

121/2

STRATHMORE MOCKS

MATHEMATICS

PAPER TWO

2009

2½ HOURS

INSTRUCTIONS TO CANDIDATES

Write your name, index number in the spaces provided on top of the page.

The paper contains two sections: section one and section two.

Answer all questions in section 1 and any five in section 2.

Non programmable silent electronic calculators and KNEC Mathematical tables may be used except where stated otherwise.

Show all the steps in your calculations, giving your answers at each stage in the spaces below each question.

Marks will be given for correct working even if the answer is wrong.

For examiner's use only

Section I

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

Section II

17	18	19	20	21	22	23	24

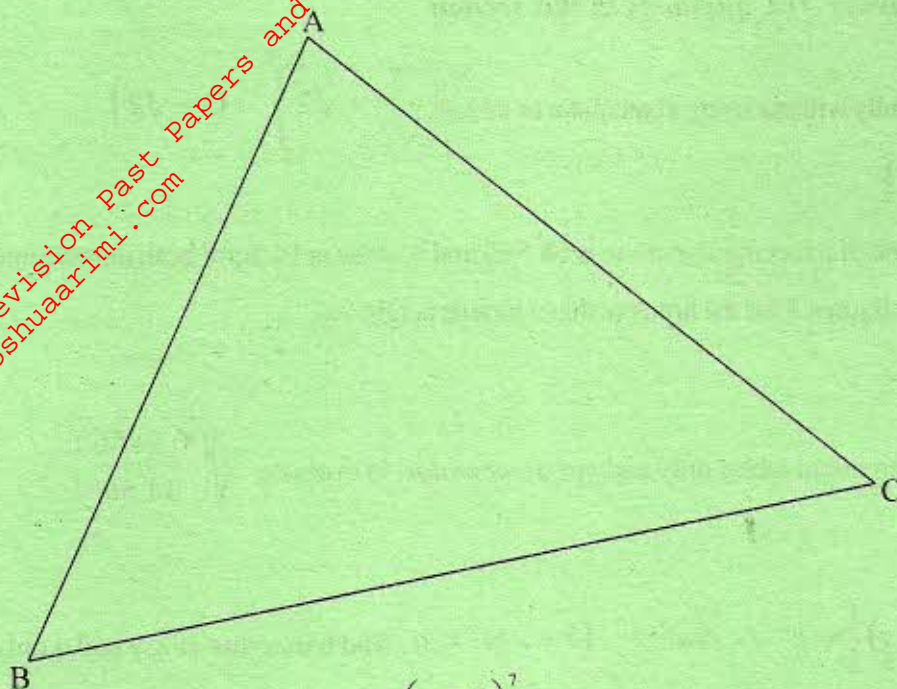
GRAND TOTAL

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SECTION I answer ALL questions in this section

(50 marks)

1. Simplify fully without using a calculator or tables $\left(\frac{3}{\sqrt{2}} - \sqrt{2}\right)^3 \div (3 - \sqrt{2})$ (3 marks)
2. The volume of a rectangular stone is 68.5ml and its base is 14.5cm² both measurements correct to 3 significant figures. Find the limits within which its height lies. (3 marks)
3. Use mathematical tables only and *not a calculator*, to evaluate $\sqrt[10]{\left(\frac{0.9856}{34.56}\right)}$ (3 marks)
4. If $(b-x)\frac{1}{b} = z$ and $(b+x)y = q$ find b in terms of z, y and q only. (3marks)
5. A matrix Y is such that YB=BA. If $A = \begin{pmatrix} 2 & 4 \\ -1 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} -5 & 8 \\ 2 & 3 \end{pmatrix}$ find Y. (3 marks)
6. A particle is S m from a particular point O after t seconds where $S = \frac{2}{3}t^3 + \frac{3}{2}t^2 - 9t + 10$.
Calculate the distance the particle is from O when it's momentarily at rest? (4 marks)
7. The cube root of $\frac{1}{T}$ varies jointly as P and inversely as the square of R. When $P = \frac{2}{3}$, R=2 and T=1.728, determine the relation between T, P and R. (3 marks)
8. The figure below represents a piece of land drawn to scale. On the diagram accurately indicate the positions of the following
 - a) A tap installed inside the plot such that it is equidistant from all the three edges. (2 marks)
 - b) A portion of the plot represented by a variable X that is closer to edge AC than BC and given that angle AXB is less than 90° (2 marks)



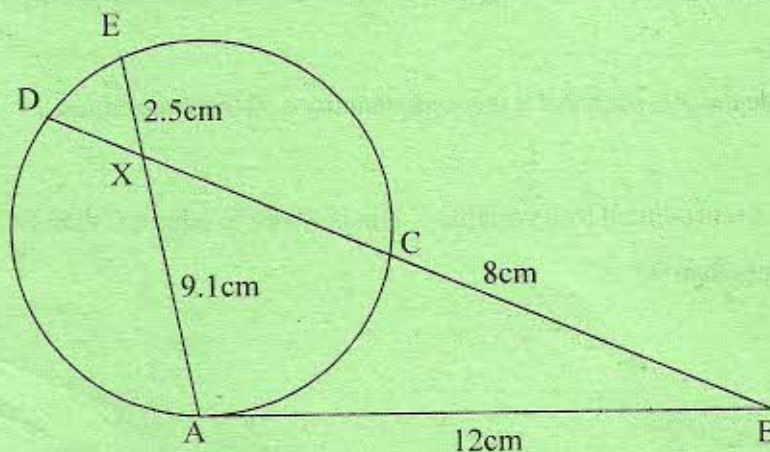
9. (a) Find the first 4 terms of the expansion $\left(1 - \frac{x}{2}\right)^7$ (1 mark)

(b) Use these terms to find the value of 1.1^7 (2 marks)

10. Two energy drinks; 'Spark' and 'Malty' each contain orange juice and glucose in liquid form in the ratios 1:3 and 3:2 respectively. 300 litres of 'Spark' is added to x litres of 'Malty' such that the final ratio of orange juice to glucose in the mixture is 9:11. Calculate the value of x . (3 marks)

11. A ship travels west at a speed of 240 knots from point $(15^\circ\text{N}, 15^\circ\text{E})$. Calculate its position after 5 hours. (2 marks)

12. The figure below shows a circle with a tangent AB, a chord DC produced to B and intersecting with chord EA at X. $AB=12\text{cm}$, $AX=9.1\text{cm}$, $XE=2.5\text{cm}$, $BC=8\text{cm}$.



Calculate the value of XC

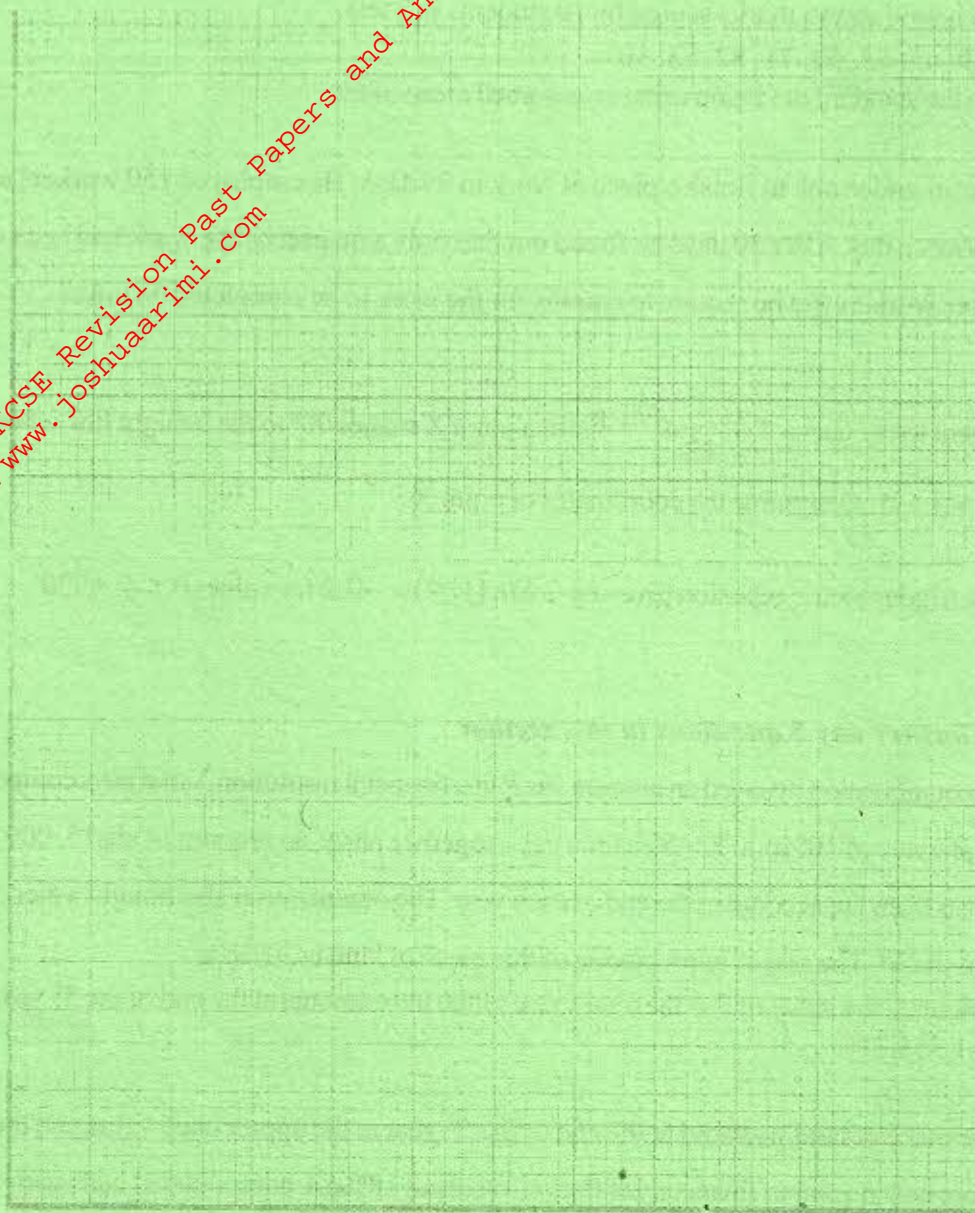
(4 marks)

13. The data below shows marks scored by 10 students in a test
71, 55, 69, 45, 65, 57, 71, 62, 55, 50
Calculate the standard deviation using an assumed mean of 60. (3 marks)
14. A contractor undertook to finish a piece of work in 80 days. He employed 150 workers each to work 6 hours a day. After 30 days he found out that only a quarter of the work had been done. How many more workers did he require to employ for the work to be completed on time? (3 marks)
15. The tangent to the curve $y = \frac{1}{12}x^4 - 8x$ at a point X makes 90° to the straight line whose equation is $y + x + 3 = 0$. Determine the coordinates of point X. (3 marks)
16. Solve the trigonometric equation given by $2 \sin\left(\frac{1}{2}\theta\right) = -0.2$ for values $0 \leq \theta \leq 720$ (3 marks)

SECTION II answer any 5 questions in this section

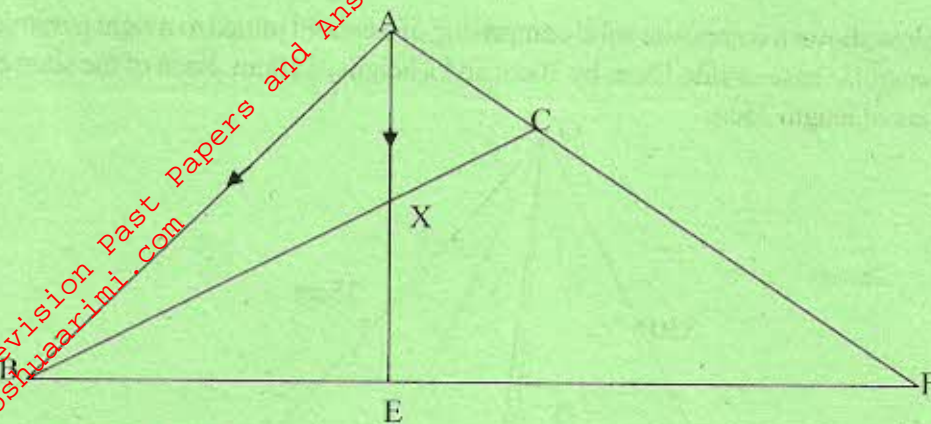
(50 marks)

17. A family organization invested an amount shs P in a financial institution X that pays compound interest at a rate of 10%p.a. To cater for a get-together party, an amount of shs15,000 is withdrawn from the account at the end of each year. The organization also bought a piece of land valued at shs $2P$. The rate of appreciation of this piece of land is 20%p.a.
- a) Calculate the value of P if the total value of the investments at the end of the 5th year is shs1,555,211. (7 marks)
- b) The piece of land was sold at the end of the 5th year at the appreciated value and the money deposited in another financial institution Y that pays 8%p.a. compounded half yearly. Calculate the interest that this account will earn in its first year of investment. (3 marks)
18. Given the function $y = -8\sin^2 x + 2\cos x + 5$, let $a = \cos x$
- a) Write down an expression of y in terms of a (1 mark)
- b) Fill in the table below to satisfy the function in (a) above. Give answers to one decimal place (2 marks)
- | | | | | | | | | | | | |
|---|----|------|------|------|------|---|-----|-----|-----|-----|-----|
| a | -1 | -0.8 | -0.6 | -0.4 | -0.2 | 0 | 0.2 | 0.4 | 0.6 | 0.8 | 1.0 |
| y | | | | | | | | | | | |
- c) On the grid below draw the graph of the function in part a) (3 marks)



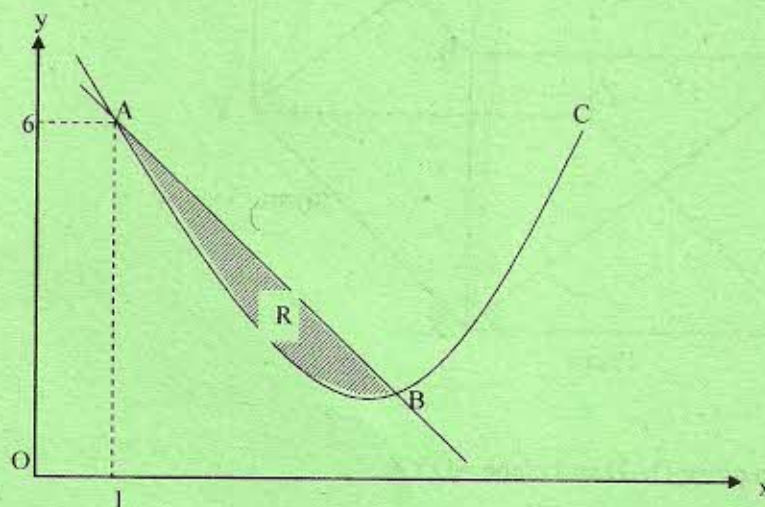
- d) Use your graph to solve the equation $8a^2 + 2a - 3 = 0$ (1 mark)
- e) Using your values acquired in d) above, determine using a calculator, the values of x in the range $0 \leq x \leq 360^\circ$ (2 marks)
- f) By drawing a suitable line on the same grid, solve for values of $270^\circ \leq x \leq 360^\circ$ the equation given by $2\cos^2 x = 1$ (2 marks)

19. In the figure below, $AB = a + 2b$, X is a point on BC and AE such that $BX:XC = 2:1$ and $AX:XE = 1:1$. $AX = 4a$



- a) Express BX , BC , BE and AC in terms of a and b (4 marks)
- b) If $AF = k$, AC and $BF = h$, express AF in two different ways and hence by solving determine the ratio of $BE : BF$ (6 marks)

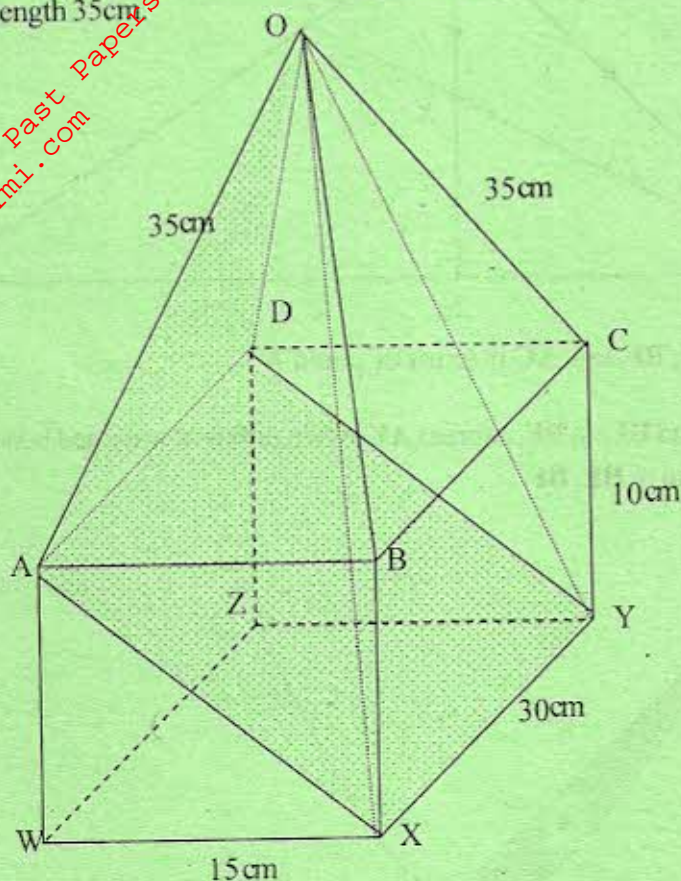
20.



The figure above shows part of a curve C with a gradient function given as $\frac{dy}{dx} = 3\sqrt{x} - 6$.
Given that the curve C passes through the point $A(1, 6)$ and has a minimum turning point at B

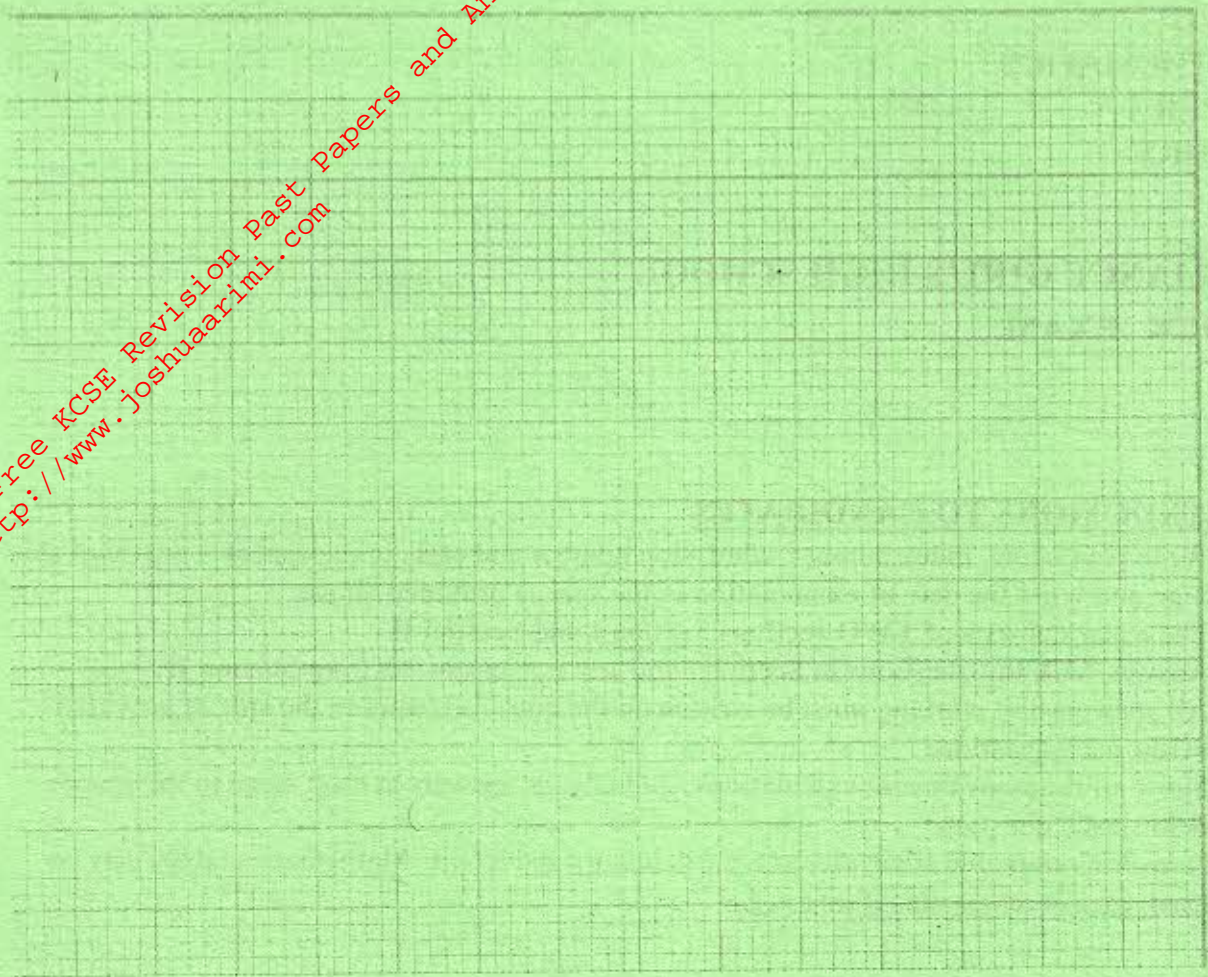
- a) Determine the equation of the curve C . (3 marks)
- b) Determine the coordinates of B . (3 marks)
- c) The region R shaded in the figure is bounded by the curve C and the straight line passing through A and B . calculate the exact area of region R ? (4 marks)
21. A man moves from a town A on a bearing of 036° to a town B which is 8.2km away. From point B he moves on a bearing of 088° to town C which is 10.6km from B . He finally moves to town D on a bearing of 297° at a distance of 25.7km from C .
Calculate
- a) How far west, town D is from town A ? (5 marks)
- b) The distance between town A and town C (2 marks)
- c) The bearing of A from C (3 marks)

22. Figure below shows a composite solid comprising of a cuboid joined to a right pyramid. The cuboid has a rectangular base of side 15cm by 30cm and a height of 10cm. Each of the slant edges in the pyramid are of length 35cm.



Calculate

- The angle between plane OAD and plane ADYX (4 marks)
 - The perpendicular distance of point O from the plane ADYX (2 marks)
 - The vertical height of point O above the base WXYZ (2 marks)
 - The angle between OX and the plane ADYX (4 marks)
23. For Saturday, a chemist has an order for 15 dozen vitamin pills S and an order for 10 dozen iron pills C. While making these two types of pills to fill the orders, they decide to make more of each for "off the street" customers. Past sales records indicate that the number of Cs should not exceed twice the number of Ss. On the other hand, evidence in the record gives the chemist confidence that at least 20 dozen more pills in total than those ordered can be sold.
- Acting on the above information, form all the inequalities by letting x = the number of dozen of S pills made and y = the number of dozen of C pills made. (3 marks)
 - Represent these inequalities in the grid below (4 marks)



- c) It costs shs36 per dozen to make the S – type pills and shs 48 per dozen to make the C – type pills. Using a search line determine how many of each type of pills should be made so that the total production costs will be as small as possible. Also, what will that cost be? (3 marks)

24. A box contains similar beads of different colours Red, Blue and Green. In the space below draw a tree diagram to show the different ways of selecting 3 beads from the box. (2 marks)

The box contains: 5 Red, 8 Blue and 11 Green beads.

- a) If three beads are selected with replacement, calculate the probability of picking beads of the same colour. (3 marks)
- b) y beads of each colour are removed from the box and put aside. Three beads are then selected from the box at random with replacement, calculate the value of y if the probability of selecting 3 beads of different colour is $\frac{1}{6}$ (5 marks)