ST. JOSEPH'S SENIOR SECONDARY SCHOOL NAGGALAMA

U.C.E MOCK EXAMINATION 2015

456/1 MATHEMATICS PAPER 1
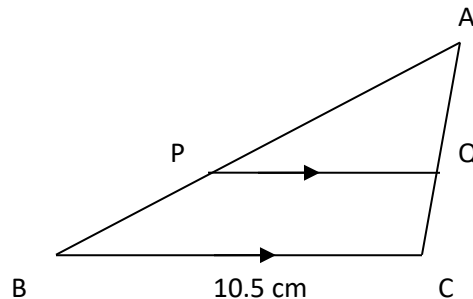
2 ½ HOURS

ATTEMPT **ALL** QUESTIONS IN SECTION A AND ANY **FIVE** FROM SECTION B.

SHOW ALL WORKING ON THE SAME PAGE AS THE REST OF THE ANSWER.

SECTION A (40 marks)

1. Solve for a in the inequality $\frac{3a+2}{3} - \frac{2a-3}{4} < -1$. (4 marks)

2. Given that $4^{x^2-23} = 16$ find the values of x. (4 marks)

3. In the figure below, PQ is parallel to BC. AP: PB = 3:4 and BC =10.5 cm.

   Calculate the length of PQ. (4 marks)

4. The average mark of 30 candidates in an examination was 40. If the 12 weakest had an average of 30, find correct to one decimal place, the average of the others. (4 marks)

5. Without using tables or a calculator, evaluate: $\frac{63.7 \times 53.7 - 53.7^2}{0.1}$. (4 marks)

6. If $\begin{pmatrix} 4 & 1 \\ x & -1 \end{pmatrix}\begin{pmatrix} 2 \\ y \end{pmatrix} = \begin{pmatrix} 4 \\ 8 \end{pmatrix}$, determine the values of x and y. (4 marks)

7. Factorise the expression: $x^2 – 8x + 16$. Hence find the values of x when $x^2 –8x + 16 = 4$. (4 marks)

8. If $\tan \theta = \frac{3}{2\sqrt{5}}$ and $\cos \theta$ is negative, then without using tables or calculator find the value of $\sin \theta$. (4 marks)

9. An object P is transformed by matrix $\begin{pmatrix} 1 & -2 \\ 1 & 2 \end{pmatrix}$ to its image P$^/$ whose area is 12 cm^2. Find the area of P. (4 marks)

10. A fair die is tossed once and what appears on the top face is recorded. Find the probability that a triangular number shows up. (4 marks)

SECTIONB (60 marks)

11. The table below shows ages of 60 university students, to the nearest years.

| Age (years)	17 - 19	20 - 22	23 – 25	26 - 28	29 – 31
Number of students	3	7	13	25	12

a) Calculate the students' median age.
b) I) Draw a histogram for the data.
   ii) Use the histogram to find the modal age. (12 marks)

12. a) A rectangular sheet of metal x metres long and y metres wide has a circular hole cut from it. What is the radius of the hole if the area of the remaining metal is A m^2. Hence find the radius given that x = 10, y = 5 and A = 6 m^2. [use $\pi = \frac{22}{7}$]

b) A book seller buys (x + y) copies of a certain book, all at the same price. She sells x of them at a profit of p% but has to sell the remainder at a loss of q%. Find the percentage profit on the whole transaction. (12 marks)

13. a) Draw the graphs of y = x^2 – 2 and y = 2 – x^2 on the same coordinate axes, for $^-4 \leq x \leq 4$

   (b)   Using your graphs state the;
          (i)   Minimum value of y = x^2 – 2
          (ii)   Maximum value of y = 2 – x^2
          iii) Coordinates of the points of intersection of the curves. Hence estimate the solutions of the equation x^2 – 2 = 2 – x^2 . (12 marks)

14. a) **A** = $\begin{pmatrix} 4 & -1 \\ 2 & 3 \end{pmatrix}$; **B** = $\begin{pmatrix} p & -2 \\ 4 & 7 \end{pmatrix}$. Calculate, in terms of p,
    (i)   **AB**,
    (ii)   **BA**.
    (iii) Given that **AB** = **BA**, *find the value of p.*

b) The Laredo Sports Shop sold 5 balls and 2 bases for shs. 8100 on Monday; 4 balls and 2 bases for shs. 6600 on Tuesday. Using matrices, what are the prices for 1 ball and 1 base? (12 marks)

15. a) If triangle ABC has vertices A(6,0), B(6,3), C(4,3) and A_1(1,4.5); B_1(1,3) and C_1(2,3) are the images under an enlargement, find the centre of enlargement and the scale factor.

b) $A_2B_2C_2$ has vertices A_2 (4.5, -1); B_2 (3, -1) and C_2 (3, -2). $A_2B_2C_2$ is the image of $A_1B_1C_1$ under a rotation. Find the centre and angle of the rotation which maps $A_1B_1C_1$ onto $A_2B_2C_2$. (12 marks)

16. The diagram below shows two intersecting circles of radii 6 cm and p cm with a common chord XY of 4 cm. Angle XOY = 30^0.
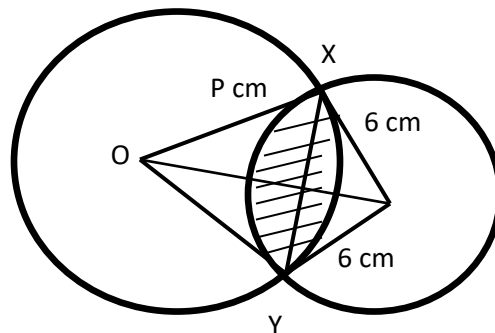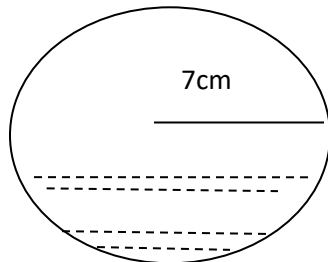

Find the area of the shaded part.

17. A school is preparing a trip for 400 students. The company who is providing the transportation has 10 buses of 50 seats each and 8 buses of 40 seats, but only has 9 drivers available. The rental cost for a large bus is $800 and $600 for the small bus.
   a) If x and y represent the number of small buses and large buses respectively; write down all inequalities satisfying the given conditions?
   b) How many buses of each type should be used for the trip for the least possible cost?
   c) Find the least possible cost?

END

1. The diagram shows a cross section of cylindrical pipe of radius 7cm containing water up to a height of 2 cm.

7cm

(a) Find the area of the cross section covered with water (shaded area)

(b) Find the volume of water if the pipe has length 30cm.

(c) Given that the volume of water in (b) above is just enough to fill another container having a shape of a cone with vertical height 10cm, determine the radius of the circular end of that container. (Use π = 3.14)

1. Express 2.6363 …… as a fraction in its simplest form.
2. The function $g(x) = ax^2 + 3$. If $g(2) = 11$, find the value of a.
3. Find the coordinates of the point of intersection o f the lines $y = 2x$ and $y = 3 - x$.
4. Two similar jugs have capacities of 1.2 litres and 2.7 litres. The smaller jug has a height of 14 cm. Determine the height of the larger jug.
5. Given that $\boldsymbol{a} = \begin{pmatrix} 6 \\ 5 \end{pmatrix}$, $\boldsymbol{b} = \begin{pmatrix} 3 \\ 8 \end{pmatrix}$ and $|\boldsymbol{a} + \boldsymbol{b}| = t$, find the value of t to 2 d.p.
6. If the area of a lake is 8 km² and is represented by an area 2 cm² on a map, find the scale of the map.
7. Find the equation of the line which passes through the point (-3,5) and is perpendicular to the line $2y + 3x + 7 = 0$.
8. Abdul's salary is shs. 4,800,000 per year. He pays an income tax of 30% per month. How much is Abdul's net income per month?

9. The diagram below shows a net of a solid. Find the volume of the solid.
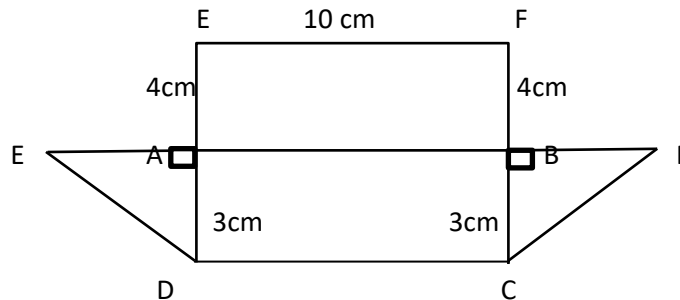
1. There are 54 students in a class, taking Maths (M), Economics (E) or Geography (G). Given that n(M) = 30; n(E) = 20; n(G) = 21; n(M ∩ E) = 13; n(M ∩ G) = 12; n(G ∩ E) = 11; n(M ∩ G ∩ E′) = 4.
     Find:
          a)   n(M ∩ E ∩ G)
          b)   how many take 2 subjects only.
          c)   n(M U E U G)′
          d)   how many take 1 subject only.

e) Find the probability that a student chosen at random takes at most two subjects

a) Use logarithms tables only to evaluate; $\left(\sqrt[3]{0.07827}\right)^2$. (4marks)

b) Find the value of $\log_3 \frac{1}{27} \div \log_3 \sqrt[3]{3}$.

c) Simplify $\log_a(x^2y^3) + \log_a(xy) - \log_a(y^4) - \log_a(x^2)$

10. A lorry set off at 7:00 am from station A to station B, 360 km away. It travelled at a constant speed of 50 kmh^{-1} for 2 hours. The lorry then stopped for 1 hour. It then proceeded at a steady speed for 4 hours to station B.
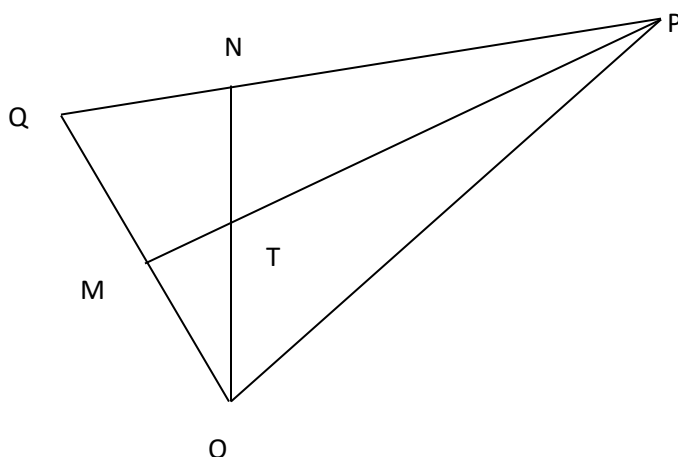A mini-bus left station B at 8: am for station A and moved non-stop for 4 ½ hours.

a) Using a scale of 2 cm to represent 40 km on the vertical axis and 2 cm to represent 1 hour on the horizontal axis, draw on the same axes, distance-time graphs for the lorry and the mini-bus.

b) Use your graphs to find the;
   i) Time when the two vehicles met.
   ii) Distance from B when the minibus.

17.

The diagram shows triangle OPQ in which **QN:NP** =1:3, **OT:TN** = 3:2 and M is the midpoint of $\overline{OQ}$.

a) Given that **OP=p** and **OQ=q** express the following vectors in terms of **p** and **q**.

i) **PQ**   ii) **ON**   iii) **PT**

b) Show that the point P, T and M are collinear.

13. a) Given that $f(x) = \dfrac{(x+2)(x-3)}{(x-5)}$ find

i) $f(5)$

ii) the values of x for which $f(x) = 0$

iii) the values of x for which $f(x)$ is meaningless

b) Given that $f(x) = x^2 + 1$ and $h(x) = x - 3$, find the value of x for which
$fh(x) = hf(x)$ (12marks)

10. a) John bought a phone at Ushs.6, 500,000. The value depreciated annually at 15%.

(i) After how long to the nearest 1 decimal place will the value of the phone be Ushs.1,300,000.

(ii) Calculate the rate of depreciation to the nearest one decimal place which would make the value of the phone be half of its original value in 5 years.

b)James bought a shirt and paid Ksh 3200 after getting a discount of 10%. The shopkeeper made a profit of 20% on the sale. Find the percentage profit the shopkeeper would have made if no discount was allowed?

12.
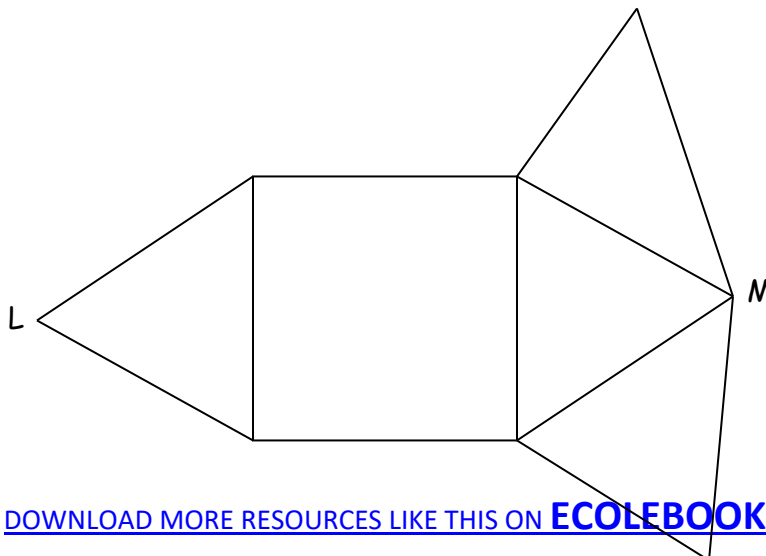
The figure shows a square of side 6cm and four congruent isosceles triangles. It represents the net of a pyramid on a square base. The distance LM is 20cm. Calculate;

a) The total surface area of the pyramid
b) The perpendicular height of the pyramid when the net is folded.
c) The angle of inclination of a triangular face to the base of the pyramid.

(12marks)