GWANDA STATE UNIVERSITY

SMS 1204

FACULTY OF COMPUTATIONAL SCIENCES

DEPARTMENTS OF APPLIED MATHEMATICS

GEOMETRY

EPOCH MINE CAMPUS: FILABUSI

Mr M NDLOVU

JUNE 2024: EXAMINATION PAPER
Time : 2 $\frac{1}{2}$ hours

Candidates should attempt **ALL** questions from **Section A** (40 marks) and **ANY THREE** questions from **Section B** (20 marks each).

Instruments and Materials

- Calculator.

SECTION A: Answer ALL questions [40].

A1. In geometry, define the following terms:

(a) Line [2]

(b) Angle [2]

(c) Surface [2]

(d) Torus [2]

(e) Theorem [2]

A2. The following table shows algebraic properties of equality of $a, b, c \in \mathbb{R}$

Property	Mathematical Statement
_____ :	If $a = b$, then a ___ $c = b + c$.
_____ :	If $a = b$, then $a - c = b - c$.
_____ :	If $a = b$, then $a \cdot c = b \cdot c$.
Division Property :	If $a = b$ and c ___ , then $\frac{a}{c} = \frac{b}{c}$.
Reflexive Property:	_____
_____ :	If $a = b$, then $b = a$
_____ :	$a(b + c) =$ _____ .
Substitution Property:	If $a = b$, replacing a & b in *eqns*.
Transitive Property:	If $a = b$ and $b = c$, then ____.

Complete the missing parts of this table. [10]

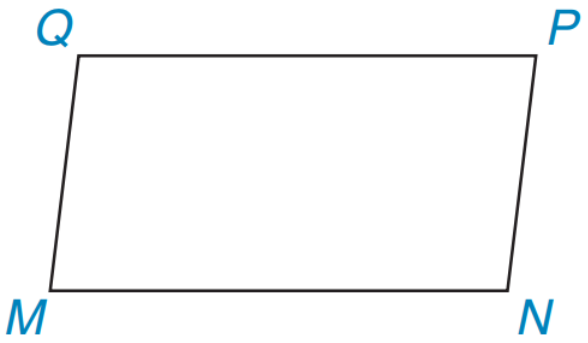
A3. (a) Define symmetry. [2]

(b) State any three types of symmetries. [3]

(c) Geometry in the real world, describe the types of symmetry displayed by this logo:

[5]

A4. (a) In $MNPQ$ $m\angle M = 2(x + 10)$ and $m\angle Q = 3x - 10$. Determine which diagonal



would be longer, $\overline{QN}$ or $\overline{MP}$? [5]

(b) Show that the distance between two points (x_1, y_1) and (x_2, y_2) is given by the formula

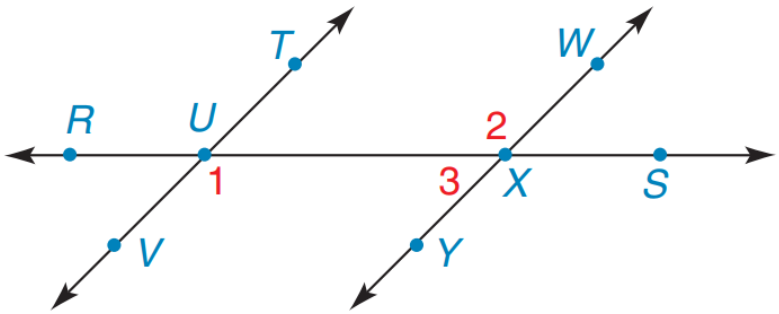
$$d = \sqrt{(x_2 - x_1)2 + (y_2 - y_1)^2}.$$

[5]

SECTION B: Answer ANY three questions [60].

B5. (a) What is the sum of supplementary angles? [2]

(b) **Given:** $\overline{TV} \parallel \overline{WY}$ with transversal $\overline{RS}$



Prove: $\angle 1$ and $\angle 3$ are supplementary. [14]

(c) Write down the theorem corresponding to the information given in (b). [4]

B6. (a) If 0-simplices are points, what are 1-simplices and 2-simplices ? [2]

(b) Draw a simplicial square with two-dimensional simplicial complexes and answer the following questions:

(i) How many 0-simplices, 1-simplices and 2-simplices are in a simplicial square? [3]

(ii) Write down these simpleces. [5]

(iii) If M is a simplicial square compute the *Euler number* given by $\chi(M)$. [4]

(iv) Compute the surface genus g of a simplicial square. [4]

(v) Intepret the your result in (iv). [2]

B7. (a) A regular tetrahedron is a regular triangular pyramid in which all faces (lateral faces and base) are congruent. If each edge has length e,

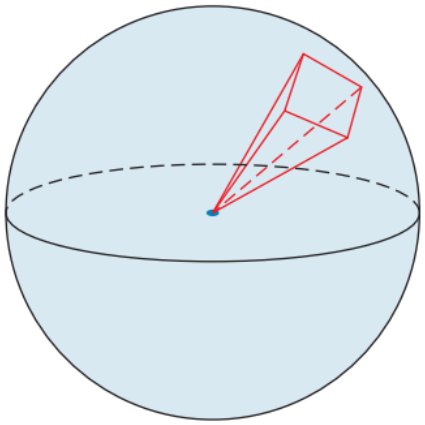
(i) Draw the pictorial view of this pyramid. [2]

(ii) Show that the area of each face is $A = \dfrac{\sqrt{3}e^2}{4}$. [2]

(iii) Show that the total area of the tetrahedron is $T = \sqrt{3}e^2$. [2]

(iv) Find the total area if each side measures $e = 5$. [2]

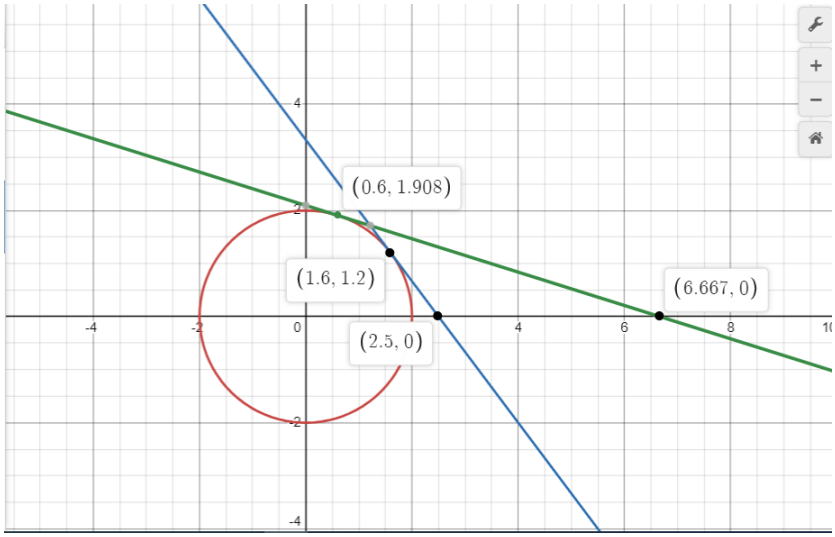
(b) A sphere is the surface that represents the theoretical limit of an "inscribed" regular polyhedron whose number of faces increases without limit.



Using this characterization of the sphere show that the volume $V = \frac{4}{3}\pi r^3$. [12]

B8. (a) Define a projection map. [2]

(b) Given the following diagram:



(i) State the equation of S^1. [2]

(ii) Write the projection maps represented by the two lines. [6]

(iii) For this case, the projection map is defined by $p : \mathbb{R}^2 \to \mathbb{R}$. Considering the information provided in the diagram, state the domain and range of all the projection maps in general. [4]

(c) In your own words together with an aid of a diagram, Explain this mapping $i : S^1 \hookrightarrow S^2$. [6]

END OF QUESTION PAPER

"*Do not worry about your difficulties in mathematics. I can assure you mine are still greater.*"– Albert Einstein