



FACULTY OF SCIENCE

SM	
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DEPARTMENT OF MATHEMATICS AND APPLIED MATHEMATICS

BACHELOR OF CONSTRUCTION & BEng Tech MINING ENGINEERING

MODULE CODE: MATM1B1
COURSE: MEASUREMENT MATHEMATICS 1B
CAMPUS: DFC
ASSESSMENT: NOVEMBER EXAMINATION

DATE: 10 NOVEMBER 2021

DURATION: 3 HOURS (08:30 – 11:30)

ASSESSOR: MR T. PAEPAE

INTERNAL MODERATOR: MR E.Z. MORAPELI

MARKS: 50

NUMBER OF PAGES: 4 PAGES (INCLUDING FRONT PAGE AND ONLINE INSTRUCTIONS)

ONLINE INSTRUCTIONS:

- Write your student number, surname, and initials on all pages.
- Use either blue or black pen.
- Non-programmable scientific calculators are allowed.
- The complete solutions must be in your own handwriting.
- All pages must be together, in sequential order, and please number the pages.
- Scan your work and save this as a pdf file on your device.
- Submit this as one pdf file on Blackboard. **No submissions via e-mail. If you upload the wrong file, a corrupt file, or no file, the exam cannot be marked, and you will get zero.** You have three submission opportunities before the deadline.
- No late submission will be accepted. Thus, no submissions after 11:30.

ASSIGNMENT SUBMISSION

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When finished, make sure that you click **Submit**.
Optionally, click **Save as Draft** to save changes and continue working later or click **Cancel** to quit without saving changes.
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SECTION A: Short Answer Questions**[Total 10]**

GIVE ONLY THE FINAL SIMPLIFIED ANSWER. WHERE APPLICABLE, GIVE NUMERICAL ANSWERS CORRECT TO THREE DECIMAL PLACES.

QUESTION 1

If $f(-1) = 2$ and $f'(-1) = -2$, find $\frac{d}{dx}[x^3 f(x)]$ when $x = -1$. (2)

QUESTION 2

Given $z = \ln(x^3 + y^2)$, find $\frac{\partial^2 z}{\partial x \partial y}$ (2)

QUESTION 3

Find $\frac{dy}{dx}$ if $\sin(x^2 y^2) = x$ (2)

QUESTION 4

Find the integral $\int \frac{x^2}{x^2 - 1} dx$ (2)

QUESTION 5

Integrate $\int \sin 5x \cos 8x dx$ (2)

SECTION B: Long Answer Questions**[Total 40]**

SHOW ALL THE STEPS TAKEN. GIVE ANSWERS IN SIMPLIFIED FORM. WHERE APPLICABLE, GIVE NUMERICAL ANSWERS CORRECT TO THREE DECIMAL PLACES.

QUESTION 6

Find $\frac{dy}{dx}$ if $y = \frac{\log x}{e^{\sqrt{x}} \cdot (\tan^{-1} x)^x}$. (5)

QUESTION 7

Given the parametric equations $x = e^{3t} - 5t$, $y = e^t - 2t$.

7.1 Find $\frac{dy}{dx}$. (3)

7.2 Find the value(s) of t for which the curve has a horizontal tangent line. (2)

QUESTION 8

Given $\tanh^{-1}(xy) = xy$, find $\frac{d^2 y}{dx^2}$. (5)

QUESTION 9

The volume of a spherical cap is given by $V = \frac{1}{3}\pi h^2(3r - h)$, where r is the radius and h is the height of the cap in meters.

Calculate the rate of change of volume, V , if the radius increases at 0.4cm/s and the height decreases at 0.5cm/s, at the instance when $r = 8$ cm and $h = 12$ cm. (5)

QUESTION 10

Evaluate $\int_1^2 \cosh^{-1} x \, dx$ (5)

QUESTION 11

Integrate $\int \frac{1}{\sqrt{(x^2+16)^3}} \, dx$ (5)

QUESTION 12

Find the integral $\int \frac{7x^2+5x+13}{(x+1)(x^2+2)} \, dx$ (5)

QUESTION 13

Integrate $\int \frac{2x+3}{4x^2+4x+5} \, dx$ (5)