

# MATHEMATICS PAPER 121/ 1 K.C.S.E 1999 QUESTIONS

**Answer all questions in this section**

1. (a) Evaluate

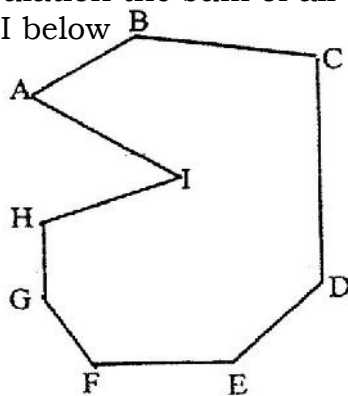
$$\frac{-8 \div 2 + 12 \times 9 - 4 \times 6}{56 \div 7 \times 2}$$

- (b) Simplify the expression

$$5a - 4b - 2 [a - (2b + c)]$$

2. A point  $(-5, 4)$  is mapped onto  $(-1, -1)$  by a translation. Find the image of  $(-4, 5)$  under the same translation.

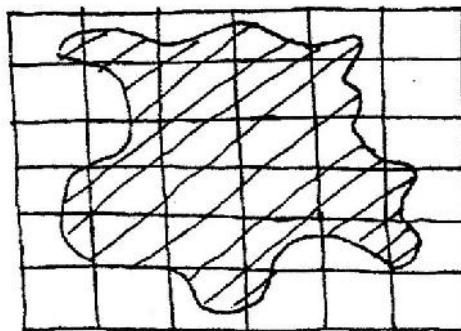
3. Find by calculation the sum of all the interior angles in the figure ABCDEFGHI below



4. An open right circular cone has a base radius of 5 cm and a perpendicular height of 12 cm.

Calculate the surface area of the cone (take  $\pi$  to be 3.142)

5. The figure below is a map of a forest drawn on a grid of 1 cm squares



- (a) Estimate the area of the map in square centimeters
- (b) If the scale of the map is 1: 50,000 estimate the area of the forest in hectares

6. The table below shows the weight and price of three commodities in a given period

Commodity	Weight	Price Relatives
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X	3	125
Y	4	164
Z	2	140

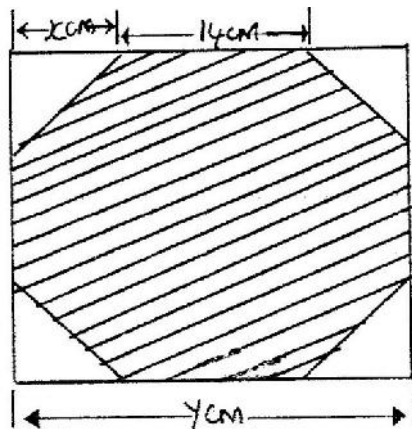
Calculate the retail index for the group of commodities

7. Two baskets A and B each contain a mixture of oranges and limes, all of the same size. Basket A contains 26 oranges and 13 limes. Basket B contains 18 oranges and 15 limes. A child selected a basket at random and picked a fruit at a random from it.

(a) Illustrate this information by a probabilities tree diagram

(b) Find the probability that the fruit picked was an orange

8. A girl wanted to make a rectangular octagon of side 14cm. She made it from a square piece of a card of size  $y$  cm by cutting off four isosceles triangles whose equal sides were  $x$  cm each, as shown below.



(a) Write down an expression for the octagon in terms of  $x$  and  $y$

(b) Find the value of  $x$

(c) Find the area of the octagon

9. The length and breadth of a rectangular floor were measured and found to be 4.1 m and 2.2 m respectively. If possible error of 0.01 m was made in each of the measurements, find the:

(a) maximum and minimum possible area of the floor

(b) Maximum possible wastage in carpet ordered to cover the whole floor

10. A business woman opened an account by depositing Kshs. 12,00 in a bank on 1<sup>st</sup> July 1995. Each subsequent year, she deposited the same amount on 1<sup>st</sup> July. The bank offered her 9% per annum compound interest. Calculate the total amount in her account on

(a) 30<sup>th</sup> June 1996

(b) 30<sup>th</sup> June 1997

11. Given below is line BC. Without using a protractor construct another through B making an angle of  $37\frac{1}{2}^\circ$  with BC. Using the constructed line subdivide BC into 7 equal parts.

B ————— C


12. ABCD is a cyclic quadrilateral and AB is a diameter. Angle  $ADC = 117^\circ$ . Giving reason for each step, calculate  $\angle BAC$ .
13. An artisan has 63 kg of metal of density  $7,000 \text{ kg/m}^3$ . He intends to use to make a rectangular pipe with external dimensions 12 cm by 15 cm and internal dimensions 10 cm by 12 cm. Calculate the length of the pipe in metres.
14. An equilateral triangle ABC lies in a horizontal plane, A vertical flag AH stand at A. If  $AB = 2 AH$  find the angle between the planes ABC and HBC.
15. By substituting triangle for  $(2 - 0)$  or otherwise simplify the expression  $(x + 2 - a)^2 + (2 - a - x)^2 - 2(x - 2 + a)(x + 2 - a)$ . Give your answer in terms of a and as a product of two squares.
16. A particle moves on a straight line. The velocity after  $t$  seconds is given by  $V = 3t^2 - 6t - 8$ . The distance of the particle from the origin after one second is 10 metres. Calculate the distance of the particle from the origin after 2 seconds.

## SECTION II (48 Marks)


*Answer any six questions from this section*

17. The cost of a minibus was Kshs. 950,000. It depreciated in value by 5% per year for the first two years by 15% per year for the subsequent years.
- Calculate the value of the minibus after 5 years
  - After 5 years the minibus was sold through a dealer at 25% more than its value to Mr. X. If the dealer's sale price was to be taken as its value after depreciation, calculate the average monthly rate of depreciation for 5 years.
18. A triangle plot of land ABC is such that  $AB = 34 \text{ m}$ ,  $AC = 66 \text{ m}$  and  $\angle BAC = 96.70^\circ$ .
- Calculate the length of BC
  - In order to subdivide the plot, a fencing post P is located on BC such that  $BP : PC = 1 : 3$ . Calculate the area of the plot ABC and hence find the area of the triangular subdivision APB.
  - A water pipe running through the subdivision APB is parallel to AB and divides the area in the ratio 4:5 where the bigger portion is a trapezium. Calculate the distance of the pipe from P.

- 

(a)  BAR

(b) ~~STR~~

(c)  BSU

- |                        |     |       |    |   |    |     |     |    |     |
|------------------------|-----|-------|----|---|----|-----|-----|----|-----|
| <b>x</b>               | -2  | -1.5  | -1 | 0 | 1  | 2   | 3   | 4  | 5   |
| <b>x<sup>2</sup></b>   |     | -3.4  | -1 | 0 | 1  |     | 27  | 64 | 125 |
| <b>-5x<sup>2</sup></b> | -20 | -11.3 | -5 | 0 | -1 | -20 | -45 |    |     |
| <b>2x</b>              | -4  | -3    |    | 0 | 2  | 4   | 6   | 8  | 10  |
| <b>9</b>               | 9   | 9     | 9  | 9 | 9  | 9   | 9   | 9  | 99  |
|                        |     | -8.7  |    |   | 9  | 7   |     | -3 |     |

(c) Using the graph estimate the root of the equation  $x^3 - 5x^2 + 2 + 9 = 0$  between  $x =$

(d) Using the same axes draw the graph of  $y = 4 - 4x$  and estimate a solution to the equation  $x^2 - 5x^2 + 6x + 5 = 0$

21. In triangle OAB,  $OA = a$   $OB = b$  and P lies on AB such that  $AP:BP = 3:5$   
(a) Find the terms of  $a$  and  $b$  the vectors

- (i) AB
- (ii) AP
- (iii) BP
- (iv) OP

- (b) Point Q is on OP such  $AQ = \frac{-5a}{8} + \frac{9b}{40}$

Find the ratio OQ:QP

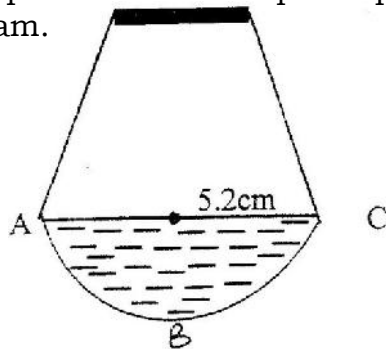
22. If  $x^2 + y^2 = 29$  and  $x + y = 3$

- (a) Determine the values of

- (i)  $x^2 + 2xy + y^2$
- (ii)  $2xy$
- (iii)  $x^2 - 2xy + y^2$
- (iv)  $x - y$

- (b) Find the value of  $x$  and  $y$

23. The diagram below shows a cross-section of a bottle. The lower part ABC is a hemisphere of radius 5.2 cm and the upper part is a frustrum of a cone. The top radius of the frustrum is one third of the radius of the hemisphere. The hemisphere part is completely filled water as shown in the diagram.

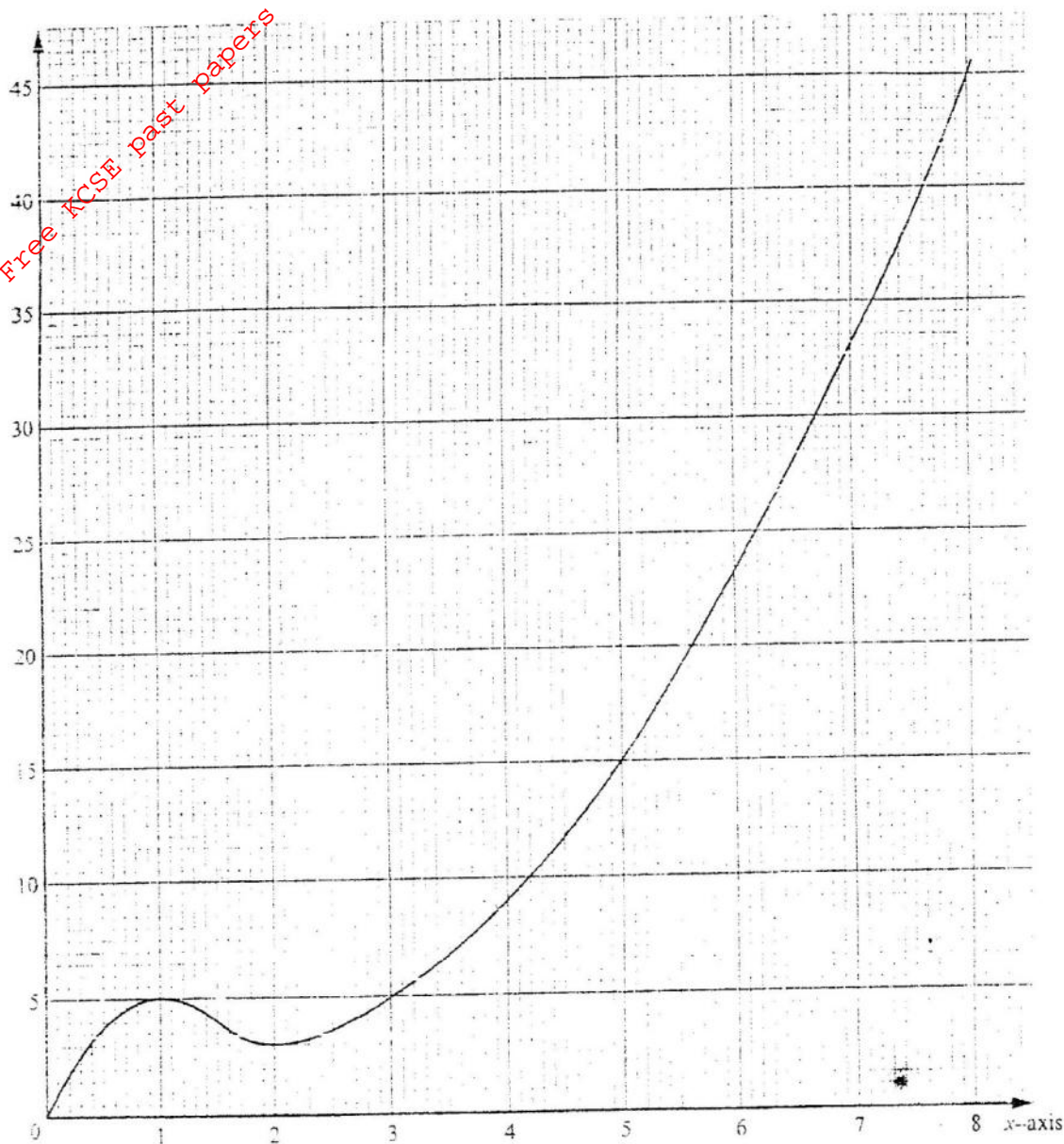


When the container is inverted, the water now completely fills only the frustrum part.

(a) Determine the height of the frustrum part

(b) Find the surface area of the frustrum part of the bottle.

24. The graph below consists of a non-quadratic part ( $0 \leq x \leq 2$ ) and a quadratic part ( $2 \leq x \leq 8$ ). The quadratic part is  $y = x^2 - 3x + 5$ ,  $2 \leq x \leq 8$



(a) Complete the table below

x	2	3	4	5	6	7	8
y	3						

( 1 mark)

(b) Use the trapezoidal rule with six strips to estimate the area enclosed by the

curve,  $x = \text{axis}$  and the line  $x = 2$  and  $x = 8$  ( 3 marks)

(c) Find the exact area of the region given in (b) ( 3 marks)

(d) If the trapezoidal rule is used to estimate the area under the curve between

$x = 0$  and  $x = 2$ , state whether it would give an under- estimate or an over estimate. Give a reason for your answer ( 1 mark)

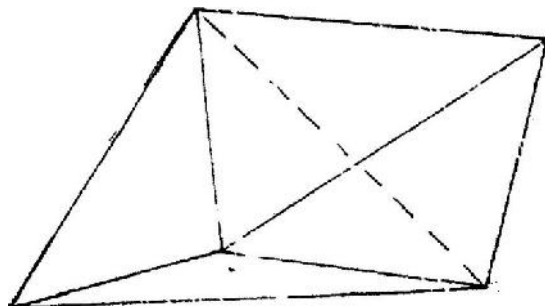
**MATHEMATICS PAPER 121/2 K.C.S.E 1999**  
**MARKING SCHEME**  
**SECTION 1 (52 Marks)**

**Answer all the questions in this section**

1. Use logarithms to evaluate  $\frac{\left( \frac{6.79 \times 0.3911}{\log 5} \right)^{3/4}}$
2. Find the range of  $x$  if  $2 \leq 3 - x < 5$
3. The mass of a mixture A of beans and maize is 72kg. The ratio of beans to maize is 3:5 respectively
  - (a) Find the mass of maize in the mixture
  - (b) A second mixture of B of beans and maize of mass 98 kg is mixed with A. The final ratio of beans to maize is 8:9 respectively. Find the ratio of beans to maize in B
4. Simplify  $\sqrt{2x \times 5^{2x-2}}$
5. In the month of January, an insurance salesman earned Kshs 6750 which was a commission of 4.5% of the premium paid to the company.
6. Solve for  $x$   $(\log_3 x)^2 - \frac{1}{2} \log_3 \frac{3}{2}$
7. The equation of a line is  $-\frac{3}{5}x + 3y = 6$

Find the:

- (a) Gradient of the line
  - (b) Equation of a line passing through point (1,2) and perpendicular to the given line.
8. The figure below shows a solid made by passing two equal regular tetrahedra.





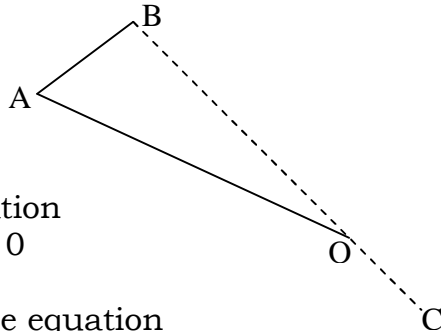
(a) Draw a net solid

(b) IF each face is an equilateral triangle of side 5cm find the surface area of the solid

9. Two towns A and B are 220km apart. A bus left town A at 11.00am and traveled towards B at 60 km/h. At the same time, a matatu left town B for town A and traveled at 80 km/h. The matatu stopped for a total of 45 minutes on the way before meeting the bus. Calculate the distance covered by the bus before meeting the matatu.

10. Use binomial expression to evaluate  $(0.96)^5$  correct to 4 significant figures

11. In the figure below triangle ABO represents a part of a school badge. The badge has as symmetry of order 4 about O. Complete the figures to show the badge.



12. Solve the equation  
 $8s^2 + 2s - 3 = 0$

Hence solve the equation

$$8 \sin^2 \theta + 2 \sin \theta - 3 = 0 \text{ for } 0^\circ \leq \theta \leq 180^\circ$$

13. The number of people who attended an agricultural show in one day was 510 men, 1080 women and some children. When the information was represented on a pie chart, the combined angle for the men and children was  $216^\circ$ . Find the angle representing the children.

14. The points P, Q and R lie on a straight line. The position vectors of P and R are  $2\mathbf{i} + 2\mathbf{j} + 13\mathbf{k}$  and  $5\mathbf{i} - 3\mathbf{j} + 4\mathbf{k}$  respectively. Q divides PR internally in the ratio 2:1

Find the

(a) Position vector of Q.

15. A construction firm has tractors  $T_1$  and  $T_2$ . Both tractors working together can

complete a piece of work in 6 days while  $T_1$  alone can complete the work in 15 days. After two tractors had worked together for four days, tractor  $T_1$  broke down.

Find the time it takes tractor  $T_2$  to complete the remaining work

16. Find the equation of the tangent to the curve

$$Y = (x^2 + 1)(x - 2) \text{ when } x = 2$$

**SECTION II ( 48 Marks)**

**Answer any six questions from this section**

17. A retailer bought 49kg of grade 1 rice at Kshs. 65 per kilogram and 60 kg of grade II rice at Kshs 27.50 per kilogram. He mixed the tow types of rice.

(a) Find the buying price of one kilogram of the mixture

(b) He packed the mixture into 2 kg packets

(i) If he intends to make a 20% profit find the selling price per packet

(ii) He sold 8 packets and then reduced the price by 10% inorder to attract customers. Find the new selling price per packet.

(iii) After selling of the remainder at reduced price, he raised the price so as to realize the original goal of 20% profit overall. Find the selling price per packet of the remaining rice.

18. A tower is on a bearing of  $030^\circ$  from a point P and a distance of elevation of the

top is  $15^\circ$  and the angle of depression of the foot of the tower is  $1^\circ$ .

a) Find the height of the tower

b) A point Q is on the same horizon plane as point P. The tower is on a bearing  $330^\circ$  from Q and at a distance of 70 m

19. Patients who attend a clinic in one week were grouped by age as shown in the table below:

Age x years	$0 \leq x < 5$	$5 \leq x < 15$	$15 \leq x < 25$	$25 \leq x < 45$	$45 \leq x < 75$
No. of patients	14	41	59	70	15

i. Estimate the mean age

ii. On the grid provided draw a histogram to represent the distribution

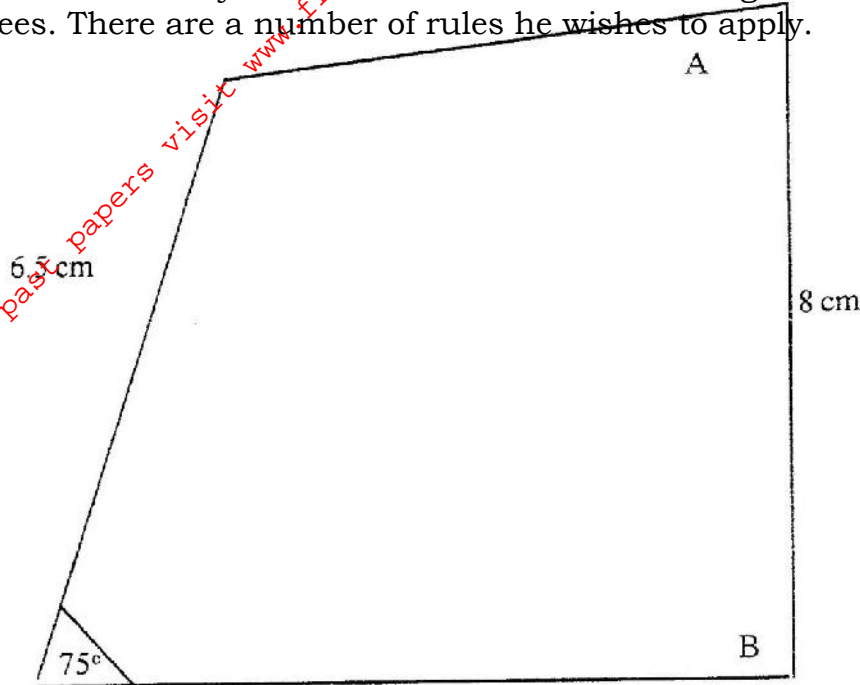
1 cm to represent 5 unit on the horizon axis

2 cm to represent 5 units on the vertical axis

20. The first term of an arithmetic progression is 4 and the last term is 20. The sum of the term is 252. Calculate the number of terms and the common differences of the arithmetic progression

(b) An Experimental culture has an initial population of 50 bacteria. The population increased by 80% every 20 minutes. Determine the time it will take to have a population of 1.2 million bacteria.

21. The diagram below shows a garden drawn to scale of 1: 400. In the garden there are already two trees marked A and B. The gardener wishes to plant more trees. There are a number of rules he wishes to apply.



- Rule 1: Each new tree must be an equal distance from both trees A and B.  
 Rule 2: Each new tree must be at least 4 m from the edges of the garden.  
 Rule 3: each new tree is at least 14 m from tree B.

- (a) draw the locus given by each of these rules on the diagram
- (b) If the new trees are to be planted 4m apart, show on your diagram the possible planting points for the new trees.
22. (a) complete the table below, giving your values correct to 2 decimal places.

x	0	10	20	30	40	50	60	70
Tan x	0							
$2x + 300$	30	50	70	90	110	130	150	170
$\sin (2x + 30^\circ)$	0.50			1				

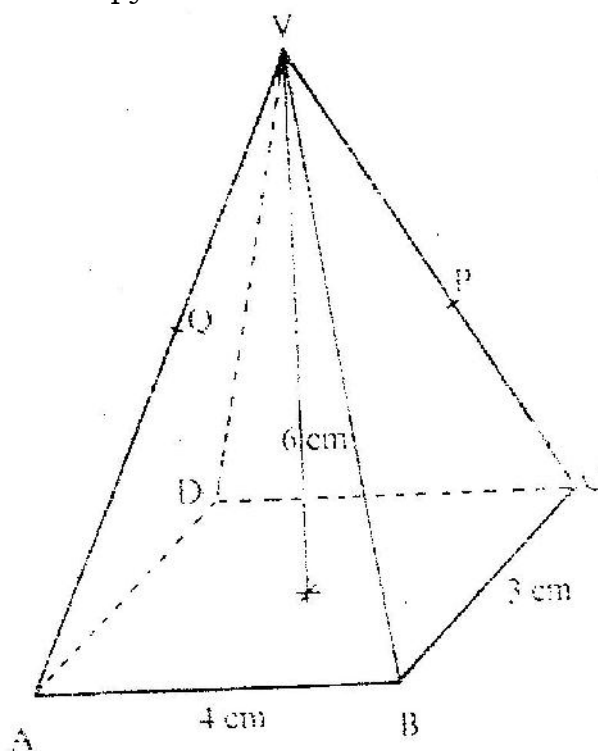
- b) On the grid provided, draw the graphs of  $y = \tan x$  and  $y = \sin (2x + 30^\circ)$  for  $0^\circ \leq x \leq 70^\circ$   
 Take scale: 2 cm for 100 on the x- axis  
 4 cm for unit on the y- axis  
 Use your graph to solve the equation  $\tan x - \sin (2x + 30^\circ) = 0$

23. The transformation R given by the matrix

$$A = \begin{pmatrix} a & b \\ c & d \end{pmatrix} \text{ maps } \begin{pmatrix} 17 \\ 0 \end{pmatrix} \text{ to } \begin{pmatrix} 15 \\ 8 \end{pmatrix} \text{ and } \begin{pmatrix} 0 \\ 17 \end{pmatrix} \text{ to } \begin{pmatrix} -8 \\ 15 \end{pmatrix}$$

- Determine the matrix A giving a, b, c and d as fractions
- Given that A represents a rotation through the origin determine the angle of rotation
- S is a rotation through  $180^\circ$  about the point (2, 3). Determine the image of (1, 0) under S followed by R.

24. The diagram below shows a right pyramid VABCD with V as the vertex. The base of the pyramid is rectangle ABCD, WITH  $ab = 4$  cm and  $BC = 3$  cm. The height of the pyramid is 6 cm.



- Calculate the
  - length of the projection of VA on the base
  - Angle between the face VAB and the base
- P is the mid-point of VC and Q is the mid-point of VD. Find the angle between the planes VAB and the plane ABPQ