121/2
MATHEMATICS
PAPER 2
Time: 2 ½ HRS

MANG'U HIGH SCHOOL
TRIAL EXAM

INSTRUCTIONS TO CANDIDATES

1. Write your name and index number admission number and class in the spaces provided above.
2. Sign and write the date of examination in the spaces provided above.
3. The paper contains TWO sections: **Section I** and **Section II.**
4. Answer **ALL** the questions in **Section I** and any **five** questions from **Section II**
5. All answers and working must be written on the question paper in the spaces provided below each question.
6. **Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.**
7. Non – programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.

For Examiner's use only.

Section I

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total

Section II

17	18	19	20	21	22	23	24	Total

Grand Total [ ]

This paper consists of 7 printed pages.

Candidates should check the question paper to ascertain that all the pages are printed as indicated and no questions are missing.
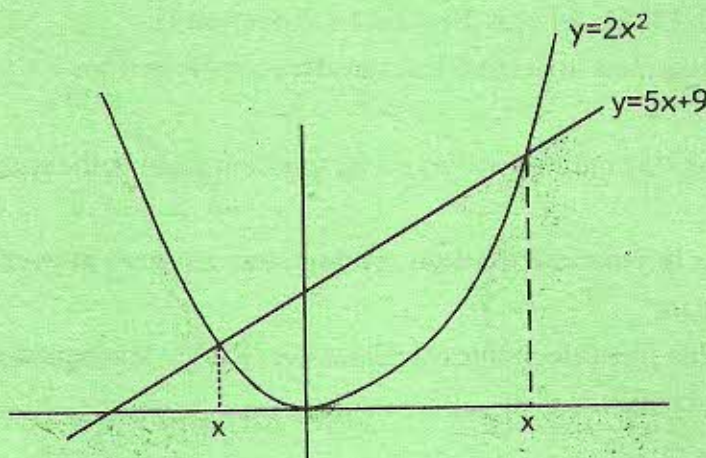
25

SECTION I (50 Marks)
Attempt **all** questions in this section.

1. Simplify $\frac{x}{y} + \frac{y}{x}$ if $x = 3\sqrt{2} - 2\sqrt{3}$ and $y = 3\sqrt{2} + 2\sqrt{3}$ (3 marks)

2. Given that p is directly proportional to q. Write down the equations connecting p and q such that $p = a + b$ when $q = a.b$. Find p when $q = a^2 - b^2$. (3 marks)

3. If $3 \log_2 t + \log_2 2 = 2$, find t (3 marks)

4. The diagram below represents the graphs of
   $y = 2x^2$ and
   $y = 5x + 9$

   (i) Calculate correct to 1 decimal place the values of x at which the graphs intersect (2 marks)

   (ii) Write down the quadratic equation satisfied by the values of x obtained in (a) above (2 marks)

5. Find the independent term in the expansion $\left(\sqrt{y} + \frac{2}{\sqrt{y}}\right)^6$ (2 marks)

6. A point p undergoes a clockwise rotation of 30^0 about the origin and maps onto $P^1\left(\sqrt{2}, -1\right)$. Obtain the coordinates of the object point p. (3 marks)

7. Make s the subject of the formula in $v^2 = \sqrt{\frac{1 + s^2}{u^2}} + \frac{u}{3}$ (3 marks)

26

8. Solve the equation $3\cos^2(\theta - 30^0) \dfrac{3\cos 60^0}{2} = 0$ for $-180^0 \leq \theta \leq 180^0$. (4 marks)

9. In the figure below O is the centre of the circle. AOBC is a straight line. TC is a tangent to the circle at T. If TC = 12cm and BC = 4cm, find the radius of the circle (4marks)
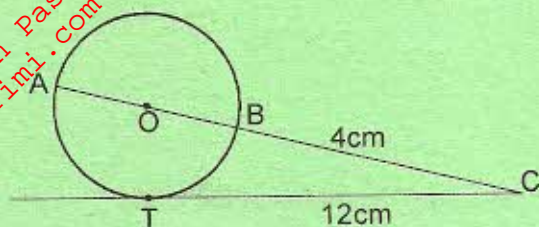
10. A solid is formed by fastening together 10 solid circular cylinders each of height 10cm whose radii are in AP. The radius of the smallest is 3cm and that of the largest is 15cm. The cylinders are placed with their axes coincident and each one rests on the next larger one. Find the total surface area of the solid. (3 marks)

11. Given that $16 \leq x \leq 64$ and $\frac{1}{4} \leq \frac{1}{2}$, find the greatest value of $\dfrac{x}{y^2}$. (2 marks)

12. If $\dfrac{a}{b} = \dfrac{c}{d} = \dfrac{e}{f}$ show that $\dfrac{4ac - 7c}{4b - 7d} = \sqrt{\left(\dfrac{a^2 - 5ce}{b^2 - 5df}\right)}$ (3 marks)

13. A washing machine valued at shs. 25,000 can be bought by cash at a discount of 10% or by instalments. A down payment of shs. 3000 is paid followed by 15 monthly instalments of shs. 1500 each. Calculate the carrying charge. (3 marks)

14. AB is a line of length 10cm. Show the locus of a point P moving in space such that 3em $\leq d \leq$ 5cm where d is the distance from P to AB. (4 marks)

15. The table below shows the frequency distribution of diameters for 40 tins in millimeters.

Diameter (mm)	130-139	140-149	150-159	160-169	170-179	180-189
No. of tins	1	3	7	13	10	6

Calculate the quartile deviation. (4 marks)

16. In the space provided below, sketch the curve $y = x(x3)(x+3)$. (4 marks)

SECTION 11 (50 MARKS)

Attempt **ANY FIVE** questions in this section

17. (a) Using a ruler and a pair of compasses only, construct a triangle ABC in which $\angle A = 60^0$, $\angle B = 90^0$ and AB = 5.5cm. Measure AC. (3marks)

(b) On the same diagram construct:

(i) The circumcircle of $\triangle ABC$. Measure the radius of the circle (3marks)

(ii) On the same side of AB as C, the locus of a point P such that the area of $\triangle ABP$ is half the area of $\triangle ABC$. Measure AP (2marks)

(iii) Mark point Q on line AC and point N on line AB such that $\triangle AQN = 30^0$ and the area of $\angle AQN$ is half the area of $\triangle AQB$. Measure QN (2marks)

18. The figure below shows a right pyramid with a triangular base.
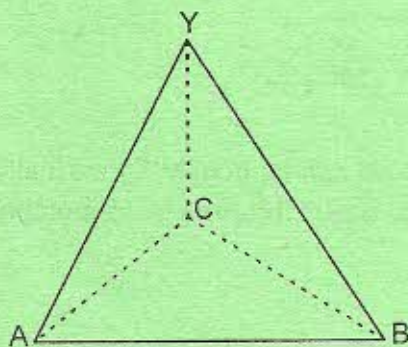
The base is an equilateral triangle of sides 10cm. The edges VA, VB and VC are 16cm each. Find the size of the angles between: (10 marks)

i) VA and the base.

ii) the face VAB and the base

iii) the face VAC and VCB

iv) the volume of the pyramid

19. The amount of money A invested over a period of n years at r% compound interest is given by the formula $A = P(1 + r)^n$

a) Obtain a linear expression in A, P and r. (1 mark)

b) If P = sh. 20,000, r = 5% and n = 10 years, use the expression obtained in (a) above to draw a straight line. (5 marks)

c) From your graph:
   i) Deduce the amount of money due to the nearest shilling at the end of:
   - 5 years
   - 8½ years (2 marks)

   ii) Deduce the time when the amount will be:
   - Sh. 26485
   - Sh. 75945 (2 marks)

20. A manufacturing plant has a contract to supply 72 machines per week. For this they employ x artisans and y apprentices, but cannot accomodate more than 16 employees. The ratio of apprentices to artisans may not be more than 9:2 and it may not be smaller than 1:2. An artisan can manufacture 9 machines per week and an apprentice can produce 6 machines per week.

a) Represent the information as inequalities.

b) Represent the inequalities graphically and indicate the feasiable region.

c) An artisan earns sh. 6000 per week and an apprentice earns sh. 3000. Use the graph to determine how the manager of the plant should employ artisans and apprentices to ensure minimum expenses.

d) What are the minimum expenses per week?

21. a) Three boys and three girls sit in a row of six seats. Find the probability that:

   i) the 3 girls sit together

   ii) the girls and boys sit in alternate seats (4 marks)

b) In an examination, one hundred candidates took papers in Physics and Chemistry. Twenty five candidates failed in Physics only. Twenty candidates failed in Chemistry only. Fifteen failed in both Physics and Chemistry. A candidate is selected at random. Find the probability that,

   i) he failed in Chemistry if it is known that he failed in Physics.

   ii) he failed in Physics if it is known that he failed in Chemistry.

   iii) he failed either in Physics or in Chemistry but not in both. (6 marks)

22. a) The equations of two concentric circles are $2x^2 + 2y^2 + 8x - 12y - 6 = 0$
$3x^2 + 3y^2 + 12x - 18x + 12 = 0$. Determine the area between the two circles.   (5 marks)

b) Find the centre, radius and equation of the circle passing through the points $(6, 9)$, $(13 - 8)$ and $(-4, -15)$.   (5 marks)

23. A bag contains 6 red, 7 blue and 3 green beads similar in shape and size. A bead is picked at random without replacement and its colour noted.

(a) Find the probability that the first bead picked is either red or blue   (2 marks)

(b) Use a tree diagram to determine the probability that;

(i) The first two beads picked are both blue   (4 marks)

(ii) Only one of the first two beads picked is green   (2 marks)

(iii) Atleast one of the first two beads picked is red   (2 marks)

24. A rectangle ABCD with vertices A (1,1) B(4,1) C(4,3) and D(1,3) is given a stretch transformation with the line $x = 1$ invariant and point (4,1) being mapped onto point (5,1) to get the image A¹ B¹C¹ D¹. The image A¹ B¹ C¹ D¹ of the rectangle is then enlarged with a scale factor of -2 centre origin to get A¹¹ B¹¹ C¹¹ D¹¹.

(i) On the grid below plot the rectangle ABCD and its images A¹ B¹ C¹ D¹ and A¹¹ B¹¹ C¹¹ D¹¹ after the successive transformation. Give the coordinates of the vertices of rectangle A¹¹ B¹¹ C¹¹ D¹¹   (4marks)
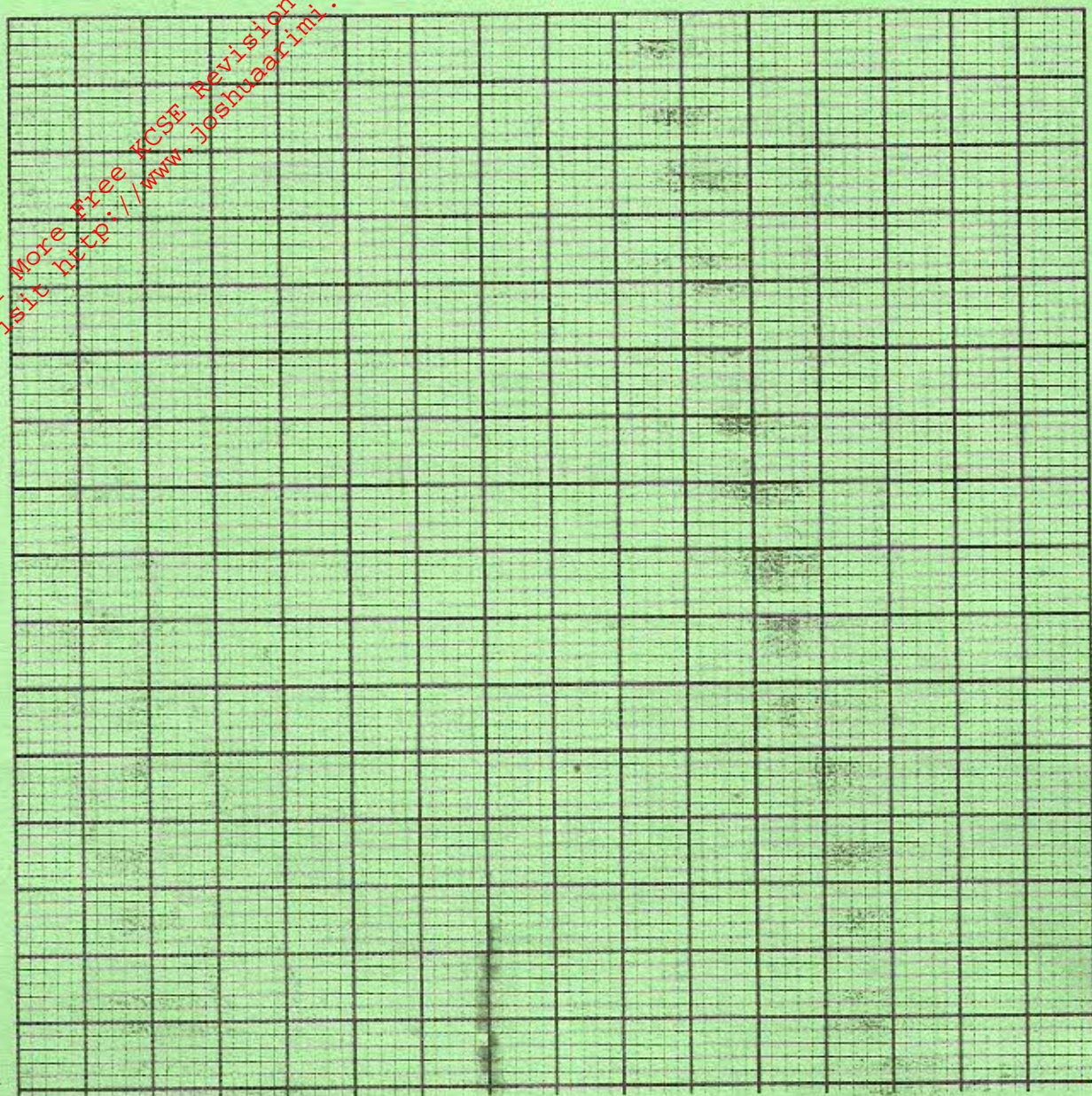
(ii) Describe the transformation which maps the image A¹¹ B¹¹ C¹¹ D¹¹ onto rectangle A¹ B¹ C¹ D¹
(1mark)

(iii) Describe the single matrix that will map the image A¹¹ B¹¹ C¹¹ D¹¹ onto rectangle ABCD
(5marks)

31