

CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

0765 Pure Math with Mechanics I

JUNE 2017

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 "0765 Pure Math with Mechanics I- 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 instruction.
6. **Answer All questions.**
7. **Formulae Booklets and 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 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 the blank spaces in the question booklet.
12. At the end of the examination, the invigilator shall collect the answer sheet first then the question booklet. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH ANY.

SECTION A: PURE MATHEMATICS

1. Given that $\frac{P}{1-x} + \frac{Q}{2+x} \equiv \frac{2x+1}{(1-x)(2+x)}$,

- A $P=1, Q=1$
- B $P=1, Q=-1$
- C $P=-1, Q=-1$
- D $P=-1, Q=1$

2. When the polynomial function $x^3 + 2x^2 + \lambda x - 3$ is divided by $x - 2$ and $x + 1$, the remainders are the same. The value of the constant λ is

- A -5
- B 15
- C 18
- D -6

3. α and β are the roots of a quadratic equation such that $\alpha + \beta = 2$ and $\alpha\beta = \frac{1}{2}$. The value of $\alpha^2 + \beta^2 =$

- A $\frac{7}{2}$
- B 3
- C 2
- D $\frac{9}{2}$

4. The normal vector to the plane $3x + 4y - 5z - 6 = 0$ is

- A $3i + 4j - 5k$
- B $-3i + 4j + 5k$
- C $3i + 4j - 6k$
- D $3i - 5j - 6k$

5. The range of values of x which satisfies the inequality $5 - x \geq 2|x - 2|$ is

- A $-3 \leq x \leq -1$
- B $-3 \leq x \leq 1$
- C $-1 \leq x \leq 3$
- D $1 \leq x \leq 3$

6. The image of the point $(\lambda - 1, \lambda + 1, \lambda - 1)$, where λ is a parameter, under the transformation

matrix $\begin{pmatrix} 1 & 0 & -1 \\ 0 & -1 & 1 \\ -1 & 1 & 0 \end{pmatrix}$ is

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

7. The equation $\cos x + \sqrt{3} \sin x = 1$ is equivalent to

- A $2 \sin\left(x + \frac{\pi}{6}\right) = 1$
- B $2 \sin\left(x + \frac{\pi}{3}\right) = 1$
- C $2 \cos\left(x - \frac{\pi}{6}\right) = 1$
- D $2 \cos\left(x - \frac{\pi}{3}\right) = 1$

8. The number of permutations of the letters of the word *CLASSICAL* is

- A $\frac{5!}{2!2!2!2!}$
- B $\frac{9!}{2!2!2!2!}$
- C $\frac{9!}{4!}$
- D $\frac{4 \times 9!}{2!2!2!2!}$

9. $\int_0^{\frac{\pi}{4}} \tan x \, dx =$

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

10. The curve $y = \frac{x^2}{x-1}$ cannot lie between $y = 0$ and $y = 4$. There is a local maximum of the curve at the point

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

11. $\lim_{x \rightarrow \infty} \left(1 + \frac{2}{x}\right)^x =$

- A 2^x
- B e^x
- C 1
- D e^2

12. The first four terms of the binomial expansion

of $\left(1 - \frac{x}{2}\right)^8$ are

- A $1 + 4x + 7x^2 + 7x^3$
- B $1 - 4x - 7x^2 + 7x^3$
- C $1 - 4x + 7x^2 - 7x^3$
- D $1 + 4x - 7x^2 - 7x^3$

13. The volume generated when the region bounded by the curve $x = \sqrt{1 + y}$, the y -axis and the lines $y = 0$ and $y = 3$, is rotated about the y -axis through 360° is

- A $\frac{14\pi}{3}$
- B 6π
- C 3π
- D $\frac{15\pi}{2}$

14. The domain of each of the functions below is \mathbb{R} . Determine which one of them is one-one mapping.

- A $f: x \mapsto x^3 - 2$
- B $f: x \mapsto \cos x$
- C $f: x \mapsto x^2 + 1$
- D $f: x \mapsto x(x - 4)$

15. The range of values of x for which the function $f: x \mapsto x^2 - 6x + 4$ is increasing is

- A $x > 3$
- B $x < 3$
- C $-3 < x < 3$
- D $x < -3$ or $x > 3$

16. Given that $\tan x = \frac{2}{3}$, $\tan 2x =$

- A $\frac{12}{5}$
- B $\frac{4}{3}$
- C $\frac{12}{13}$
- D $\frac{4}{9}$

17. Given that the complex numbers z_1 and z_2 are such that $z_1 = \cos 10^\circ + i \sin 10^\circ$ and $z_2 = \cos 15^\circ + i \sin 15^\circ$, $z_1 z_2 =$

- A $\cos 115^\circ + i \sin 115^\circ$
- B $\cos 25^\circ + i \sin 25^\circ$
- C $\cos^2 35^\circ + i \sin^2 35^\circ$
- D $\cos 50^\circ + i \sin 50^\circ$

18. Given the complex number $z = i$, $\sum_{r=1}^6 (z)^r =$

- A $1 + i$
- B $-i$
- C $-1 + i$
- D -1

19. $\int_0^1 (3x + 1)^5 dx =$

- A $\frac{127}{7}$
- B $\frac{7}{2}$
- C $\frac{32}{9}$
- D $\frac{21}{2}$

20. The function $f: \mathbb{R} \rightarrow \mathbb{R}$ is defined by

$$f: x \mapsto \frac{8x - 3}{2x - 7}, x \neq \frac{7}{2}. f \text{ is}$$

- A odd
- B surjective
- C even
- D injective

21. A bag contains 10 small balls of equal size. Given that two of the balls are green and the others are of different colours, the number of different selections of 2 balls that can be made from the bag is
- A $\frac{10!}{2!}$
 B 29
 C 37
 D 36

22. Given that the complex number z is such that $|z| = 4$ and $\arg z = -\frac{\pi}{3}$, then $z =$
- A $4(1 + i\sqrt{3})$
 B $2(1 + i\sqrt{3})$
 C $4(1 - i\sqrt{3})$
 D $2(1 - i\sqrt{3})$

23. The distance of the origin from the plane $2x - 3y + 6z = 14$ is
- A 2
 B 14
 C -2
 D -14

24. The determinant of the matrix $\begin{pmatrix} 1 & -1 & 2 \\ 1 & 1 & 0 \\ -1 & 1 & 2 \end{pmatrix}$ is
- A 4
 B 8
 C 6
 D 2

25. The vector \mathbf{v} , where $|\mathbf{v}| = 28$, is in the direction of the vector $2\mathbf{i} + 3\mathbf{j} - 6\mathbf{k}$. $\mathbf{v} =$
- A $14\mathbf{i} + 21\mathbf{j} - 42\mathbf{k}$
 B $8\mathbf{i} + 12\mathbf{j} - 24\mathbf{k}$
 C $26\mathbf{i} + 25\mathbf{j} - 22\mathbf{k}$
 D $14\mathbf{i} + \frac{28}{3}\mathbf{j} - \frac{14}{3}\mathbf{k}$

26. The area of the finite region enclosed by the curve $xy = 4$, the x -axis and the ordinates $x = 2$ and $x = 8$ is
- A $4 \ln 6$.
 B $16 \ln 2$.
 C $8 \ln 2$.
 D $\ln 4$.

27. A linear relationship between the logarithms of the variable x and y which are connected by the relation $y = ax^n$ is
- A $\log y = n(\log a + \log x)$
 B $\log y = n \log a + \log x$
 C $\log y = \log a + \log nx$
 D $\log y = \log a + n \log x$

28. The values of y for various values of x are given in the table below.

x	1	2	3	4	5	6
y	3	4.2	5.2	6	6.7	7.3

- Using the trapezium rule, $\int_1^6 y dx \approx$
- A 32.40
 B 27.25
 C 25.90
 D 27.52

29. Given that $f(x) = x^2 \ln(x - 2)$, $f'(3) =$
- A 9
 B 6
 C $6 \ln 5 - 9$
 D -9

30. $\frac{1}{(1 + \sqrt{3}i)^3} =$
- A -8
 B $-\frac{1}{8}$
 C $\frac{1}{8}$
 D 8

31. The vector perpendicular to both $3\mathbf{i} - 6\mathbf{j} - 4\mathbf{k}$ and $-3\mathbf{i} + 2\mathbf{j} + 2\mathbf{k}$ is
- A $-4\mathbf{i} + 6\mathbf{j} + 12\mathbf{k}$
 B $-4\mathbf{i} + 6\mathbf{j} - 12\mathbf{k}$
 C $4\mathbf{i} - 6\mathbf{j} - 12\mathbf{k}$
 D $-2\mathbf{i} + 3\mathbf{j} + 6\mathbf{k}$

32. The remainder when $x^3 - 5x^2 + 7$ is divided by $(x - 1)^2$ is
- A 3
 B 5
 C $-7x + 10$
 D $7x - 10$

33. Given that the complex numbers $z_1 = 3 + i$ and $z_2 = -3 - i$ are such that $|z - z_1| = |z - z_2|$. The locus of z is
- A a circle
 - B the line $3y = -x$
 - C the line $y = 3x$
 - D the line $y = -3x$

34. Let $A = \{1, 2, 3, 4\}$ and R be a relation defined on A . Given that $R = \{(1, 1), (1, 3), (2, 2), (2, 1), (3, 1), (1, 2), (4, 4)\}$. R is
- A Reflexive
 - B Symmetric
 - C Anti-symmetric
 - D transitive

35. Given that $\frac{dy}{dx} = 6(\sin 2x - \cos 3x)$ and $y = 0$ when $x = 0$, $y =$
- A $-3 \cos 2x - 2 \sin 3x - 3$
 - B $3 \cos 2x - 2 \sin 3x + 3$
 - C $-3 \cos 2x - 2 \sin 3x + 3$
 - D $3 \cos 2x + 2 \sin 3x - 3$

SECTION B: MECHANICS

36. The work done by a force $(3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k})$ N acting on a particle which moves from a point with position vector $(\mathbf{i} + \mathbf{j} + 2\mathbf{k})$ m to another point with position vector $(3\mathbf{i} - 2\mathbf{j} + 4\mathbf{k})$ m is
- A 46 J
 - B 4 J
 - C $(6\mathbf{i} - 12\mathbf{j} + 10\mathbf{k})$ J
 - D $(12\mathbf{i} + 4\mathbf{j} + 30\mathbf{k})$ J

37. A small sphere of mass 10 kg is moving with speed 5 ms^{-1} and collides with another sphere of mass 4 kg moving in the opposite direction with speed 2 ms^{-1} . If after collision the speed of the 4 kg mass is 5.5 ms^{-1} , the coefficient of restitution between the spheres is
- A $\frac{1}{2}$
 - B $\frac{1}{3}$
 - C $\frac{1}{4}$
 - D $\frac{3}{4}$

38. The displacement \mathbf{r} of a particle at time t is given by $\mathbf{r} = (t^3 \mathbf{i} - 2t \mathbf{j} + 3t^2 \mathbf{k})$ m. The speed of the particle after 1 second is
- A $\sqrt{14} \text{ ms}^{-1}$
 - B $(3\mathbf{i} - 2\mathbf{j} + 6\mathbf{k}) \text{ ms}^{-1}$
 - C 7 ms^{-1}
 - D 49 ms^{-1}

39. Four particles of masses 5, 2, 1, and 4 kg are placed at the points with position vectors $2\mathbf{j} - \mathbf{k}$, $5\mathbf{i} - \mathbf{j}$, $4\mathbf{i} - 3\mathbf{j} + \mathbf{k}$ and $\mathbf{i} + \mathbf{j} + 3\mathbf{k}$ respectively. the position vector of their centre of mass is
- A $\frac{2}{3}\mathbf{i} + \frac{3}{4}\mathbf{j} + \frac{3}{2}\mathbf{k}$
 - B $\frac{3}{2}\mathbf{i} + \frac{3}{4}\mathbf{j} + \frac{3}{2}\mathbf{k}$
 - C $\frac{3}{2}\mathbf{i} + \frac{4}{3}\mathbf{j} + \frac{2}{3}\mathbf{k}$
 - D $\frac{3}{2}\mathbf{i} + \frac{3}{4}\mathbf{j} + \frac{2}{3}\mathbf{k}$

40. A car moves at constant speed of 60 km h^{-1} on a level road when the engine is working at 15 kW. The resistance to the motion of the car is
- A 375 N
 - B 37,500 N
 - C 90,0000 N
 - D 900 N

41. A particle of mass 4 kg is placed on a smooth horizontal table and connected by a light inextensible string passing over a small fixed smooth pulley at the edge of the table to a mass of 6 kg hanging freely. The system is released from rest. Taking g as 10 ms^{-2} , the tension in the string is
- A 36 N
 - B 24 N
 - C $24\sqrt{2} \text{ N}$
 - D 48 N

42. Two boats B_1 and B_2 are moving with velocities $(4\mathbf{i} - 3\mathbf{j} + 7\mathbf{k}) \text{ ms}^{-1}$ and $(2\mathbf{i} + 3\mathbf{j} + 4\mathbf{k}) \text{ ms}^{-1}$ respectively. The relative velocity of B_1 when viewed from B_2 is
- A $(-2\mathbf{i} + 6\mathbf{j} - 3\mathbf{k}) \text{ ms}^{-1}$
 - B $(6\mathbf{i} + 11\mathbf{k}) \text{ ms}^{-1}$
 - C $(2\mathbf{i} + 3\mathbf{k}) \text{ ms}^{-1}$
 - D $(2\mathbf{i} - 6\mathbf{j} + 3\mathbf{k}) \text{ ms}^{-1}$

6

43. A particle of mass m is attached by a light inelastic string of length 2 m to a fixed point O . The particle moves with constant speed $v\text{ ms}^{-1}$ in a horizontal circle whose centre is 1.5 m vertically below O and radius $\frac{\sqrt{7}}{2}$, $v^2 =$

- A $\frac{7}{6}g$
- B $\frac{6}{7}g$
- C $\frac{9}{16}g$
- D $\frac{16}{9}g$

44. A particle moves horizontally with retardation $3v^2$, where v is its speed at time t . If the initial speed of the particle is 2 ms^{-1} , $v =$

- A $\frac{2}{1-6t}$
- B $\frac{2}{6t-1}$
- C $\frac{2}{1+6t}$
- D $\frac{-2}{1+6t}$

45. A particle moves horizontally with velocity v , where $v = (t^2\mathbf{i} + 3t\mathbf{j})\text{ ms}^{-1}$, at time t seconds. Initially, $\mathbf{r} = (3\mathbf{i} - 4\mathbf{j})\text{ m}$. The distance covered in 3 seconds is

- A $9\sqrt{2}\text{ m}$
- B $(12\mathbf{i} + 5\mathbf{j})\text{ m}$
- C 13 m
- D $(9\mathbf{i} + 9\mathbf{j})\text{ m}$

46. The forces $\mathbf{F}_1 = (-4\mathbf{i} + 3\mathbf{j})\text{ N}$, $\mathbf{F}_2 = (-2\mathbf{i} + 4\mathbf{j})\text{ N}$ act through the points $\mathbf{r}_1 = (2\mathbf{i} - \mathbf{j})\text{ m}$ and $\mathbf{r}_2 = 4\mathbf{j}\text{ m}$ respectively. The total moment of the forces about the origin is

- A -10 Nm
- B 10 Nm
- C -16 Nm
- D 16 Nm

47. The events E_1 and E_2 are such that $P(E_1) = \frac{1}{3}$, $P(E_1|E_2) = \frac{1}{4}$ and $P(E_2|E_1) = \frac{1}{2}$, $P(E_2) =$

- A $\frac{2}{3}$
- B $\frac{1}{12}$
- C $\frac{1}{8}$
- D $\frac{5}{6}$

48. The probability that Ekane gets out of bed is $\frac{2}{5}$. If he gets out of bed late, the probability that he is late to school is $\frac{4}{5}$. If he gets out of bed early, the probability that he is late to school is $\frac{3}{10}$. The probability that Ekane is late to school is

- A $\frac{1}{2}$
- B $\frac{8}{25}$
- C $\frac{9}{50}$
- D $\frac{12}{125}$

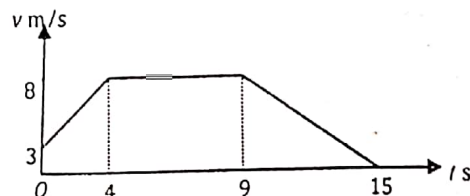
49. The equation of the trajectory of a projectile is given by

$$y = x - \frac{x^2}{40}$$

The horizontal distance travelled by the projectile when it has risen a height of 9.6 m is

- A 16 m or 24 m
- B 16 m or 10 m
- C 10 m or 30 m
- D 24 m or 30 m

50. The speed-time graph of a body is shown below.



The distance covered by the body in 15 seconds is

- A 80 m
- B 112 m
- C 86 m
- D 88 m