الجامعة الوطنية
National University
Science & Technology للعلوم والتكنولوجيا
كلية عمان البحرية الدولية
International Maritime College Oman

Final Exam
PMATH-I.II: ARITHMATICS-II
Spring 2026

Points of attention:

- For each question, the maximum earned points are specified in the question.
- Write clearly! Answers that are not readable are not marked and don't earn marks!
- All answers should be written in English using **blue or black pens** only.
- Use the pencil only for diagrams and graphs.
- Show all the calculation steps in the given space.
- When finished, submit the question paper, together with the answer scripts and the signed cover page to the invigilator.
- Any cheating/copying may result in an instant failing of the examination.

Exam Duration: 2.5 hours
Instructor's Name: Muhammad Javed
Exam Date: 14/05/2026
Program: LTM

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Student Information

Name: ID:

Signature:

Invigilator

Initials: ☐ Student ID checked

Time received:

Question 1 **[5 marks]**

The cost function for producing $q$units of a product is given by

$$c = 0.4q^2 + 3.2q + 11$$

a. Determine the rate of change of cost with respect to quantity, $\frac{dc}{dq}$. (2 marks)

b. Determine the relative rate of change of cost with respect to q. (2 mark)

c. Find the value of this rate of change when $q = 20$. (1 mark)

Question 2 **[6 marks]**

A logistics manager uses the following model to estimate the total storage and transportation cost of raw materials required for a production process:

$$f(x) = 60\left(150 + 8x + \frac{180}{x}\right), \quad 3 \leq x \leq 75$$

Where $f(x)$ is the total cost (in dollars) over the planned period, x represents the number of tons of material shipped per delivery, and a shipment of x tons is delivered every x days.

a. Compute the total cost when $x = 3$. (1 mark)
b. Determine the value of x that minimizes the total cost. (3 marks)
c. Calculate the minimum total cost. (2 marks)

Question 3 **[5 marks]**

A logistics company distributes packaged goods, and the unit price depends on the shipment volume. The price–demand relationship is given by

$$p = \frac{1200}{q + 10}$$

Where $p$is the price per unit (in dollars), and $q$is the number of units shipped.

a. Determine the marginal revenue function. (2 marks)

b. Evaluate the marginal revenue when the shipment volume is $q = 50$ units.

(3 marks)

Question 4 **[8 marks]**

Evaluate the following

a. Determine the derivative of

$$g(x) = (x^2 - 1)(3x^3 - 6x^2 + 5x)$$ (3 marks)

b. Find the anti-derivative of

$$f(y) = y^4(y^2 - \sqrt{7}y - \frac{1}{\sqrt{y}})$$ (3 marks)

c. Determine the integral (2 marks)

$$\int_{-1}^{2} (1 - 5x)dx$$

Question 5 **[5 marks]**

A logistics company distributes consumer goods to regional warehouses. The company's marginal revenue (in dollars) from distributing $q$units of a product per week is modeled by;

$$\frac{dr}{dq} = 1500 - 30q - 2q^2$$

where r is the total revenue, and q is the number of units distributed.

a. Determine the total revenue function, $r(q)$. (3 marks)

b. Hence, find the demand (price) function, assuming that the total revenue is zero when no units are distributed. (2 marks)

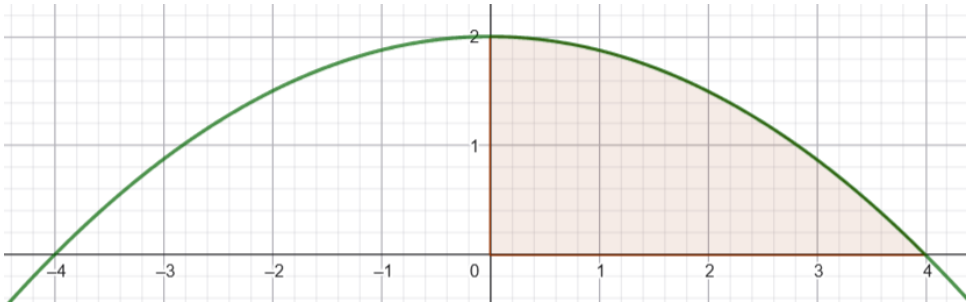
Question 6 **[5 marks]**

Find the **area of the region in the first quadrant** bounded by the curve $f(x)$, the line $x = 0$ and the line $y = 0,$ where the length of the lines are in centimeters.

a. Write down the **definite integral** that represents the area of the region**.** (2 marks)

b. Evaluate the integral and hence find the area of the region. (3 marks)

$$f(x) = 2 - \frac{1}{8}x^2$$



Question 7 **[6 marks]**

The region is bounded by the curve $y = x^2 - x - 2$ and the line $y = 0$, where x and y are measured in meters.

a. Write down the definite integral that represents the area of the region bounded by the curve and the line $y = 0$. (3 marks)

b. Evaluate the integral to find the area of the bounded region, round the answer to one decimal place. (3 marks)

MLO and Bloom's Level of Complexity

Q #	MLO Addressed	Complexity Level	Mark	Remark
1	2	Apply	5	Real-life logistics
2	2	Apply	6	Optimization in logistics
3	1 and 3	Analyze	5	Marginal cost & relative rate of change
4	1	Apply	8	Derivatives, anti-derivatives, definite integral
5	2	Apply	5	Integration with initial condition
6	2	Apply	5	Area under curve (first quadrant)
7	2 and 4	Evaluate	6	Area between two curves

References

JR, E. F. H., 2019. *Introductory Mathematical Analysis*. 14 ed. Ontario: Pearson.