# 121/2
# MATHEMATICS

**SECTION 1 (50 MARKS)**
**Attempt all questions.**

1. Factorise $x^2 - y^2$, hence evaluate $3282^2 - 3272^2$ (3mks) *Nym *
2. Find $\cos x - \sin x$, if $\tan x = \frac{3}{4}$ and $90^o \leq x \leq 360^o$ (3mks) *Nym *
3. Expand $\left[1 - \frac{1}{2}X\right]^6$ up to the fourth term. Hence use your expansion to evaluate $(1.02)^6$ to four decimal places. (4mks) *Nym *
4. The average of the first and fourth terms of a GP is 140. Given that the first term is 64. Find the common ratio. (3mks) *Nym *
5. Make b the subject of the formula. (3mks) *Nym *

$$A = \frac{b\,d}{\sqrt{b^2 - d}}$$

6. Two variables P and Q are such that P varies partly as Q and partly as the square root of Q. Determine the equation connecting P and Q. When Q=16, P=500 and when Q = 25, P = 800 (4mks) *Nym *
7. A radio has a marked price of shs. 10,000. The shopkeeper can allow a discount of 15% on the marked price and still make a profit of 25% on the cost price. Find the cost price of the radio. (2mks) *Nym *.
8. Using a calculator, evaluate

$$\sqrt[4]{\frac{4.562 \times 0.38}{0.82}}$$

giving your answer to 4 significant figures. (3mks) *Nym *

9. Eighteen labourers dig a ditch 80m long in 5 days. How long will it take 24 labourers to dig a ditch 64 m long? (3mks). *Nym *
10. The expression $1 + \frac{x}{2}$ is taken as an approximation for $\sqrt{1+x}$

Find the percentage error in doing so if x = 0.44 (3mks) *Nym *

11. The matrices $A = \begin{bmatrix} 3 & 0 \\ 0 & 4 \end{bmatrix}$ and $B = \begin{bmatrix} a & b \\ o & c \end{bmatrix}$

are such that AB = A + B
Find a, b, and c. (3mks) *Nym *

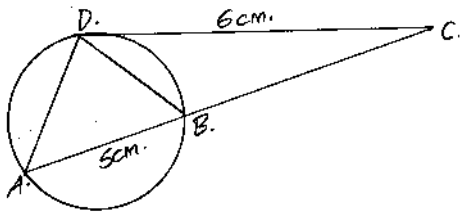
12. Simplify (3mks) *Nym *

$$\frac{2x^2 - x - 1}{x^2 - 1}$$



13. On map of scale 1:25000 a forest has an area of $20cm^2$. What is the actual area in $Km^2$ (3mks) *Nym *

14. In the figure below, DC = 6cm, AB = 5cm. Determine BC if DC is a tangent. (3mks). *Nym *




15. Evaluate without using logarithm tables.

$$3\log_{10}^{2} + \log_{10}^{750} - \log_{10}^{6}$$

(3mks) *Nym *

16. A bag contains 10 balls of which 3 are red, 5 are white and 2 green. Another bag contains 12 balls of which 4 are red, 3 are white and 5 are green. A bag is chosen at random and a ball picked at random from the bag. Find the probability that the ball so chosen is red. (4mks). *Nym *

**SECTION II (50 MARKS)**

**Answer any five questions in this section.**

17. Income tax is charged on annual income at the rates shown below.

| Taxable Income K£ | Rate (shs per K£) |
|---|---|
| 1 – 1500 | 2 |
| 1501 – 3000 | 3 |
| 3001 – 4500 | 5 |
| 4501 – 6000 | 7 |
| 6001 – 7500 | 9 |
| 7501 – 9000 | 10 |
| 9001 – 12000 | 12 |
| Over 12000 | 13 |

A certain headmaster earns a monthly salary of Ksh. 8570. He is housed in the school and as a result, his taxable income is 15% more than his salary. He is entitled to a family tax relief of Kshs. 150 per month.

(a) How much tax does he pay in a year. ( 6 mks) *Nym *

(b) From the headmaster's salary the following deductions are also made every month;

W.C.P.S 2% of gross salary
N.H.I.F Kshs. 20
House rent, water and furniture charges Kshs. 246

Calculate the headmaster's net salary. (4 mks) *Nym *

18. (a) (i) Taking the radius of the earth, R = 6370 km and $\pi = {}^{22}/_{7}$ calculate the shorter distance between the two cities P ($60^oN$ , $29^oW$) and Q ($60^oN$, $31^oE$) along the parallel of latitude. (3mks) *Nym *

(ii) If it is 1200Hrs at P, what is the local time at Q. (3mks). *Nym *

(b) An aeroplane flew due South from a point A ($60^0N$, $45^0E$) to a point B. The distance covered by the aeroplane was 800km. Determine the position of B. (4mks).

19. A and B are connected by the equation B = KA + M where K and M are constants. The table below shows the values of A and corresponding values of B.

| A | 1.5 | 3.0 | 4.5 | 6.0 | 7.5 | 9.0 |
|---|---|---|---|---|---|---|
| B | 8 | 11 | 14 | 17 | 20 | 23 |

(a) Draw a suitable straight line on the grid provided. (3mks) *Nym *
(b) Determine the gradient of the line. (2mks) *Nym *
(c) State the values of K and M, hence express B in terms of A. (3mks) *Nym *
(d) From your graph estimate (i) B when A = 3.6
(ii) A when B = 13. (2mks) *Nym *

20. (a) Complete the table for y = Sin x + 2 Cos x. (2mks) *Nym *

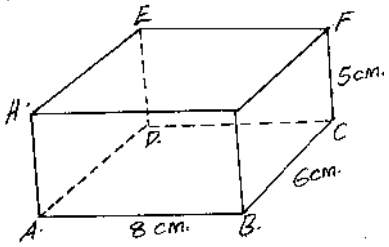
| x | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sinx | 0 | | | 1.0 | | 0.5 | | -0.5 | | | -0.87 |
| 2 cos x | 2 | | | 0 | | -1.73 | | -1.73 | | | 1.0 |
| Y | 2 | | | 1.0 | | -1.23 | | -2.23 | | | 0.13 |

(b) Draw the graph of y = Sin x + 2 cos x. (3mks) *Nym *
(c)Solve sinx + 2 cos x = 0 using the graph. (2mks) *Nym *
(d) Find the range of values of x for which $y \leq -0.5$ (3mks). *Nym *

21. A bag contains 3 red, 5 white and 4 blue balls. Two balls are picked without replacement. Determine the probability of picking.
(a) 2 red balls 2mks *Nym *
(b) Only one red ball 2mks *Nym *
(c) At least a white ball 2mks *Nym *
(d) Balls of same colour. 2mks *Nym *
(e) Two white balls 2mks *Nym *

22. (a) Draw the graph of the function 2mks *Nym *
$y = 10+3x - x^2$ for $-2 \leq x \leq 5$
(b) use of the trapezoidal rule with 5 stripes, find the area under the curve from x = -1 to x = 4. 4mks *Nym *
(c) Find the actual area under the curve from x = -1 to x = 4. 2mks *Nym *
(d) Find the percentage error introduced by the approximation. 2mks *Nym *

23. The figure below is a cuboid ABCDEFGH such that AB = 8cm, BC = 6cm and CF 5cm.
Determine (a) the length (i) AC (2mks) *Nym *
(ii) AF (2mks) *Nym *




(b) The angle AF makes with the plane ABCD. (3mks) *Nym *
(c) The angle AEFB makes with the base ABCD. (3mks) *Nym *

24. A manager wishes to hire two types of machine. He considers the following facts.

| | **Machine A** | **Machine B** |
|---|---|---|
| Floor space | $2m^2$ | $3m^2$ |
| Number of men required to operate | 4 | 3 |

He has a maximum of $24m^2$ of floor space and a maximum of 36 men available. In addition he is not allowed to hire more machines of type B than of type A.
(a) If he hires x machines of type A and y machines of type B, write down all the inequalities that satisfy the above conditions. 3mks *Nym *

(b) Represent the inequalities on the grid and shade the unwanted region. 3mks *Nym *

(c) If the profit from machine A is sh. 4 per hour and that from using B is kshs8 per hour. What number of machines of each type should the manager choose to give the maximum profit? (4mks) *Nym *