-2\mathbf{i} + 2\mathbf{j} - 4\mathbf{k}$
- C $-2\mathbf{i} + 2\mathbf{j} + 4\mathbf{k}$
- D $2\mathbf{i} - 2\mathbf{j} - 4\mathbf{k}$

28. Given $n \in \mathbb{N}^*$ such that $u_n = 1 - \frac{1}{n}$, the sequence (u_n) is
- A strictly monotonic increasing
 - B not bounded below
 - C strictly monotonic decreasing
 - D tends to infinity as $n \rightarrow \infty$.

29. The function $f: \mathbb{R} \rightarrow \mathbb{R}$, where $f: x \mapsto x - \frac{1}{3}x^3$ accepts the following ranges of values of x .
- A decreases for $x \leq -1$, increases for $-1 < x < 1$, decreases for $x \geq 1$
 - B increases for $x \leq -1$, decreases for $-1 < x < 1$, increases for $x \geq 1$
 - C increases for $x \leq 1$, decreases for $x > 1$
 - D decreases for $x \leq 1$, increases for $x > 1$.

30. The complex number $1 + \sqrt{3}i$ can be expressed in exponential form as
- A $2e^{\frac{\pi i}{6}}$
 - B $2e^{-\frac{\pi i}{6}}$
 - C $2e^{-\frac{\pi i}{3}}$
 - D $2e^{\frac{\pi i}{3}}$

31. $(\cos 4\theta + i \sin 4\theta)^2 (\cos 3\theta + i \sin 3\theta) =$
- A $\cos 5\theta + i \sin 5\theta$
 - B $\cos 11\theta + i \sin 11\theta$
 - C $\cos 3\theta + i \sin 3\theta$
 - D $\cos 19\theta + i \sin 19\theta$

32. An iterative formula is given by $X_{n+1} = \frac{X_n^3 + 1}{5}$.
Given that $X_1 = 0$, $X_3 =$
- A 0.2
 - B 0.2016
 - C 0.208
 - D 2.016

33. Given the matrix A , where $A = \begin{pmatrix} 2 & 8 & 9 \\ 0 & -1 & -3 \\ 0 & 2 & 1 \end{pmatrix}$

the determinant of A^T , the transpose of A , is

- A -14
- B 14
- C -10
- D 10

34. The image of the line $y = 2x$ under the transformation matrix $\begin{pmatrix} 2 & 1 \\ 1 & 3 \end{pmatrix}$ is the line

- A $7x - 4y = 0$
- B $7x + 4y = 0$
- C $4x - 7y = 0$
- D $4x + 7y = 0$

35. The equations

$$\begin{aligned} 2x - 3y + 4z &= 1, \\ 3x - y &= 2, \\ x + 2y - 4z &= 1 \end{aligned}$$

- A are linearly independent
- B are straight lines
- C are linearly dependent
- D have a unique solution.

SECTION B: MECHANICS

36. The position vector of a particle of mass 4 kg is $\mathbf{r} = [t^2\mathbf{i} - 3t\mathbf{j} + (1 - t^2)\mathbf{k}]$ m. Its momentum when $t = 1$ s is

- A $(8\mathbf{i} - 8\mathbf{j})$ N s
- B $(2\mathbf{i} - 3\mathbf{j} - 2\mathbf{k})$ N s
- C $(4\mathbf{i} - 3\mathbf{j})$ N s
- D $(8\mathbf{i} - 12\mathbf{j} - 8\mathbf{k})$ N s

37. A truck of mass 900 kg is travelling along a straight level road against a constant resistance of 400 N. Given that the engine of the car is working at 20 kW when the speed of the car is 20 ms^{-1} , the acceleration of the car is

- A $\frac{1}{3} \text{ m s}^{-2}$
- B 1 m s^{-2}
- C $\frac{2}{3} \text{ m s}^{-2}$
- D $\frac{4}{3} \text{ m s}^{-2}$

38. The work done to compress a spring of modulus of elasticity 4 N to half its original length is 1.2 J. The natural length of the spring is

- A 0.8 m
- B 0.3 m
- C 4.8 m
- D 2.4 m

39. A projectile is fired with a speed of 20 ms^{-1} at an angle θ to the horizontal, where $\tan \theta = \frac{3}{4}$. Its speed after 2 s is

- A $2\sqrt{6} \text{ m s}^{-1}$
- B $8\sqrt{5} \text{ m s}^{-1}$
- C 5 m s^{-1}
- D 8 m s^{-1}

40. A body of mass 4 kg moves with constant angular speed $3\pi \text{ rad s}^{-1}$ around a horizontal circle of radius 2 m. The magnitude of the force acting towards the centre of the circle is

- A $12\pi^2 \text{ N}$
- B $72\pi^2 \text{ N}$
- C $36\pi^2 \text{ N}$
- D $24\pi^2 \text{ N}$

41. A smooth sphere S , of mass $3m$, moving with speed u collides directly with an identical smooth sphere Q , of mass $2m$, moving in the opposite direction with speed u . Given that the coefficient of restitution between the spheres is $\frac{2}{3}$, the speed of Q after impact is

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

42. Two bodies A and B have masses m and $4m$ respectively. Given that the particles are moving with equal momentum, the ratio of the kinetic energy of A to the kinetic energy of B is

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

43. Three particles of mass 5 kg, 3 kg and 7 kg are placed at points A , B and C respectively whose position vectors are $(\mathbf{i} - 2\mathbf{j})$ m, $(7\mathbf{i} + \mathbf{j})$ m and $(-3\mathbf{i} + 5\mathbf{j})$ m respectively. The position vector of their centre of mass is

- A $(-\frac{1}{3}\mathbf{i} + \frac{28}{15}\mathbf{j})$ m
- B $(-\frac{1}{3}\mathbf{i} - \frac{28}{15}\mathbf{j})$ m
- C $(\frac{1}{3}\mathbf{i} + \frac{28}{15}\mathbf{j})$ m
- D $(\frac{1}{3}\mathbf{i} - \frac{28}{15}\mathbf{j})$ m

7

44. If $P(A \cap B) = \frac{1}{3}$, $P(A \cup B) = \frac{5}{6}$ and $P(A) = \frac{1}{2}$, then

- A A and B are independent events
- B A and B are mutually exclusive events
- C $P(A) = P(B)$
- D $P(A) > P(B)$

45. A bar AB , of length 0.6 m and weight 3 N is suspended horizontally by two strings at its ends A and B . Given that its centre of gravity is 0.4 m from A , then the tension in the string at A is

- A 0.2 N
- B 1.4 N
- C 0.8 N
- D 1.0 N

46. Neglecting air resistance and taking g as 10 m s^{-2} , the height fallen by a fruit from rest to a speed 10 m s^{-1} is

- A 5 m
- B 10 m
- C 0.5 m
- D 15 m

47. A car moving at 5 m s^{-1} is brought to rest after travelling a distance of 1.5 km. The time taken by the car to come to rest is

- A 600 s
- B 300 s
- C 3000 s
- D 150 s

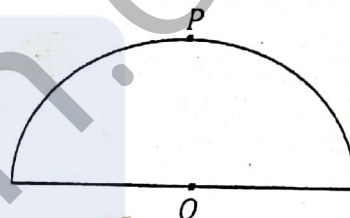
48. A parcel of mass 20 kg is placed on the floor of a lift. Taking g as 10 m s^{-2} , the reaction of the lift on the parcel when the lift is ascending with an acceleration of 3 m s^{-2} is

- A 260 N
- B 140 N
- C 200 N
- D 600 N

49. The work done by a force $(-2\mathbf{i} + 5\mathbf{j}) \text{ N}$ which moves a particle from a point A to another point B , where $\mathbf{OA} = (-\mathbf{i} - 3\mathbf{j}) \text{ m}$ and $\mathbf{OB} = (2\mathbf{i} + \mathbf{j}) \text{ m}$, is

- A 1 J
- B 13 J
- C 14 J
- D -14 J

50.



The diagram above shows a uniform semi-circular lamina of radius $2a$, centre O . The distance of the centre of mass from P , vertically above O is

- A $\frac{6a\pi - 8a}{3\pi}$
- B $\frac{6a\pi + 8a}{3\pi}$
- C $\frac{8a - 6a\pi}{3\pi}$
- D $\frac{6a\pi - 4a}{3\pi}$

STOP
NOW GO BACK AND CHECK YOUR WORK