THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

ENTRANCE EXAMINATIONS – 2015

MA003 – ENGINEERING MATHEMATICS

For candidates applying for Applied Physics/Radio Therapy, Mathematics & 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: _____

Tick the type of course for which you are applying.

[ ] Applied Physics/Radio Therapy
[ ] Mathematics & 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 3 marks.

1. Find the value of n if $\left(1\frac{1}{3}\right)^n - \left(1\frac{1}{3}\right) = \frac{28}{27}$. Ans:_____

2. A formula used by optician is: $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$. Given that $u = 3$ and $v = 5\frac{1}{2}$, find the *exact* value of f. Ans: _____

3. Given that $a = \frac{3}{4}$, $b = \frac{2}{5}$ and $c = \frac{1}{3}$. Work out.

   (a) $\frac{1}{a+b}$ Ans: _____

   (b) $\frac{b}{c}$ Ans: _____

   (c) $\frac{1}{b} - \frac{1}{a}$ Ans: _____

   (d) $\frac{b}{ac}$ Ans: _____

4. Solve the following equation for the unknowns.

   (a) $3^{x-1} = \sqrt{3}$ Ans: _____

   (b) $11^{2t-1} = \frac{1}{121}$ Ans: _____

SECTION B: Multiple Choice Questions

Circle the correct choice for each question. Each part is worth 3 marks.

1. A cylinder is $\frac{1}{4}$ full of water. After 60 mls of water is added, the cylinder is $\frac{2}{3}$ full. Calculate the total volume of the cylinder.
   A. 144 mls B. 411 mls C. 104 mls D. 134 mls

2. A rubber ball is dropped from a height of 300 cm. After each bunch, the ball rises to $\frac{4}{5}$ of its previous height. How high to the nearest cm, will it rise after the fourth bunch?
   A. 102 cm B. 132 cm C. 123 cm D. 213 cm

3. Kambiri Pendepo spends his income as follows:
   - $\frac{2}{5}$ of his income goes in tax.
   - $\frac{2}{3}$ of what is left goes on food, rent and transport.
   - He spends the rest on cigarettes, beer and betting.

   What fraction of his income is spent on cigarettes, beer and betting?

   A. $\frac{1}{4}$ B. $\frac{1}{5}$ C. $\frac{4}{15}$ D. $\frac{16}{15}$

4. A new car is valued at K15000. At the end of each year, its value is reduced by 15% of its value at start of the year. What will be the value of the car at the end of third year?
   A. K9211.88 B. K9281.36 C. K7982.16 D. K8993.38

5. Over a period of 6 months, a colony of rabbits increase in number by 25% and then by a further 30%. If there were originally 200 rabbits in the colony, how many were there at the end?
   A. 235 B. 325 C. 225 D. 315

6. A train leaves Paris at 15:24 and arrives in Milan at 19:44. A new train will cut 20% off the journey time. At what time will the 15:24 train now arrives in Milan?
   A. 19:44 B. 21:51 C. 18:52 D. 16:48

SECTION C: 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 4 marks.

1. The length of a rectangle exceeds the width by 2cm. If the diagonal is 10cm long, find the width of the rectangle.

Ans: _____

2. The number of Hours N required to dig a certain hole is inversely proportional to the number of men available X. When 6 men are digging the hole, it takes 4 hours to complete.

   (a) Find the time taken when 8 men are available.

Ans: _____

   (b) If it takes half an hour to dig the hole, how many men are there?

Ans: _____

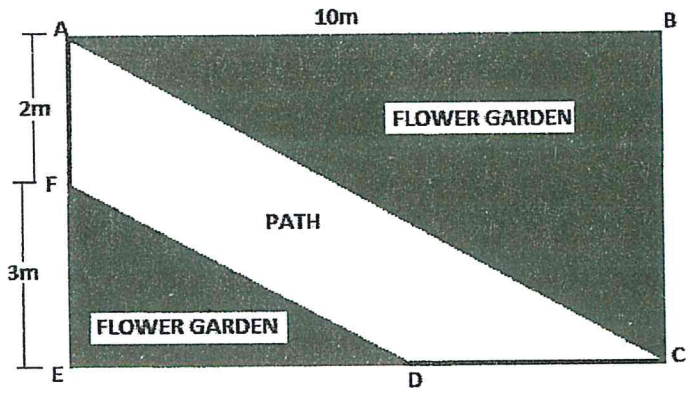
3. A plane is flying at the constant height of 8000m. It flies vertically above me and 30 seconds later, the angle of elevation is 74 degrees.

   (a) Draw the diagram of this information.

(b) How far did the plane travel in that 30 seconds?

Ans: _____

4. Polu Baikira makes a path across his rectangular flower garden, as shown in the diagram below.



AB=10m, AF=2m, FE=3m. The edges of AC and FD of the path are parallel.

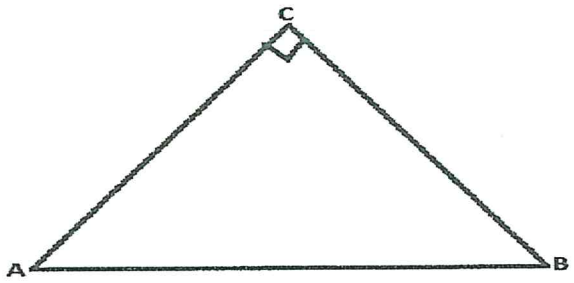
(a) Find the length of ED.

Ans: _____

(b) Calculate the area of the path.

Ans: _____

5. Nelwin has to mark out a triangular floor bed, ABC, as shown in the diagram below.



The distance AB must be 10m and the angle ACB must be 90 degrees. The lengths of the other two sides, AC and BC must total 13m.

(a) Taking the length of AC as x meters, form an equation in x, and show that it simplifies to $2x^2 - 26x + 69 = 0$.

(b) Solve the equation to find two possible values of x, correct to 2decimal places.

Ans: _____