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CAMEROON GENERAL CERTIFICATE OF EDUCATION BOARD

General Certificate of Education Examination

0765 Pure Math with Mechanics 1

JUNE 2018 **ADVANCED LEVEL**

Centre Number	
Centre Name	
Candidate Identification Number	
Candidate Name	

Mobile phones are NOT allowed in the examination room.

Pure Math with Mechanics 1

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 Math 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 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 instructions.
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 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. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH IT.**

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SECTION A: PURE MATHEMATICS

1. Given that
$$\frac{x}{(3-x)(4-x)} \equiv \frac{P}{3-x} + \frac{q}{4-x},$$
A $P = 3,\ q = 4$
B $P = 4,\ q = -3$
C $P = 3,\ q = -4$
D $P = -3,\ q = -4$

2. The roots of the quadratic equation
$$2x^2 - 3x - 1 = 0$$
are:
A real and equal
B real and distinct
C imaginary
D both negative

3. A relation R is defined on the set, $\mathbb{Z}$, of integers by
xRy if and only if $x + y \geq 5$.
R is
A reflexive
B symmetric
C transitive
D an equivalence relation

4. When the polynomial $P(x)$, where
$$P(x) = ax^3 + 5x^2 + 2x,$$
is divided by $x - 1$ the remainder is 4. The value of the constant a is
A $\frac{-17}{7}$
B 3
C -3
D $\frac{-13}{7}$

5. The value of $\frac{1}{2}\log_2 \sqrt{8}$ is
A $\frac{4}{3}$
B $\frac{1}{4}$
C $\frac{3}{2}$
D $\frac{3}{4}$

6. The sum of the first n terms of a sequence is given by
$$S_n = 3n^2 + n.$$
An expression for the n^{th} term of the sequence is
A $2(5n - 3)$
B $2(3n - 1)$
C $4(4n - 3)$
D $3n - 2$

7. $\sum_{r=1}^{\infty} 15\left(\frac{1}{4}\right)^r =$
A 5
B 4
C $\frac{5}{4}$
D $\frac{5}{2}$

8. When $(3 - 2x)^{\frac{1}{2}}$ is expanded in ascending powers of x, the range of values of x for which the expansion is valid is
A $-\frac{3}{2} < x < \frac{2}{3}$
B $-\frac{2}{3} < x < \frac{3}{2}$
C $-\frac{3}{2} < x < \frac{3}{2}$
D $-\frac{2}{3} < x < \frac{2}{3}$

9. The general solution of the equation $\sec(\theta + 30^0) = 2$ is
A $\theta = 360^0 n \pm 30^0 - 60^0$
B $\theta = 180^0 n \pm 30^0 - 60^0$
C $\theta = 360^0 n \pm 60^0 - 30^0$
D $\theta = 180^0 n \pm 60^0 - 30^0$

10. The sine of the acute angle between the plane π and the line l, where
π: $x - y + z = 2$, and
l: $\frac{x-2}{2} = \frac{y+1}{2} = \frac{z}{1}$, is
A $\frac{1}{\sqrt{5}}$
B $\frac{1}{\sqrt{15}}$
C $\frac{1}{3\sqrt{3}}$
D $\frac{1}{\sqrt{3}}$

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11. $\lim_{x \to -2} \frac{x^2 - x - 6}{(x+5)(x+2)} =$

A $\frac{1}{3}$

B $-\frac{5}{3}$

C $-\frac{3}{5}$

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

12. $\frac{\sin 4\theta + \sin 2\theta}{\cos 4\theta + \cos 2\theta} \equiv$

A $\tan 3\theta$
B $\tan \theta$
C $\cot 3\theta$
D $\cot \theta$

13. Given that $y = (1 + 2x)^{\frac{1}{2}}$,
$\frac{dy}{dx} =$

A $\frac{1}{2}(1 + 2x)^{-\frac{1}{2}}$

B $(1 + 2x)^{-\frac{1}{2}}$

C $2(1 + 2x)^{-\frac{1}{2}}$

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

14. $\int \frac{3x}{1+x^2} dx =$

A $3 \ln (1 + x^2) + k$
B $3 \tan^{-1} x + k$
C $\frac{2}{3} \ln (1 + x^2) + k$
D $\frac{3}{2} \ln (1 + x^2) + k$

15. A real valued function f is defined by
$f : x \mapsto \frac{2x}{4 - 3x}, x \in \mathbb{R}, x \neq \frac{4}{3}$

The range of f is

A $\{x \in \mathbb{R} | x \neq \frac{3}{4}\}$

B $\{x \in \mathbb{R} | x \neq -\frac{2}{3}\}$

C $\{x \in \mathbb{R} | x \neq \frac{2}{3}\}$

D $\{x \in \mathbb{R} | x \neq \frac{1}{2}\}$

16. The range of real values of x for which
$\frac{x-3}{x+2} \leq 0$ is

A $x \leq -2$ or $x \geq 3$
B $-2 < x \leq 3$
C $x \leq -3$ or $x \geq 2$
D $-3 \leq x \leq 2$

17. The vector equation of a straight line is
$\mathbf{r} = 2\mathbf{i} + \mathbf{j} - 2\mathbf{k} + t(3\mathbf{i} + 2\mathbf{j} + 6\mathbf{k})$.
The direction cosines of the line are

A $[2, 1, -2]$
B $[3, 2, 6]$
C $\left[\frac{2}{3}, \frac{1}{3}, -\frac{2}{3}\right]$
D $\left[\frac{3}{7}, \frac{2}{7}, \frac{6}{7}\right]$

18. Given the parametric equations
$x = 2t + \sin 2t$ and $y = 2 - \cos 2t$,
where t is the parameter,
$\frac{dy}{dx} =$

A $-\tan t$

B $\frac{\sin 2t}{1 + \cos 2t}$

C $\cot t$

D $\frac{\sin t \cos t}{2(1 + \cos 2t)}$

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19. The general solution of the differential equation $\cos x \frac{dy}{dx} = y \sin x$ is

A $\ln y = \ln(\cos x) + k$

B $\ln y = \ln(\sin x) + k$

C $\ln y = -\ln(\sin x) + k$

D $\ln y = -\ln(\cos x) + k$

20. $\frac{1-i}{1-2i} =$

A $\frac{3}{5} + \frac{1}{5}i$

B $-\frac{1}{5} + \frac{1}{5}i$

C $-\frac{3}{5} - \frac{1}{5}i$

D $1 + \frac{2}{3}i$

21. The equation $x^4 - 2^{-x} = 0$ has a root in the interval

A $0 \leq x \leq 1$

B $1 \leq x \leq 2$

C $-1 \leq x < 0$

D $-2 \leq x \leq -1$

22. Given that $y = x \ln(3x^2)$, the value of $\frac{dy}{dx}$ when $x = 1$ is

A 3

B $\ln 3$

C $1 + \ln 3$

D $2 + \ln 3$

23. The modulus of the complex number $\frac{1+\sqrt{3}i}{1+i}$ is

A 2

B $\sqrt{3}$

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

D $\frac{1}{\sqrt{2}}$

24. The coordinates of the points A and B are $(-2, 3)$ and $(4, 1)$, respectively. An equation of the circle which has AB as diameter of length $\sqrt{10}$ is.

A $x^2 + y^2 + 2x - 4y - 5 = 0$

B $x^2 + y^2 - 2x - 4y - 5 = 0$

C $x^2 + y^2 - 2x + 4y - 5 = 0$

D $x^2 + y^2 + 2x + 4y - 5 = 0$

25. The table below shows the values of x and the corresponding values of y for a certain experiment.

x	0	2	4	6	8
y	0.7	2.5	2	1.5	0.5

Using the trapezium rule, an appropriate value of $\int_0^8 y\,dx$ is

A 13.2

B 6.6

C 18.6

D 52.8

26. The gradient of the tangent to the curve $y^2 = 4x + y$ at the point $(0, 1)$ is

A $\frac{5}{2}$

B 4

C -4

D -2

27. The equations of the three asymptotes to the curve

$$y = \frac{(x-2)^2}{(x+3)(x-4)}$$ are

A $x = 2, x = -3, x = 4$

B $y = 1, x = -3, x = 4$

C $x = 2, x = 3, x = -4$

D $x = 2, x = 3, x = -4$

28. The number of ways in which a committee of 6 members can be selected from 6 male and 4 female parliamentarians, given that it must contain at least 3 female parliamentarians is

A ${}^4C_2 \times {}^6C_4 + {}^4C_4 \times {}^6C_2$

B ${}^4C_3 \times {}^6C_3 + {}^6C_4 \times {}^4C_2$

C ${}^4C_4 \times {}^6C_2 + {}^4C_2 \times {}^6C_4$

D ${}^4C_3 \times {}^6C_3 + {}^4C_4 \times {}^6C_2$

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29. The function $f:\mathbb{R}-\{2\} \rightarrow \mathbb{R}$, is defined by $f(x)=\frac{x}{x-2}$, is

A surjective

B injective

C both injective and surjective

D neither surjective nor injective

30. $\int_0^{\frac{\pi}{4}}(1+\cos 2x)dx =$

A $\frac{\pi}{4}+2$

B $\frac{\pi}{4}-\frac{1}{2}$

C $\frac{\pi}{4}-2$

D $\frac{\pi}{4}+\frac{1}{2}$

31. The complex number $\left(\cos\frac{\Pi}{27}+i\sin\frac{\Pi}{27}\right)^9$ can be expressed in the form a + bi, where a, b ϵ $\mathbb{R}$, as

A $-\frac{1}{2}+\frac{\sqrt{3}}{2}i$

B $\frac{1}{2}+\frac{\sqrt{3}}{2}i$

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

D $\frac{1}{2}+\frac{\sqrt{3}}{2}i$

32. The image of the point P(3,0,6) under the transformation whose matrix is M

Where $M=\begin{pmatrix}1&3&2\\0&1&1\\1&3&0\end{pmatrix}$ is the point

A (15, 6, 13)

B (15, 6, 3)

C (13, 4, 3)

D (13,4, 13)

33. Given the statement p and q such that p: John is tall; q: John is fat. The statement $\sim p \wedge \sim q$ is equivalent to

A John is neither tall nor fat

B John is not tall but fat

C It is not true that John is tall or not fat

D John is not tall or not fat

34. The statement $\sim (p \wedge q)$ is the same as

A $\sim p \wedge \sim q$

B $\sim p \wedge q$

C $p \vee \sim q$

D $\sim p \vee \sim q$

35. Given that $\begin{vmatrix}1&2&-2\\2&1&3\\3&2&-4\end{vmatrix}=d$, then

$\begin{vmatrix}1&6&-8\\2&3&12\\3&6&-16\end{vmatrix}=$

A $7d$

B $72d$

C $12d$

D $12d^2$

SECTION B: MECHANICS

36. To a lady riding at a velocity of $(\mathbf{i}+2\mathbf{j})$ m s^{-1}, the wind appears to be blowing at a velocity of $(-2\mathbf{i}+3\mathbf{j})$ m s^{-1}. The true velocity of the wind is

A $(-\mathbf{i}+5\mathbf{j})$ m s^{-1}

B $(-3\mathbf{i}+\mathbf{j})$ m s^{-1}

C $(3\mathbf{i}-\mathbf{j})$ m s^{-1}

D $(\mathbf{i}-5\mathbf{j})$ m s^{-1}

37. Events A and B are independent, with $P(A)=\frac{2}{3}$ and $P(A\cap B')=\frac{1}{2}$. $P(A\cap B)=$

A $\frac{1}{2}$

B $\frac{1}{3}$

C $\frac{1}{4}$

D $\frac{1}{6}$

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38. A particle of mass 2 kg slides down a plane inclined at 30^0 to the horizontal with an acceleration of $12.5ms^{-2}$. Taking g as $10ms^{-2}$, the coefficient of friction between the particle and the plane is

A $\frac{1}{8}$

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

C $\frac{\sqrt{3}}{6}$

D $\frac{\sqrt{3}}{8}$

39.

Fig 1

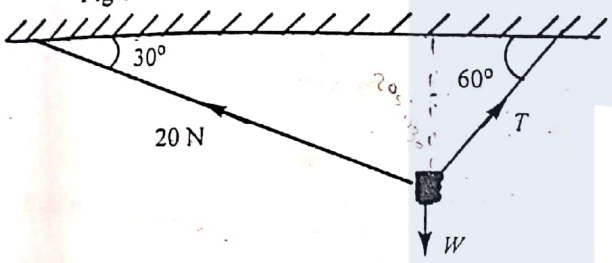

Fig 1. shows a block W suspended by two light inextensible strings which are inclined at 30^0 and 60^0 to the horizontal. The tensions in the strings, when the system rests in equilibrium, are 20 N and T. T =

A 20 N

B $20\sqrt{3}$ N

C $40\sqrt{2}$ N

D 40 N

0. The horizontal and vertical components of the initial velocity of a projectile are 4 m s^{-1} and 3 m s^{-1} respectively. Taking g as $10ms^{-2}$, the time taken by the particle to reach maximum height is

A 0.6

B 0.8

C 0.3

D 0.4

41. The x-coordinate of the centroid of the area in the first quadrant, bounded by the curve $y = x^2$, the x- axis and the line $x = 2$ is

A $\frac{2}{3}$

B $\frac{3}{2}$

C $\frac{6}{5}$

D $\frac{3}{4}$

42. A force F, where $\mathbf{F} = (2\mathbf{i} - 3\mathbf{j} + 2\mathbf{k})$ N moves a particle from a point A with position vector $\mathbf{r}_1$ to a point B with position vector $\mathbf{r}_2$, where
$\mathbf{r}_1 = (\mathbf{i} + 2\mathbf{j} + 3\mathbf{k})$ m,
$\mathbf{r}_2 = (3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k})$ m.
The work done in moving the particle from A to B is

A $2\sqrt{51}$ J

B $\frac{1}{\sqrt{51}}$ J

C 6 J

D 2 J

43. An elastic string, of natural length $2a$ and modulus of elasticity λ, is fixed at one end and a particle of mass $3m$ is attached to the other end. When the particle hangs freely in equilibrium the length of the string is $3a$.
λ =

A $9\,mg$

B $4\,mg$

C $6\,mg$

D $2\,mg$

44. The velocity vector $\mathbf{v}$ of a particle at time t seconds is given by
$\mathbf{v} = [(3t^2 - 1)\mathbf{i} + 2\mathbf{j}]$ m s^{-1}
When $t = 0$, the particle is at the origin. The position vector of the particle when $t = 2$ is

A $(6\mathbf{i} - 4\mathbf{j})$ m

B $(6\mathbf{i} + 4\mathbf{j})$ m

C $12\mathbf{i}$ m

D $(11\mathbf{i} - 2\mathbf{j})$ m

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45. A sphere impinges directly on an identical sphere which is initially at rest. The coefficient of restitution between the spheres is $\frac{1}{2}$. The ratio of the speeds of the spheres after impact is

A 1 : 2
B 1 : 1
C 1 : 3
D 3 : 4

46. The maximum speed of a lorry of mass 3000kg moving on a level road against a non-gravitational resistance of magnitude of 3200 N and working at a constant rate of 16 0,000 W is

A 500 ms^{-1}
B 50 ms^{-1}
C 5 ms^{-1}
D 150 ms^{-1}

47. The position vector of a particle moving on a plane at time t is r, where $\mathbf{r} = \left[\left(\frac{3}{2}t^2 - 2\right)\mathbf{i} + (2t^2 - 2)\mathbf{j} + t^3\mathbf{k}\right] m$. The acceleration of the particle when t = 1s is

A $(3\mathbf{i} + 4\mathbf{j} + 3\mathbf{k})ms^{-2}$
B $(4\mathbf{i} + 3\mathbf{j} + 6\mathbf{k})ms^{-2}$
C $6\mathbf{k}\ ms^{-2}$
D $(3\mathbf{i} + 4\mathbf{j} + 6\mathbf{k})ms^{-2}$

48. Particles of mass 2kg and 3kg are placed at the points with position vectors $(6i - j)m$ and $(i + 4j)m$ respectively. The position vector of their centre of mass is

A $(4i + j)m$
B $(3i + 2j)m$
C $(-4i + j)m$
D $(-3i - j)m$

49. The speed of car of mass 1200kg travelling in a straight line is reduced from 25 ms^{-1} to 5 ms^{-1} by a constant force acting for 4 s. The magnitude of the force is

A 7 500 N
B 1 500 N
C 6 000 N
D 9 000 N

50. The speed v ms^{-1} of a particle moving in a straight course at time t seconds is $v = 9t^2 - 8t - 6$. The distance travelled by the particle in the interval $2 \leq t \leq 6$ is

A 256 m
B 427 m
C 72 m
D 472 m

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