THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

ENTRANCE EXAMINATIONS – 2020

MA003 – ENGINEERING MATHEMATICS

For candidates applying for Applied Physics, 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: _____ Given Name: _____

Signature: _____ Date: _____

Tick the type of course for which you are applying.

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

Section A: Multiple Choice Questions

Circle the correct choice for each question. Each question worth 2 marks.

1. The correct choice when transposing $Q=\frac{w(H-h)}{T-t}$ for T is

   (a) $T=-t-\frac{w(H+h)}{Q}$ (b) $T=t+\frac{w(H-h)}{Q}$ (c) $T=t-\frac{w(H+h)}{Q}$

2. Solve the expression $4x^{-2}(3+5y^{-2})+2y(7x^2+1)+y^{-1}(4x^{-1}-3)$ when $x=1$ and $y=-1$.

   (a) 12 (b) 13 (c) 14 (d) 15

3. The corresponding value for x for the given simultaneous equations $3x-7=4$ and $x^2+8=3xy$ is

   (a) 1 (b) 2 (c) 3 (d) 4

4. Polu, Wemu and Tepou share a sum of money in the ration 7:5:14. If Wemu receives K18 less than Tepou, then Tepou would receive

   (a) K28 (b) K14 (c) K10 (d) K52

5. 4 integers that are written in the order of size, starting with the smallest integer are represented by *a*, *b*, *c* and *d*. If the mean of *a*, *b*, *c* and *d* is 15 while the sum of *a*, *b* and *c* is 39, find the value of *d*.

   (a) 11 (b) 9 (c) 23 (d) 21

6. 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

7. A particle moves along a straight line. The fixed point *O* lies on this line. The displacement of the particle from *O* at time t seconds, $t\geq 0$ is s meters, where $s=t^3-5t^2-8t+3$. Find the value of t for which the particle is instantaneously at rest.

   (a) 2 (b) 4 (c) 3 (d) 5

8. The value of $\tan^2 60^0+\sin^2 60^0$ is

   (a) $\frac{3}{4}$ (b) $1\frac{3}{4}$ (c) $3\frac{3}{4}$ (d) $4\frac{3}{4}$

9. If simple interest on K420 invested for 3 years is K63. What is the rate of interest?

   (a) 5% (b) 3% (c) 6% (d) 4%

10. A mortar mixture is made of cement, sand and water mixed by weight in the ratio 1:3:5 respectively. What weight of sand is contained in 63 kg of the mixture?

(a) 21 kg (b) 10 kg (c) 7 kg (d) 35 kg

11. If $f: x \to 2x+5$, $g: x \to \frac{1}{2}x$ and $h: x \to 3x-1$. Find $ghf(-2)$.

(a) 2 (b) -2 (c) 1 (d) -1

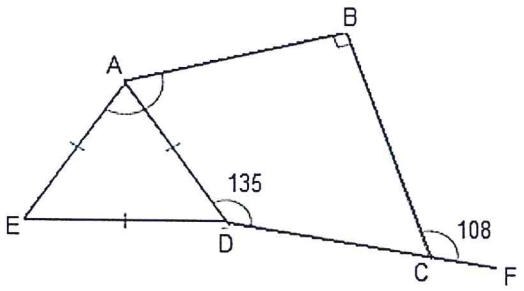
12. If $X = \{x: 9 < x < 18\}$ and $Y = \{y: 10 < y < 21\}$, what is $n(X \cup Y)$, given that x and y are integers.

(a) 11 (b) 15 (c) 10 (d) 12

Section B: Workings Required

Show workings for each question. Each question worth 3 marks.

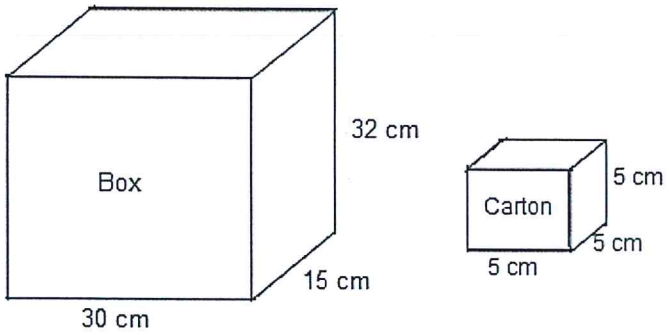
1. For a given figure below, $ABCD$ is a quadrilateral. ADE is an equilateral triangle. DCF is a straight line.



(a) Work out the size of angle EAB.

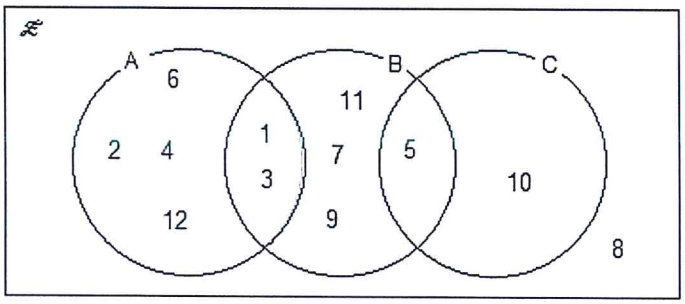
(b) Find angle ADE.

2. A wooden box measures 30 cm by 15 cm by 32 cm. The box has a lid. A carton measures 5 cm by 5 cm by 5 cm. James has 110 cartons. He wants to put all these cartons in the box and be able to shut the lid. How many cartons does James need to fill the wooden box and shut the lid?



3. There are some people in a cinema. Three-fifth of the people in the cinema are children. For the children in the cinema; number of girls : number of boys = 2 : 7. If there are 170 girls in the cinema, calculate the number of adults in the cinema.

4. Using the Venn diagram below, answer the following questions.

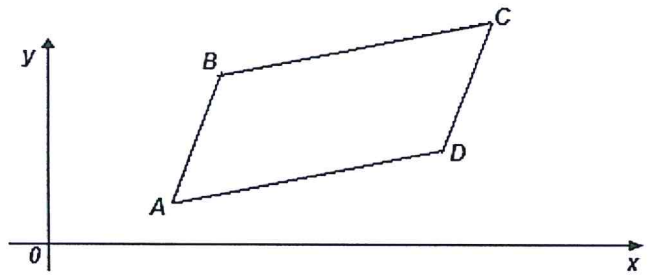


(a) Write down the numbers that are in the set $B \cup C$.

(b) If one of the numbers in the Venn diagram is picked at random, find the probability that this number is in the set C'.

5. Solve for x for the equation $\frac{1}{9x^2-25}-\frac{1}{6x+10}=0$.

6. The diagram shows parallelogram $ABCD$.



Given that $\overrightarrow{AB}=\begin{pmatrix}2\\7\end{pmatrix}$, $\overrightarrow{AC}=\begin{pmatrix}10\\11\end{pmatrix}$ and the point B has coordinates $(5,8)$, find the coordinates of point C.

7. Jack plays a game with two fair spinners, **A** and **B**. Spinner **A** can land on the number 2 or 3 or 5 or 7 while Spinner **B** can land on the number 2 or 3 or 4 or 5 or 6. He will win the game if one spinner lands on an odd number **and** the other spinner lands on an even number where both spinners are spanned at the same time. If Jack plays the game twice, calculate the probability that Jack wins the game both times.

8. A body moves a distance of s metres in a time of t seconds so that $s = 2t^3 - 5t^2 + 4t + 5$. Find its acceleration after 3 seconds.

9. Given that $y = 60x + 3x^2 - 4x^3$, calculate the value of x for which y has its minimum value.

10. A high school had 1200 students enrolled in 2003 and 1500 students in 2006. If the student population P, grows as a linear function of time t, where t is the number of years after 2003. How many students will be enrolled in the school in 2010?

11. Find the area between the straight line $y = 12 + 3x$ and the curve $y = 2x^2 + 3$.

12. Solve the equation $-2x^2 - 3x - 7 = 0$.