THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MATHEMATICS AND COMPUTER SCIENCE

2023 NSL ENTRANCE EXAMINATIONS

MA002 – SCIENCE MATHEMATICS

For candidates applying for Applied Sciences, Food Technology, Applied Chemistry, Surveying, Geographic Information Systems, Forestry and Agriculture

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 Question Paper.
3. Show your workings where required in SECTION B.
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

[ ] Bachelors in Applied Science .
[ ] Bachelors in Surveying
[ ] Bachelors in Geographic Information Systems (GIS)
[ ] Bachelors in Forestry
[ ] Bachelors in Agriculture
[ ] Bachelors in Food Technology
[ ] Bachelors in Applied Chemistry
[Others] _____

SECTION A – MULTIPLE CHOICE QUESTIONS (70 Marks)

Circle the correct choice. Each question is worth 2 marks.

1. What is 1.08772 correct to four significant figures?

   A. 1.087 **B.** 1.088 **C.** 1.8770 **D.** 1.0877

2. Kambiri bought a car valued at K7,700. One year later the car's value had decreased by $\frac{2}{7}$. What is the new value of the car?

   A. K2,200 **B.** K4,400 **C.** K5,500 **D.** K9,900

3. Express $\frac{x^5-4x}{x^2+2}$ in its simplest form.

   A. $\frac{x}{x^2+2}$ **B.** $\frac{x^2+2}{x}$ **C.** $x(x^2+2)$ **D.** $x(x^2-2)$

4. The expression $2log_2x^3 - log_2x^2$ is equivalent to

   A. $4log_2x$ **B.** log_2x **C.** log_2x^5 **D.** $log_2\left(\frac{1}{x}\right)$

5. The parabola $y = x^2 - 3x - 1$ intersect the line $y = 3$ at the point

   A. $x = -4$ and $x = 1$ **B.** $x = 4$ and $x = -1$ **C.** $x = -1$ and $x = 2$ **D.** $x = 1$ and $x = 2$

6. The expression $\sqrt{32a} - \sqrt{50a} + \sqrt{18a}$ in simplest surd form is

   A. $\sqrt{a}$ **B.** $2\sqrt{a}$ **C.** $2\sqrt{2a}$ **D.** $4\sqrt{2a}$

7. The slope of a line $3y + 2x + 5 = 0$ is

   A. $-\frac{3}{2}$ **B.** $\frac{3}{2}$ **C.** $\frac{2}{3}$ **D.** $-\frac{2}{3}$

8. The following data are Maths test marks out of 10 for eleven students:
   5, 6, 4, 10, 8, 7, 7, 9, 3, 6, and 4. What is the median mark?

   A. 8 **B.** 7 **C.** 6 **D.** 5

9. Consider the set $A = \{2, 4, 6, 8, 10\}$. Which of the following is not a subset of A?

   A. $\{2, 4\}$ **B.** $\{1, 2, 4\}$ **C.** $\{6, 8, 10\}$ **D.** $\{2, 4, 6, 8, 10\}$

10. Given that $f(x) = sinx$, the exact value of $f'\left(\frac{\pi}{3}\right)$ is

A. $\frac{1}{\sqrt{2}}$ **B.** $\frac{\sqrt{3}}{2}$ **C.** $\sqrt{3}$ **D.** $\frac{1}{2}$

11. Find $\int \frac{1}{2x} dx$.

A. $(2x)^{-1} + c$ **B.** $ln(2x) + c$ **C.** $\frac{1}{2}ln(2x) + c$ **D.** $\frac{1}{2}ln(x) + c$

12. The solution to the inequality $-2x - \frac{1}{2} \leq -x - 2$ is

A. $x \leq -\frac{3}{2}$ **B.** $x > -\frac{3}{2}$ **C.** $x < \frac{3}{2}$ **D.** $x \geq \frac{3}{2}$

13. Yarea Kambi invests K10,000 in an account which pays 5% interest per annum and compounded every 6 months. How much would be in the account after 10 years?

A. K15,321 **B.** K15,354 **C.** K16,386 **D.** K16,235

14. The point of intersection for the lines $x - y + 2 = 0$ and $2x + y - 5 = 0$ is

A. $(3, -1)$ **B.** $(-3,1)$ **C.** $(1,3)$ **D.** $(-3, -1)$

15. A plane flies 50 km in 15 minutes. How long does it take to fly 300 km?

A. 60 mins **B.** 90 mins **C.** 30 mins **D.** 15 mins

16. What is the maximum value of the expression $6 - x - x^2$?

A. $\frac{10.5}{4}$ **B.** $\frac{25}{4}$ **C.** $\frac{3}{4}$ **D.** 0

17. The surd expression $\frac{1}{\sqrt{3}} - \frac{\sqrt{3}}{2}$ is equivalent to

A. $-\frac{\sqrt{3}}{6}$ **B.** $\frac{1-\sqrt{3}}{\sqrt{3}}$ **C.** $\frac{1-\sqrt{3}}{6}$ **D.** $\frac{1-\sqrt{3}}{2\sqrt{3}}$

18. The speed of a particle is 100 meters per seconds. What is this speed in km/hr?

A. 3.6 km/hr **B.** 36 km/hr **C.** 360 km/hr **D.** 3,600 km/hr

19. If 2 fligs make a flog and 3 flogs make a flug, how many fligs are in 12 flugs?

A. 74 **B.** 72 **C.** 68 **D.** 84

20. A car travels 6 km on two litres of petrol. How far will the car travel on 5 litres?

A. 15 km **B.** 12 km **C.** 8 km **D.** 6 km

21. The range of the data set {11, 32, 17, 41, 19, 8, 63, 28} is

A. 63 **B.** 55 **C.** 17 **D.** 8

22. From a point on a power post 9 metres above ground level, the angle of depression of Yowai's head is 30 degrees. How far is Yowai from the power post, if he is 1.6 metres tall?

A. 8.54 m **B.** 10.39 m **C.** 12.82 m **D.** 15.59 m

23. If a card is drawn at random from a standard pack of 52 playing cards, the probability that it is a Jack OR a Diamond is

A. 0.25 **B.** 0.31 **C.** 0.02 **D.** 0.75

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

A. 2 cm **B.** 4 cm **C.** 6 cm **D.** 5 cm

25. The graph of the parabola $y = ax^2 + bx + c$ intersects the $x - axis$ twice if:

A. $b^2 - 4ac = 0$ **B.** $b^2 - 4ac < 0$ **C.** $b^2 - 4ac > 0$ **D.** $b^2 + 4ac = 0$

26. In a sale, a discount of 30% was allowed on the marked price of a mattress. A customer paid K250 for the mattress. What was its price before the discount?

A. K325 **B.** K75.57 **C.** K357.14 **D.** K175.23

27. In a class of 25 members, 15 take history, 17 take geography and 3 take neither subject. How many class members take both subjects?

A. 11 **B.** 15 **C.** 10 **D.** 14

28. An alloy consists of copper, zinc and tin in the ratio 1: 3: 4. If the weight of copper in the alloy is 10 g, then the weight of zinc and tin are respectively

A. 40 g and 50 g **B.** 40 g and 30 g **C.** 30 g and 40 g **D.** 30 g and 50 g

29. The line $y=3x+c$ passes through the point $(4,27)$. What is the value of c?

A. 10 **B.** 5 **C.** 12 **D.** 15

30. A number x is subtracted from two times its square and the result is 45. An equation to find the value of x would be:

A. $x^2-2x=45$ **B.** $2x-x^2=45$ **C.** $x-2x^2=45$ **D.** $2x^2-x=45$

31. The mean weight of five men is 76 kg. The weights of four of the men are 72 kg, 74 kg, 75 kg and 81 kg. What is the weight of the fifth man?

A. 76 kg **B.** 78 kg **C.** 77 kg **D.** 80 kg

32. Simplify $\frac{x^2-9}{4x-12}=\frac{x+3}{2}$

A. $\frac{x+3}{4}$ **B.** $\frac{1}{2}$ **C.** $\frac{x+3}{2(x-3)}$ **D.** $\frac{2}{1}$

33. $\int_0^{\frac{\pi}{2}} sin(2x)dx$ is equal to

A. 1 **B.** -2 **C.** -1 **D.** 2

34. If $x=\frac{1}{2}$, $y=\frac{2}{3}$ and $z=\frac{3}{4}$, evaluate $x\div y+z$

A. $1\frac{1}{2}$ **B.** $\frac{3}{7}$ **C.** $1\frac{1}{12}$ **D.** $\frac{3}{4}$

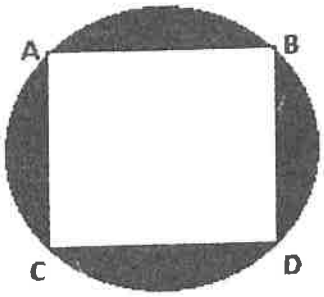
35. If matrix $A=\begin{bmatrix}2 & 3 & 4\\ 1 & 2 & 3\end{bmatrix}$ and matrix $B=\begin{bmatrix}1 & 2\\ 2 & 3\\ 0 & 4\end{bmatrix}$, then AB is equal to

A. $\begin{bmatrix}8 & 5\\ 20 & 29\end{bmatrix}$ **B.** $\begin{bmatrix}8 & 5\\ 29 & 20\end{bmatrix}$ **C.** $\begin{bmatrix}5 & 8\\ 20 & 29\end{bmatrix}$ **D.** $\begin{bmatrix}8 & 29\\ 5 & 20\end{bmatrix}$

SECTION B – CALCULATION QUESTIONS (20 Marks)

For questions 36 to 39, show all calculations. Marks will be awarded for correct working out. Underline your final answer. Each question is worth 5 marks.

36. The square ABCD has area 4 cm^2 and touches the circle at 4 points. Find the area of the shaded region, correct to the nearest cm^2.



37. What is the gradient of a line that is perpendicular to the line joining the points $A(-10,3)$ and $B(4,5)$?

38. Given the equation $2^{5x-1} = \frac{1}{8^{x(x-1)}}$, solve for x.

39. A rectangular room is 2 meters longer than its width. If the perimeter of the room is 24 meters, calculate its length.

- End of Examination -