THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

ENTRANCE EXAMINATIONS – 2017

MA003 – ENGINEERING MATHEMATICS

For candidates applying for Applied Physics, Computer Science, Electrical Engineering, Mechanical Engineering, Civil Engineering, Mining Engineering, and Mineral Processing Engineering.

TIME ALLOWED: 2 HOURS

INFORMATION FOR CANDIDATES

1. Print and sign your name below, and tick a box to indicate the type of course for which you are applying.
2. All answers must be written in this booklet.
3. Show your workings where required.
4. Do not use red ink or pencil to write this exam.
5. **Calculators are allowed in the examination room.**

Surname: _____ First name: _____

Signature: _____ Date: _____ Venue: _____

Tick the type of course for which you are applying.

[ ] Applied Physics
[ ] Computer Science
[ ] Electrical Engineering
[ ] Mechanical Engineering
[ ] Civil Engineering
[ ] Mining Engineering
[ ] Mineral Processing Engineering

SECTION A: Short Answer Questions

Write the correct answer in the spaces provided on the far right for each question. Each part is worth 2 marks.

1. Convert 2.5 kilometers into millimeters, writing your final answer in standard scientific notations. **Ans:** _____

2. Completely factorize $8x^2 - 34x + 21$. **Ans:** _____

3. Solve $\frac{1}{6x} + \frac{1}{3x} = \frac{1}{3}$. **Ans:** _____

4. Given the equation $t = 2\sqrt{\frac{x^2 + y^2}{wy}}$, solve for x. **Ans:** _____

5. If $\frac{4}{16^{y-2}} \times \left(\frac{1}{4}\right)^{y} = 64^{-2y-1}$, find the value for y. **Ans:** _____

6. The equation of a straight-line PQ is expressed in the form $y = mx + c$. Given that P is the point $(0,4)$ and the gradient of PQ is 5. Solve for $f(-3)$. **Ans:** _____

7. Kambiri is a university student. He has budgeted K420 for incidental expenses. After 3 weeks, he finds that he has spent K50. If he continues to spend at the same rate, how long (in weeks) will his money last? **Ans:** _____

8. Calculate the smallest angle of a right-angled triangle if its shorter sides are 50 cm and 60 cm. **Ans:** _____

9. Find $w = \frac{kmn(k+m+n)}{(k+m)(k+n)}$ if $k = \frac{1}{2}$, $m = -\frac{1}{3}$, $n = \frac{1}{4}$. **Ans:** _____

10. An aircraft carries fuel in three tanks whose capacities are in the ratio 3:4:5. The capacity of the smallest tank is 720 litres. Calculate the capacity of the largest tank. **Ans:** _____

11. Convert 47000 millimeter into kilometers. **Ans:** _____

12. If $A=\{2,4,6,8,10\}$, $B=\{1,2,3,4,5\}$ and $C=\{2,5,6,8\}$; determine $A\cap(B\cap C)$.

Ans: _____

13. Find the minimum value of the curve $y=3x^2+2x-3$. **Ans:** _____

14. An isosceles triangle has equal sides of 6cm long and a base of 4cm long. Calculate the area of this triangle. **Ans:** _____

15. Given the equation $\log x^4-\log 100=1$, solve for x. **Ans:** _____

SECTION B: Workings required

Show workings for each question and write your final answer in the spaces provided on the far right for each question. Each part is worth 3 marks.

1. Solve the equation $\frac{1}{x-2}-\frac{1}{x^2-4}=\frac{4}{5}$. **Ans:** _____

2. Given that the scale of a map is 1:1000.

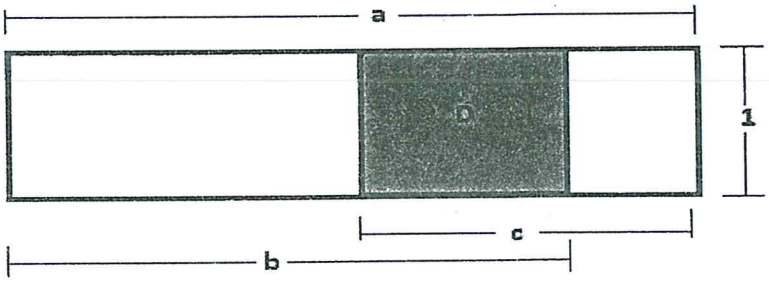
a) What are the actual dimensions of a rectangle which appears as 4cm by 3cm on the map?

Ans: _____

b) What is the actual area in cm^2? **Ans:** _____

c) What is the actual area in m^2? **Ans:** _____

3. Use the figure below to calculate the shaded region **D** when **a**=12.1, **b**=8.2 and **c**=8.



Ans: _____

4. A rectangular room is 4 metres wider than it is high and it is 8 metres longer than it is wide. The total area of the walls is 512 square metres. Find the width of the room.

Ans: _____

5. Answer the following questions;

   a) Find the slope of the curve $f(x)=\sqrt{x-1}$ at the point $x=5$. **Ans:** _____

   b) Suppose the population of a town grows according to the equation $y=100t-t^2$, find the rate of growth at the time, $t=100$ years. **Ans:** _____

6. **B** is a point due east of a point **A** on the coast. **C** is another point on the coast and is 6 km due south of **A**. The distance **BC** is 7 km. calculate the bearing of **C** from **B**.

Ans: _____

7. A soccer player is 12 meters from one goal post and 15 meters from the other. The goal mouth is 8 meters wide. If he shoots for goal along the ground, within what angle must he direct the ball in order to have a chance of scoring? **Ans:** _____

8. The distance **d** through which a stone falls from rest is proportional to the square of the time taken **t**. If the stone falls 45 meters in 3 seconds,
   a) How far will it fall in 6 seconds? **Ans:** _____

   b) How long will it take to fall 20 meters? **Ans:** _____

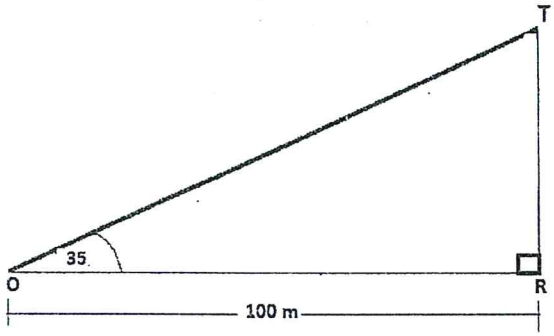
9. A tortoise makes a journey in two parts; it can either walk at 2 meters per minute or it can crawl at 1 meter per minute. If the tortoise walks the first part and crawls the second part, the journey takes 110 minutes. If it crawls the first part and walks the second part, the journey takes 100 minutes. Letting x meters be the length of first part and y meters be the length of the second part, find the lengths of the two parts of the journey. **Ans:** _____

10. Solve the following

a) Find the value of $\tan^2 60^0 + \sin^2 60^0$. **Ans:** _____

b) If angle A is acute and $2\sin^2 A - \frac{1}{3} = \cos^2 A$, find A. **Ans:** _____

11. The figure below shows a tower **TR** and an observer at **O**. From **O** which is 100 meters from the base **R** of the tower **TR**, the angle of elevation of the top of the tower is found to be 35°. Answer the following questions.



a) The observer walks forward towards the tower until the angle of elevation of the top **T** is 45°. How far does he walk forward? **Ans:** _____

b) Find the distance of the observer from the base of the tower when the angle of elevation of the top is 65°. **Ans:** _____