Pure Maths with Mechanics 1
0765

GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

JUNE 2025 **ADVANCED LEVEL**

Centre Number	
Centre Name	
Candidate Number	
Candidate Name	

Mobile phones are NOT allowed in the examination room.

MULTIPLE CHOICE QUESTION PAPER

Duration: 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 – 0765 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 instructions.
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 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 then the question booklet after. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH IT.**

SECTION A: PURE MATHEMATICS

1. Given that f: $\mathbb{R} \longrightarrow \mathbb{R}$, where $f(x) = \frac{x+2}{x+1}$, the range of f is
   A $\{x \in \mathbb{R}, x \neq 1\}$
   B $\{x \in \mathbb{R}, x \neq -2\}$
   C $\{x \in \mathbb{R}, x \neq -1\}$
   D $\{x \in \mathbb{R}, x \neq 2\}$

2. If functions $g : \mathbb{R} \longrightarrow \mathbb{R}$ and function $h : \mathbb{R} \longrightarrow \mathbb{R}$ are such that $f(x) = 3x - 2$ and $h(x) = x - 1$, then $(g \circ h)(x) =$
   A $3x + 3$
   B $3x - 3$
   C $3x - 5$
   D $3x + 5$

3. If $\mathbf{A} = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix}$, then the cofactor of the element 6 is
   A $\begin{vmatrix} 1 & 2 \\ 7 & 8 \end{vmatrix}$
   B $-\begin{vmatrix} 1 & 2 \\ 7 & 8 \end{vmatrix}$
   C $+6\begin{vmatrix} 1 & 2 \\ 7 & 8 \end{vmatrix}$
   D $-6\begin{vmatrix} 1 & 2 \\ 7 & 8 \end{vmatrix}$

4. If $\frac{2x+1}{(1-x)(2+x)} \equiv \frac{A}{1-x} + \frac{B}{2+x}$, then
   A $A = 1, B = 1$
   B $A = 1, B = -1$
   C $A = -1, B = -1$
   D $A = -1, B = 1$

5. The normal vector to the plane $6x + 2y - 7z - 12 = 0$ is
   A $-6\mathbf{i} - 2\mathbf{j} + 7\mathbf{k}$
   B $6\mathbf{i} + 2\mathbf{j} - 12\mathbf{k}$
   C $6\mathbf{i} - 2\mathbf{j} - 12\mathbf{k}$
   D $6\mathbf{i} + 2\mathbf{j} - 7\mathbf{k}$

6. If α and β are roots of a quadratic equation such that $\alpha + \beta = 3$ and $\alpha\beta = \frac{3}{2}$. The value of $\alpha^2 + \beta^2 =$
   A 12
   B 5
   C 6
   D 9

7. When $f(x) = 2x^3 + x^2 - 13x + 6$ is divided by $x + 1$ the remainder is
   A 20
   B -4
   C 18
   D -6

8. The range of values of x for which $|x + 4| \leq 2$ is
   A $x \leq -6$
   B $x \leq -6$ or $x \geq -2$
   C $x \geq -2$
   D $-6 \leq x \leq -2$

9. If $\sin\theta = \frac{4}{5}$ and θ is an acute angle, then the exact value of $2\sin\theta\cos\theta$ is
   A $\frac{24}{25}$
   B $\frac{16}{25}$
   C $\frac{9}{25}$
   D $\frac{12}{25}$

10. The values of x that satisfy the equation $3^{2x} - 10(3^{x+1}) + 9 = 0$ are
    A $x = 1, \quad x = 9$
    B $x = -2, x = 0$
    C $x = -1, x = -9$
    D $x = 0, \quad x = 2$

11. If $y = 0$ when $x = 2$, then the solution of the differential equation $y\frac{dy}{dx} = x$ is
    A $y^2 = x^2 + 2$
    B $y^2 = x^2 - 4$
    C $y^2 = x^2 - 2$
    D $y^2 = x^2 + 4$

12. On the set $A = \{2, 4, 8, 16\}$, a relation R is defined by $x \, R \, y$ if and only if y is a multiple of x. R is
    A an equivalence relation
    B symmetric
    C transitive
    D Not reflecxive

13. The line segment AB, where $A(5, 5)$ and $B(3,-2)$, is the diameter of a circle. The equation of the circle is
    A $(x - 5)(x - 3) + (y - 5)(y - 2) = 0$
    B $(x - 5)(x + 3) + (y - 5)(y + 2) = 0$
    C $(x - 5)(x - 3) + (y + 5)(y + 2) = 0$
    D $(x - 5)(x - 3) + (y - 5)(y + 2) = 0$

14. Two vectors **a** and **b** are given as $\mathbf{a} = \mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$ and $\mathbf{b} = 2\mathbf{i} - \mathbf{j} + 2\mathbf{k}$. The vector product $\mathbf{a} \times \mathbf{b}$ is
A $8\mathbf{i} + 2\mathbf{j} - 7\mathbf{k}$
B $8\mathbf{i} - 2\mathbf{j} - 7\mathbf{k}$
C $8\mathbf{i} - 2\mathbf{j} + 7\mathbf{k}$
D $8\mathbf{i} - 6\mathbf{j} - 7\mathbf{k}$

15. The volume generated when the area of the finite region enclosed by the x-axis and the curve $y = 2x^2 - 4x$ is rotated completely about the x-axis is
A $\pi \int_0^{-2} (2x^2 - 4x)^2 dx$
B $\pi \int_0^{2} (2x^2 - 4x)^2 dx$
C $2\pi \int_{-2}^{2} (2x^2 - 4x)^2 dx$
D $2\pi \int_{-2}^{0} (2x^2 - 4x)^2 dx$

16. A root of the equation $x^3 + x - 26 = 0$, lies between
A 1 and 2
B 3 and 4
C 4 and 5
D 2 and 3

17. The sum of the first n terms of a sequence is given by $S_n = 2n^2 + n$. The n^{th} term of this sequence is
A $4n + 1$
B $4n - 3$
C $4n - 1$
D $4n + 3$

18. The first three terms in the binomial expansion of $(1 + 3x)^{-1}$ are
A $1 - 3x + 9x^2$
B $1 + 3x - 9x^2$
C $1 - 3x - 9x^2$
D $1 - 3x + 9x^2$

19. The value of x for which $\log 2 + \log(2x + 5) = 1$ is
A 2
B $-\frac{1}{2}$
C $\frac{1}{2}$
D -2

20. $\lim_{x \to 2} \left(\frac{x - 2}{x^2 - 5x + 6} \right) =$
A 0
B -1
C ∞
D 1

21. $\int_0^1 \frac{x}{1 + x^2} dx =$
A $\ln 2$
B $\ln 4$
C $\frac{1}{2} \ln 2$
D $\frac{1}{2} \ln 4$

22. If $y^3 = 12x - x^3$ then $\frac{dy}{dx} =$
A $\frac{x^2 - 4}{y^2}$
B $\frac{x^2 + 4}{y^2}$
C $\frac{4 + x^2}{y^2}$
D $\frac{4 - x^2}{y^2}$

23. The complex number
$$z = \frac{1 + 2i}{3 - 4i}$$
can be expressed in the form $a + bi$ as
A $\frac{11}{25} + \frac{2}{5}i$
B $-\frac{11}{25} + \frac{2}{5}i$
C $\frac{1}{5} - \frac{2}{5}i$
D $-\frac{1}{5} + \frac{2}{5}i$

24. The argument of the complex number
$$z = \frac{1 + i\sqrt{3}}{1 + i}$$
is
A $\frac{\pi}{4}$
B $\frac{\pi}{12}$
C $\frac{7\pi}{12}$
D $-\frac{\pi}{12}$

25. The general solution of the equation $\sin\theta = \frac{\sqrt{3}}{2}$ is

A $n\pi - (-1)^n \frac{\pi}{3}$

B $n\pi + (-1)^n \frac{\pi}{6}$

C $n\pi + (-1)^n \frac{\pi}{3}$

D $n\pi - (-1)^n \frac{\pi}{6}$

26. The tangent of the acute angle between the lines $y = 5x - 7$ and $y = x - 6$ is

A $\frac{2}{3}$

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

C -1

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

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

x	1	2	3	4	5	6
y	2	3.2	4.2	5	5.7	6.3

Using the trapezium rule, $\int_1^6 y dx \approx$

A 22.25

B 26.40

C 22.52

D 34.70

28. The number of arrangements of the letters of the word SUCCEEDED is

A $\frac{9!}{2!3!}$

B $\frac{9!}{2!2!3!}$

C $\frac{5!}{2!2!3!}$

D $\frac{5!}{2!3!}$

29. The equations of the vertical asymptotes to the graph of $f(x) = \frac{8}{x^2-4}$ are

A $x = 0, x = 4$

B $x = 2, x = 4$

C $x = -2, x = 2$

D $x = -2, x = 4$

30. The solution set of the inequality $\frac{x+2}{x-1} \geq 0$ is

A $\{x : -2 \leq x \leq -1\}$

B $\{x : -2 \leq x < -1\}$

C $\{x : x \leq -2 \cup x \geq 1\}$

D $\{x : x \leq -2 \cup x > 1\}$

31. A committee of 5, with at least one boy and one girl, is to be formed from 3 boys and 5 girls. The number of ways this committee can be form if there are to be more girls than boys is

A 45

B 15

C 30

D 21

32. The value of a for which the quadratic equation $ax^2 - 10x + 4 = 0$ has equal roots is

A $-\frac{25}{4}$

B $\frac{4}{25}$

C $-\frac{4}{25}$

D $\frac{25}{4}$

33. A linear reduction of a relationship $y = ax^{n-1}$, produced the result $\log y = 4\log x + 2$. The values of the constants loga and n are

A $\log a = 2, n = 5$

B $\log a = 1, n = 5$

C $\log a = 2, n = 3$

D $\log a = 1, n = 4$

34. The cardinality of set of $X = \{a, b, c\}$. is

A 9

B 8

C 6

D 3

35. The Cartesian equation of the curve with parametric equations $x = 1 - t^2$ and $y = 4t$, where t is a parameter is

A $4x = 4 + y^2$

B $4x = 4 - y^2$

C $16x = 16 - y^2$

D $16x = 16 + y^2$

SECTION B: MECHANICS

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

A $(3\mathbf{i} - 6\mathbf{j})$ Ns
B $(2\mathbf{i} - 2\mathbf{j} - 3\mathbf{k})$ Ns
C $(6\mathbf{i} + 3\mathbf{j} - 9\mathbf{k})$ Ns
D $(6\mathbf{i} - 6\mathbf{j} - 9\mathbf{k})$ Ns

37. A truck of mass 1800 kg is moving along a straight level road against a constant resistance of 800 N. Given that the engine of the car is working at 40 kW when the speed of the car is 20 m s^{-1} , the acceleration of the car is

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

38. When an elastic string is stretched to a length of 1.8 m, the tension in the string is 14 N. Given that the modulus of elasticity of the string is 28 N, the natural length of the string is

A 1.6 m
B 0.6 m
C 0.12 m
D 1.2 m

39. A particle is projected from a point on a horizontal plane with speed V at an angle θ to the plane. The greatest height H attained by the particle is

A $H = \frac{2V^2 \sin^2\theta}{g}$
B $H = \frac{V^2 \sin^2\theta}{2g}$
C $H = \frac{V^2 \sin 2\theta}{2g}$
D $H = \frac{V^2 \sin 2\theta}{g}$

40. A particle of mass 3 kg is moving in a horizontal circle of radius 1 m. The centripetal force is 48 N. The angular speed of the particle is

A 16 rad s^{-1}
B 3 rad s^{-1}
C 4 rad s^{-1}
D 6 rad s^{-1}

41. A smooth sphere B of mass 6 kg travelling with speed 3 m s^{-1} collides directly with another smooth sphere A of mass 4 kg travelling with the same speed as B but in the opposite direction. Sphere B is brought to rest by the impact. The kinetic energy of *A* after impact is

A 0 J
B 3 J
C $\frac{9}{2}$ J
D 18 J

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

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

43. The magnitude of the resultant of the forces $\mathbf{F}_1 = (-5\mathbf{i} + 12\mathbf{j})$ N, $\mathbf{F}_2 = (-18\mathbf{i} - 8\mathbf{j})$ N, $\mathbf{F}_3 = (4\mathbf{i} + 9\mathbf{j})$ N and $\mathbf{F}_4 = (4\mathbf{i} - 5\mathbf{j})$ N is

A 23 N
B 17 N
C 7 N
D $\sqrt{46}$ N

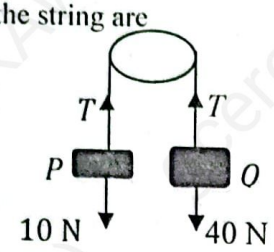
44. A girl on a ship, whose velocity is $(4\mathbf{i} - 7\mathbf{j})$ m s^{-1} is watching a boat whose velocity is $(-8\mathbf{i} - 2\mathbf{j})$ m s^{-1} . The speed of the boat as it appears to the girl is

A $(-12\mathbf{i} + 5\mathbf{j})$ m s^{-1}
B $(12\mathbf{i} - 5\mathbf{j})$ m s^{-1}
C 13 m s^{-1}
D $(-12i - 9j)$ m s^{-1}

45. Two events *A* and *B* are such that $P(A|B) = \frac{11}{21}$ and $P(B) = \frac{3}{5}$, then $P(A \cap B) =$

A $\frac{5}{7}$
B $\frac{4}{7}$
C $\frac{24}{35}$
D $\frac{11}{35}$

The diagram shows two particles P and Q hanging freely and connected by a light inextensible string passing over a fixed smooth pulley. The system is released from rest. Taking g as $10\ \text{m s}^{-2}$, the acceleration of P and the tension in the string are



A $6\ \text{m s}^{-2}$ and 8 N
B $10\ \text{m s}^{-2}$ and 8 N
C $10\ \text{m s}^{-2}$ and 16 N
D $6\ \text{m s}^{-2}$ and 16 N

Three particles of weight 7 N, 9 N and 4 N have position vector $(4\mathbf{i} + \mathbf{j})$ m, $3\mathbf{j}$ m and $(3\mathbf{i} + 4\mathbf{j})$ m respectively. The position vector of their centre of mass is

A $\left(\frac{7}{3}\mathbf{i} + \frac{8}{3}\mathbf{j}\right)$ m
B $\left(2\mathbf{i} + \frac{5}{2}\mathbf{j}\right)$ m
C $(40\mathbf{i} + 50\mathbf{j})$ m
D $\left(\frac{7}{20}\mathbf{i} + \frac{8}{20}\mathbf{j}\right)$ m

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48. The speed of a particle at time t seconds is given by $v = (3t^2 + 6t + 2)\ \text{m s}^{-1}$. The distance travelled by the particle between $t = 1$ s and $t = 4$ s is

A 114 m
B 85 m
C 63 m
D 126 m

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49. A car moving at $5\ \text{m s}^{-1}$ is brought to rest after travelling a distance of 1.5 km. Th acceleration of the car is

A $\frac{25}{3}\ \text{m s}^{-2}$
B $-\frac{25}{3}\ \text{m s}^{-2}$
C $\frac{1}{120}\ \text{m s}^{-2}$
D $-\frac{1}{120}\ \text{m s}^{-2}$

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50. Two fair dice are thrown on a floor, the probability that the same scores are obtained is

A $\frac{5}{6}$
B $\frac{1}{36}$
C $\frac{1}{2}$
D $\frac{1}{6}$

STOP

GO BACK AND CHECK YOUR WORK