ENG169

UNIVERSITY OF GREATER MANCHESTER

SCHOOL OF ENGINEERING AND BUILT ENVIRONMENT

B.ENG (HONS) AUTOMOTIVE PERFORMANCE ENGINEERING

SEMESTER ONE EXAMINATION 2025/2026

ENGINEERING MATHEMATICS 1

MODULE NO: MSP4022

Date: Wednesday 14th January 2026 **Time: 2pm to 4pm**

INSTRUCTIONS TO CANDIDATES:

There are EIGHT (8) questions

Answer any FIVE (5) questions.

All questions carry equal marks.

Marks for parts of questions are shown in brackets.

Electronic calculators may be used provided that data and program storage memory is cleared prior to the examination.

CANDIDATES REQUIRE:

Formula Sheet (provided).

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Question 1

(a) In a motorsport parts warehouse, the following package deals are available for the following workshop tools:

Deal A: 2 sets of spanners, 3 sets of pliers, and 1 hammer cost **£16**.

Deal B: 1 spanner, 2 sets of pliers, and 3 sets of hammer cost **£19**.

Deal C: 4 sets of spanners, 1 plier, and 1 hammer cost **£18.**

Find the unit price of **Spanners**, **pliers**, and **hammers**.

(13 marks)

(b) Solve the following:

$$x - 37 = -7y$$

$$2x - 7y = -52$$

(7 marks)

Question 2

(a) The Impedance of a circuit is given by: $\boldsymbol{Z} = \sqrt{\boldsymbol{R^2} + \left(\propto \boldsymbol{L} + \frac{\boldsymbol{1}}{\propto \boldsymbol{C}}\right)^{\boldsymbol{3}}}$. Transpose the equation for **L**.

(10 marks)

(b) Solve the following quadratic equations by factorisation:

$$3x^2 + x - 2 = 0$$

(5 marks)

(c) Solve the following quadratic equations using the quadratic formula:

$$3x^2 + 9x + 2 = 0$$

(5 marks)

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Question 3

(a) Simplify the following

i. $15p^{-\frac{1}{3}} \times 2p^{-\frac{1}{2}}$ **(5 marks)**

ii. $\frac{(4xy^3)^2}{(2x)^3}$ **(5 marks)**

(b) Solve $\frac{1}{4}\log(x^8) - \log(2x-1) = \log(x^2) + \log(2)$ **(10 marks)**

Question 4

(a) The fourth term of a geometric sequence is 32 and the first term is 4.

i. What is the common ratio in the sequence?
ii. Find the 13th term of this sequence.

(10 marks)

(b) A Geometric sequence formula is given below.

$$X_n = 3\times\left(\frac{1}{5}\right)^n \text{ Where n} = 0,1,2,3,\ldots..$$

i. Simplify and write down the first four terms of this sequence.
ii. What is the sum of the first five terms of this sequence?

(10 marks)

Question 5

(a) Using Pascal's triangle, expand and simplify

i. $(2x+y)^4$ **(7 marks)**

ii. $(p-3q)^4$ **(8 marks)**

(b) Simplify $\left(\frac{\mathbf{64}}{\mathbf{49}}\right)^{-\frac{3}{2}}$ **(5 marks)**

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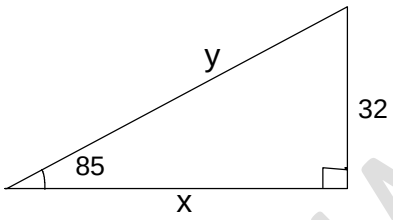
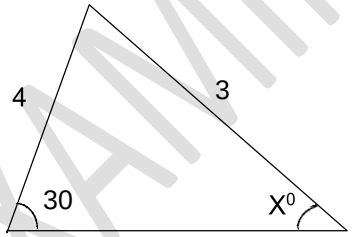
Question 6

(a) For the right-angled triangle below, use trigonometry to calculate the lengths *x* and *y* of the sides indicated:



(8 marks)

(b) Find the angle x^0 indicated in the following triangle:



(12 marks)

Question 7

Differentiate the following functions;

i. $y = t^4 - 2t^3 + 17t - 3$ **(5 marks)**

ii. $y = cos\ x^3$ **(8 marks)**

iii. $y = \frac{e^{3x}}{3x-4}$ **(7 marks)**

Question 8

Evaluate the following integrals:

i. $\int_1^4 (12x^3 - 6x^2 + 8x)dx$ **(13 marks)**

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ii. Integrate $\int (y^2 + 24y^5)\, dy$ **(7 marks)**

END OF QUESTIONS

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FORMULA SHEET

Cosine rule

$$a^2 = b^2 + c^2 - 2bc\cos(A) \quad or \quad \cos(A) = \frac{b^2 + c^2 - a^2}{2bc}$$

$$b^2 = a^2 + c^2 - 2ac\cos(B) \quad or \quad \cos(B) = \frac{a^2 + c^2 - b^2}{2ac}$$

$$c^2 = b^2 + a^2 - 2bc\cos(C) \quad or \quad \cos(C) = \frac{a^2 + b^2 - c^2}{2ab}$$

Sine Formula

$$\frac{\sin(A)}{a} = \frac{\sin(B)}{b} = \frac{\sin(C)}{c}$$

Sum of Arithmetic series with last term	$S_n = \frac{n}{2}(a + l)$
Arithmetic series	$a + (n-1)d$
Sum of Geometric series (infinite series)	$S_\infty = \frac{a}{(1-r)}$
Sum of Arithmetic series	$S_n = \frac{n}{2}(2a + (n-1)d)$
Geometric series	$a_n = ar^{n-1}$

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Sum of Geometric series	$$S_n = \frac{a(r^n - 1)}{(r - 1)}$$

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$$\log_a(xy) = \log_a x + \log_a y$$ $$\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$$ $$\log_a(x)^n = n\log_a(x)$$	***Quadratic Formula*** $$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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$$\log_a(x) = \frac{\log_b(x)}{\log_b a}$$

$$\log_a a = 1$$

$$\log_a 1 = 0$$

Chain Rule of differentiation

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{d}{d}$$

Product Rule of differentiation

$$\frac{d(uv)}{dx} = u\frac{dv}{dx} +$$

Quotient Rule of differentiation

$$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{av}{dx}}{v^2}$$

Function	Indefinite Integral
$\int a\,dx$	$ax + C$
$\int x\,dx$	$x^2 / 2 + C$
$\int 1/x\,dx$	$\ln x + C$
$\int x^2\,dx$	$x^3 / 3 + C$
$\int \sin(x)\,dx$	$-\cos(x) + C$
$\int \cos(x)\,dx$	$\sin(x) + C$
$\int \sec^2(x)\,dx$	$\tan(x) + C$
$\int e^x\,dx$	$e^x + C$

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