University of Fort Hare

AMB121F

Supplementary Examinations: January 2019

Subject: Mathematics
Paper: Business Mathematics

Time: 3 Hours Marks: 100 Subminimum: 40

This question paper consists of 4 pages

Internal examiner(s)

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External examiner(s)

Instructions

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

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Mathematics Supplementary Exams January 2019

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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, AB = 6 cm and diagonal AC = 10 cm. Compute the area and the perimeter of the parallelogram. (4)

1.2 Trapezium ABCD has AE perpendicular to BC and $AD \parallel BC$, AE = 5 cm, AD = 10 cm, AB = 7 cm and DC = 8 cm. Compute the area and the perimeter of the trapezium. (8)

1.3 A closed right circular cylinder has a base radius of 3 cm and its surface area is 960 cm^2. Compute its volume. (6)

1.4 A right circular cone of slant height 15 cm has base radius of 3 cm. Compute its volume and its surface area accurate to two decimal places. (6)

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Question Two

2.1 Determine the values of x and y if $(x, 2)$ is the midpoint of the line segment joining $(-2, y)$ and $(4, -2)$. (3)

2.2 Find the value of x for which $M(-5,-2)$ and $N(x,-4)$ are equidistant from $P(3,5)$. (3)

2.3 Find the equation of the circle that passes through $(2,3)$ and $(-4,-5)$ with its centre on the line $x+y=1$. (7)

2.4 If the line $x-y=1$ cuts the circle $x^2+y^2=13$ 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 , 2) 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)

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Question Three

3.1 Find a general solution of the equation $5\cos^2 x + \sin x = 1$. (5)

3.2 Solve, without using a calculator, cos x = sin 36^o. (2)

3.3 Evaluate, without using a calculator, sin 105^o cos 165^o. (3)

3.4 Find the period and the amplitude of the function $y = 2\sin(-3x)$ and then draw the graph of this function (5)

3.5 Find (a) $\lim_{x\to 2^+} \frac{6-3x}{|x-2|}$; (b) $\lim_{x\to 2} \frac{3x^2-5x-2}{x-2}$. (6)

3.6 Find $\lim_{x\to 3} \frac{x^3-27}{x-3}$. (3)

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Question Four

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

4.2 Find the equations of the tangent and the normal to the curve $y = 3x^5 - 3/\sqrt{x^3} + 2$ at $x=1$. (5)

4.3 ABC is a triangle having $AC = 13$ cm; $BC = 8$ cm; and $AB = 9$ cm. D is a point on AC so that $\angle DBA = 54^o$. Calculate $\angle A$ and side DB. (7)

4.4 Discuss and draw the graph of the equation $y = -x^3+4x^2+12x$, showing the turning points, local maxima and minima, points of inflection, regions of decrease and increase . (8)

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Question Five

ALL SOLUTIONS MUST BE WELL MOTIVATED. No marks will be awarded for answers having no motivation

5.1 Calculate the area of $\triangle ABC$ if $AC = 12$ m; $AB = 7$ m and $\angle C = 26^o$. (6)

5.2 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)

5.3 A firm manufacturing concrete asbestos products wishes to wall-in $200m^2$ exhibition space in the form of a rectangular plot bordering on a road. If the cost of the ornamental walling along the road is treble that along the other three sides, find the dimensions of the display area which will cost the company the least. (6)

5.4 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)

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Question Six

6.1 The height attained by a shell, fired vertically upwards, is given by $s = 20t - 3t^2$ (s in metres; 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) Find the acceleration of the shell and interprete your result. (6)

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

$$\begin{array}{rcrcrcl} 2x & + & y & - & z & = & 2 \\ x & - & y & + & z & = & 7\,. \\ 2x & + & 2y & + & z & = & 4 \end{array}$$ (6)

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

$$\begin{array}{rcrcrcl} 2x & + & y & - & z & = & 2 \\ x & - & y & + & z & = & 7\,. \\ 2x & + & 2y & + & z & = & 4 \end{array}$$ (6)

6.4 Find the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 2 & -1 & 1 \\ 1 & 2 & -1 \end{bmatrix}$. (5)

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