



University of Fort Hare

AMB121F

Degree Examinations: November 2018

Subject: Mathematics
Paper: Business Mathematics

Time: 3 Hours

Marks: 100

Subminimum: 40

This question paper consists of 4 pages

Internal examiner(s)

Prof B B Makamba
Mr Z Mahlasela

External examiner(s)

Instructions

Answer **FIVE(5)** questions. Symbols used have the usual meanings.

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Question One

- 1.1 Suppose in the parallelogram ABCD, with AD parallel to BC, AE is drawn perpendicular to BC. The length of BE = 2 cm, AE = 3 cm and diagonal AC = 9 cm. Compute the area and the perimeter of the parallelogram. (4)
- 1.2 Trapezium ABCD has AE perpendicular to BC and $AD \parallel BC$, BE = 4,5 cm, AD = 12 cm, AB = 8 cm and DC = 7 cm. Compute the area and the perimeter of the trapezium. (6)
- 1.3 A closed right circular cylinder has a height of 8 cm and its volume is 960 cm^3 . Compute its surface area. (5)
- 1.4 A right circular cone of vertical height 20 cm has base radius of 4 cm. Compute its volume and its surface area accurate to two decimal places. (5)
- 1.5 In $\triangle ABC$, AC = 6 cm and CD is drawn perpendicular to AB with length of CD = 4cm and BD = 6.5 cm. Compute the area and the perimeter of $\triangle ABC$. (5)

[25]

Question Two

- 2.1 Determine the values of x and y if $(-2, y)$ is the midpoint of the line segment joining $(-5, 1)$ and $(x, 6)$. (3)
- 2.2 Find the value of y for which $M(2, 3)$ and $N(-1, y)$ are equidistant from $P(-3, 4)$. (3)
- 2.3 Find the equation of the circle that passes through $(-2, 3)$ and $(4, -5)$ with its centre on the line $x - y = 2$. (8)
- 2.4 If the line $x + y = 1$ cuts the circle $x^2 + y^2 = 25$ at A and B, (a) find the coordinates of A and B; (b) find the length of the chord AB; (c) find the midpoint M of the chord AB; (d) show that $OM \perp AB$ where O is the origin; (e) show that T(3, -4) lies on the circle; (f) find the slope of OT; (g) find the equation of the tangent to the circle at T. Illustrate with a diagram. (10)
- [24]

Question Three

- 3.1 If $\tan x = 3/4$, $90^\circ \leq x \leq 360^\circ$, find, without using a calculator
(i) $\sin 2x$
(ii) $\cos 2x$. (6)
- 3.2 Evaluate without using a calculator:
(a) $\cos(75^\circ)$ (3)
(b) $\sec(-675)^\circ$ (3)
- 3.3 Solve (find a general solution of) $2 \sin 2x - 1 = 0$, without using a calculator. (2)
- 3.4 Solve, without using a calculator, $\sin x = \cos 54^\circ$. (2)
- 3.5 Find the period and the amplitude of the function $y = 3 \cos(-2x)$ and then draw the graph of this function (4)
- 3.6 Find $\lim_{x \rightarrow 5} \frac{3x^2 - 14x - 5}{x - 5}$. (3)

3.7 Find $\lim_{x \rightarrow -1} \frac{x^3+1}{x+1}$. (3)
(26)

Question Four

4.1 Find $f'(x)$ from first principles (definition) if $f(x) = \frac{3}{2x-1}$. (4)

4.2 Find the equations of the tangent and the normal to the curve $y = 4\sqrt{x^5} - 3/x^3 + x$ at $x = 1$. (5)

4.3 Discuss and draw the graph of the equation $y = x^3 - 5x^2 - 2x + 24$, showing the turning points, local maxima and minima, points of inflection, regions of decrease and increase. (8)

4.4 A sheet of cardboard measures 40 cm by 25 cm. Square corners of side x cm each are cut out, then the sheet is folded to form a box. Find the dimensions of the box so that its volume is a maximum. (5)
[22]

Question Five

5.1 A cylindrical can (with top and bottom) has fixed volume V . Discuss the dimensions of the can that give the minimum external surface area of the can. (5)

5.2 The height attained by a shell, fired vertically upwards, is given by $s = 5t + 45t^2 - 10t^3$, (s in meters and t in seconds).
(a) What is the velocity at which the shell is fired?
(b) Find the maximum height reached by the shell.
(c) How long will the shell be in the air?
(d) Find the total distance travelled by the shell.
(e) Compute the acceleration of the shell and interpret your result for the case $t = 5$ sec. (7)

5.3 A small aircraft company handles flights to a holiday island. The return fares are R200 first class and R150 tourist class. A first class passenger is allowed 30 kg of baggage and tourist class 20 kg. Only 900 kg of

baggage can be carried altogether and the aircraft has 40 passenger seats. Use linear programming techniques (inequalities and linear graphs) to compute: (a) How many passengers of each class should be carried for maximum income

(b) What is the maximum income per round trip? (8)

5.4 Solve the following system of equations using Row reduction (elementary row operations) on the augmented matrix:

$$\begin{aligned} 2x + y - z &= 2 \\ x - y + z &= 7 \end{aligned} \quad (6)$$

$$2x + 2y + z = 4 \quad [26]$$

Question Six

6.1 A furniture factory makes two types of spice rack. It takes 20, 10 and 10 minutes to cut, assemble and finish type A respectively; and 10, 20 and 60 minutes to cut, assemble and finish type B respectively. An economical production run requires at least 8 hours in the cutting department, at least 10 hours in the assembly department and at least 18 hours in the finishing department. If the materials for a type A rack cost R1.50, and for a type B rack cost R4, 50, how many racks of each type should be scheduled for minimum cost? What is the minimum cost? [Hint: First let x be the number of Type A racks and y be the number of Type B racks produced per day. Then write inequalities that determine the feasibility region. Draw the corresponding graph and use a search line to complete the process.] (10)

6.2 Express the following system in matrix form and then solve it using the

$$\begin{aligned} x + y + z &= 2 \\ \text{inverse of the coefficient matrix: } 2x - y + z &= 0 \\ x + 2y - z &= 4 \end{aligned} \quad (8)$$

6.3 Solve the following system of equations using Cramer's Rule :

$$\begin{aligned} 2x + y - z &= 2 \\ x - y + z &= 7 \end{aligned} \quad (6)$$

$$2x + 2y + z = 4 \quad [24]$$