## **TERM 2-2022**

## **MATHEMATICS (QUESTION PAPER)**

## **FORM 4**

## **TIME 2½ HOURS**

PAPER 2

## **Name………………………………………………………………… Adm No………………………………..**

## **School…………………………………………………………………. Class…………………………………….**

## **Signature………………………………………………………… Date………………………………………**

***Instructions to Candidates***

1. *Write your name, admission number and class in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *This paper consists of* ***two*** *sections****; Section I*** *and* ***Section II.***
4. *Answer* ***all*** *the questions in* ***Section I*** *and any* ***five*** *questions from* ***Section II***
5. ***Show all the steps in your calculations, giving your answers at each stage in the spaces provided below each question***
6. *Marks may be given for correct working even if the answer is wrong.*
7. *Non-programmable silent electronic calculators and KNEC Mathematical tables may be used, except where stated otherwise.*
8. ***This paper consists of 14 printed pages.***
9. ***Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***

**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**

**Grand**

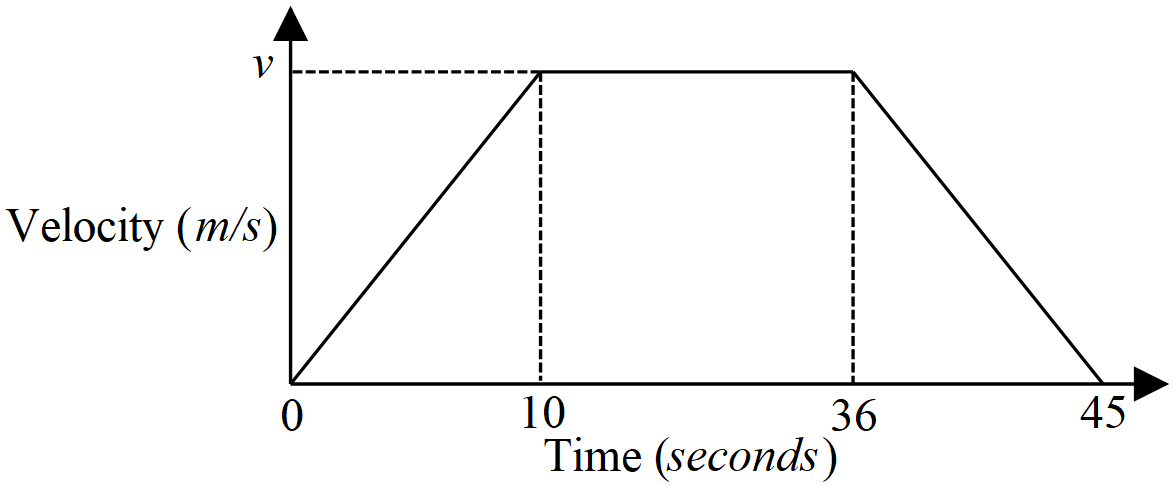
**Total**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **17** | **18** | **19** | **20** | **21** | **22** | **23** | **24** | **Total** |
|  |  |  |  |  |  |  |  |  |

**SECTION I (50 Marks)**

*Answer* ***all*** *the questions in this section in the spaces provided below each question*

1. A quadratic equation has roots as and . Write the equation in the form , where and are integers. (3 marks)
2. Given that and , find the maximum value of: (2 marks)
3. Without using a mathematical table or a calculator, write the expression below in the form , where and are constants (3 marks)
4. Solve for in the equation (3 marks)
5. A truck is bought at Kshs. 1,800,000. It depreciates by 10% per annum in the first 2 years, thereafter its annual depreciation rate is 15%. Find the value of the truck after 5 years. (4 marks)
6. The position vectors of points A and B are and respectively. Calculate the magnitude of correct to 3 decimal places. (3 marks)
7. The figure below shows the velocity-time graph of a particle that moves for 60 seconds and covered a distance of 852 metres.



Calculate the value of (2 marks)

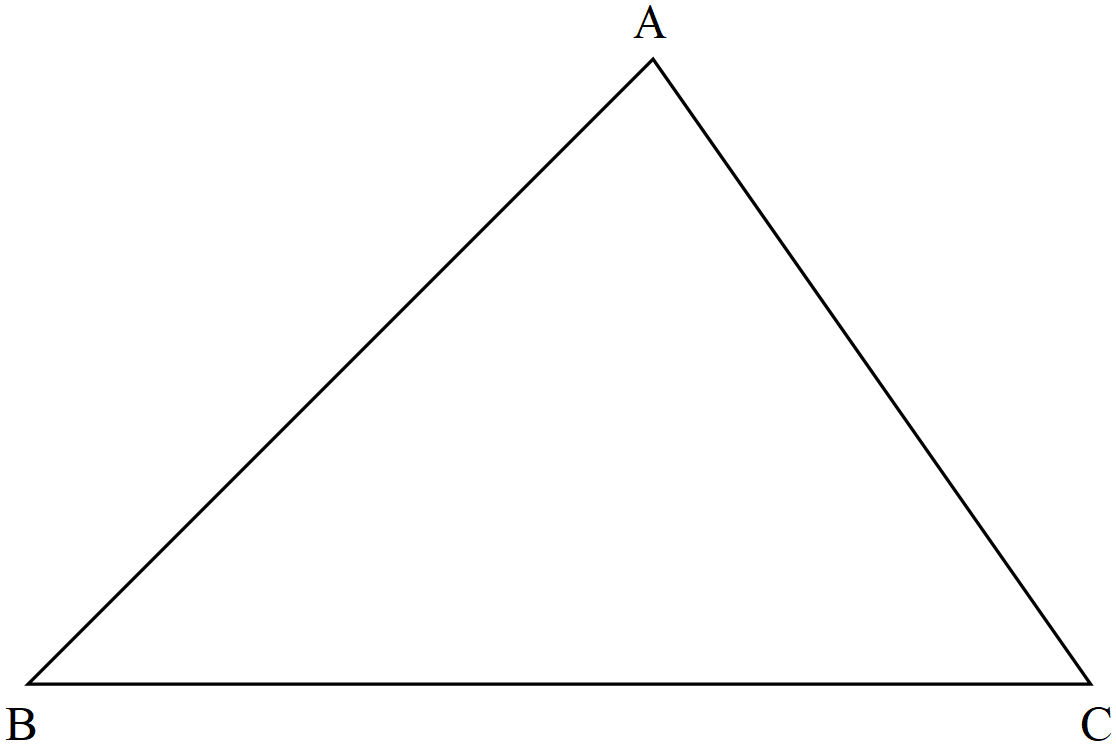
1. Make the subject of the formula: (3 marks)
2. The equation of a circle is . Determine the co-ordinates of the centre and the area of the circle in terms of π (3 marks)
3. (a) Expand in ascending powers of up to the term in (1 mark)

(b) Use your expansion to evaluate correct to 5 decimal places. (2 marks)

1. (a) Complete the table below for the function for (1 mark)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | 2 |  | 5 |  |  |

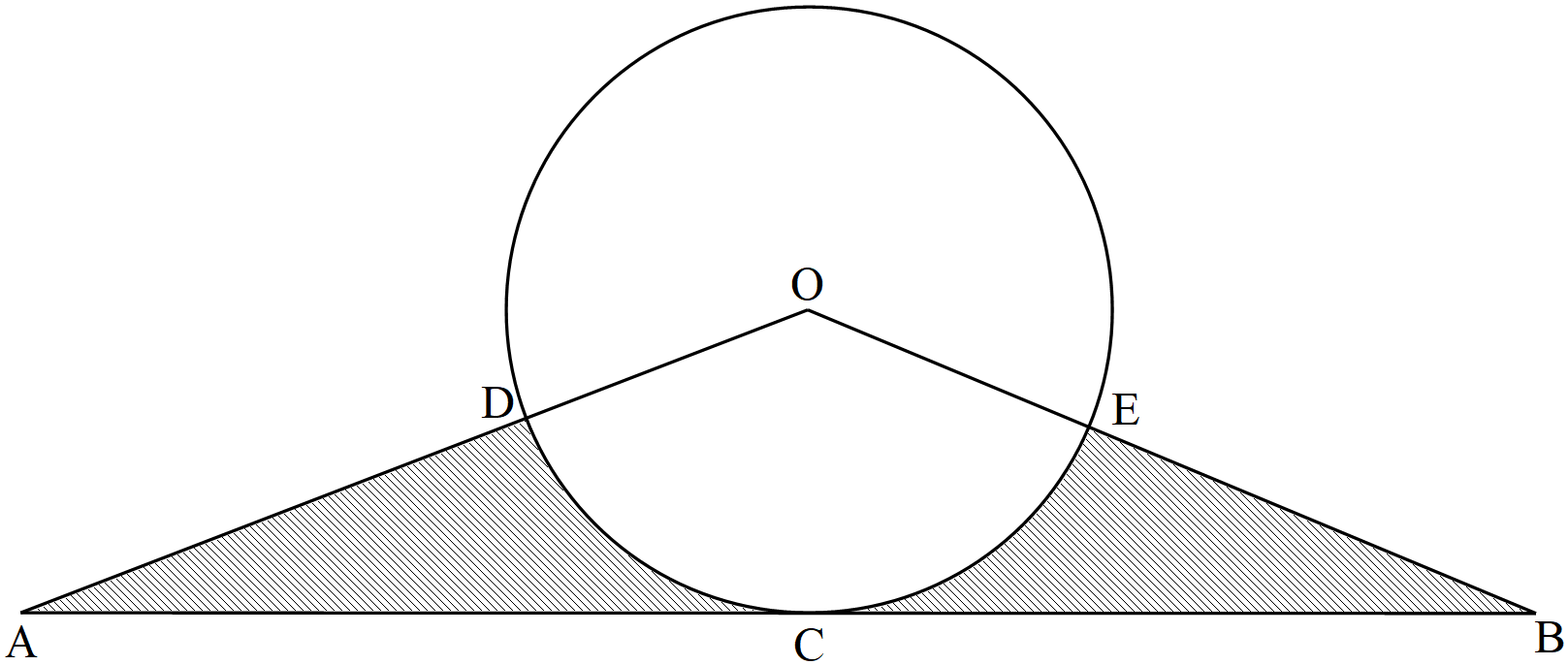
1. Use the mid-ordinate rule with 4 strips to find the area bound by the function, the x-axis and the lines and . (2 marks)
2. A town T lies on latitude 370N and longitude 500E. An airport is located on another town R whose longitude is 100W on the same latitude as T. An aeroplane leaves town T and flies westwards to R. Calculate the distance covered by the plane in km. (Take R = 6370km and) (3 marks)
3. The diagram below shows a plot of land. Shade the region R enclosed under the following conditions:
4. is more than 2 cm from line AB
5. R is nearer to CB than CA



By construction and using a scale of 1 cm to represent 10 metres, shade the region where the borehole lies.

(5 marks)

1. In the figure below, O is the centre of the circle. AB is a tangent to the circle at C. AD=17cm and AO=24cm



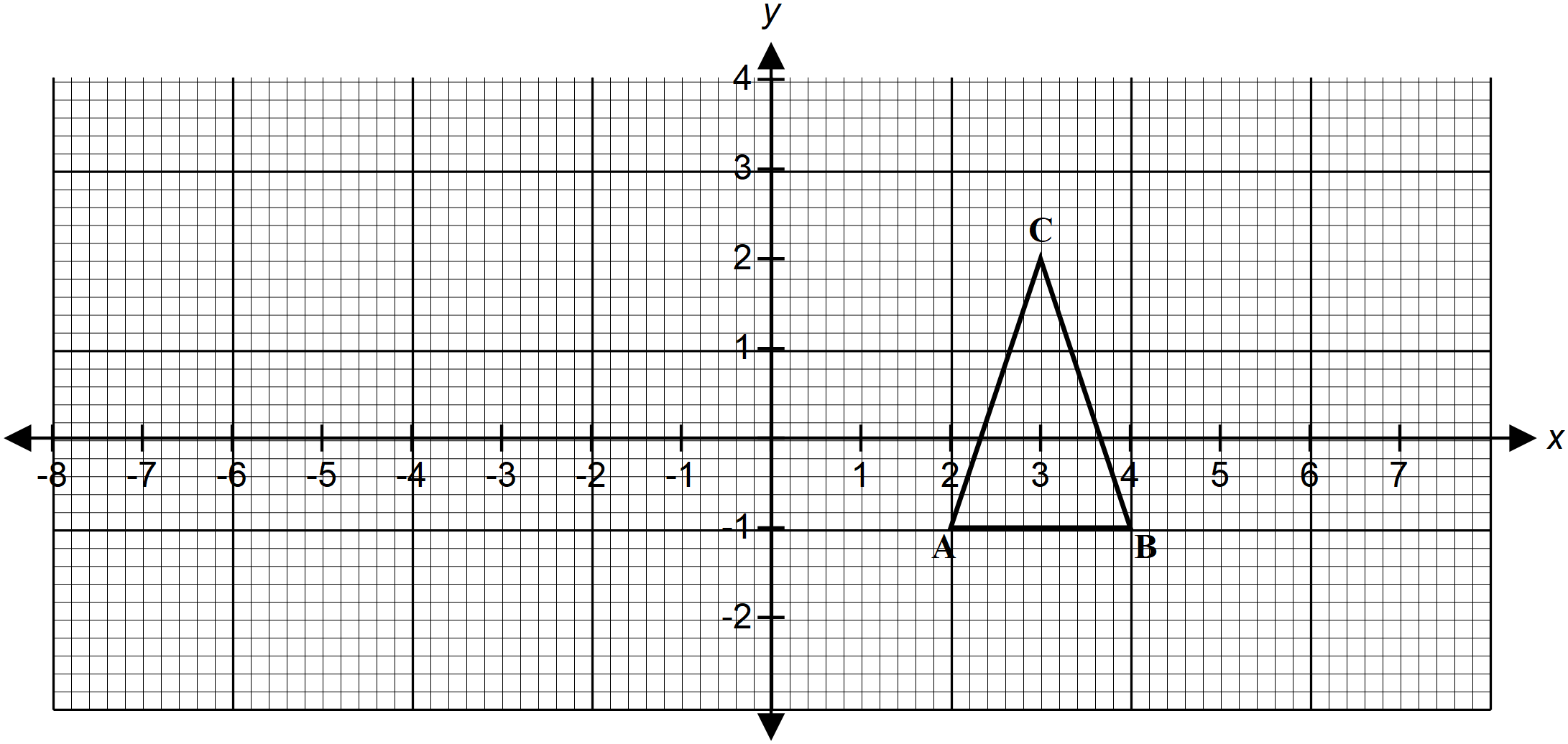
Calculate the shaded area correct to 4 significant figures. (4 marks)

1. A trader makes two types of chairs; ordinary and special. The cost of each ordinary chair is Kshs. 300 while the cost of a special chair is Kshs. 700. He is prepared to spend not more than Kshs. 21, 000. It is not viable for him to make less than 20 chairs. Ordinary chairs must be less than twice the special chairs but more than 15. By taking the number of ordinary chairs as *x* and the special chairs as *y*; Write down all the inequalities representing the above information. (4 marks)
2. A construction firm has two tractors; P and Q. tractor P completes a job in 4 days while tractor Q completes the work in 6 days. The two tractors start working together and after 2 days, tractor P breaks down. How long does it take Q to complete the remaining work? (3 marks)

**SECTION II (50 marks)**

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

1. The graph below shows a triangle C with vertices and
   1. Δ is the image of under a transformation given by the matrix . Determine the coordinates of and (2 marks)
   2. On the grid provided draw ∆ and describe the transformation fully (3 marks)



* 1. ∆ is the image of ∆ under a reflection along the line . Draw ∆ on the same pair of axes and state its coordinates (2 marks)
  2. Determine the matrix representing a single transformation that maps ∆ onto ∆ (3 marks)

1. (a) Write down the first three terms of the sequence whose nth term is given by (1 mark)

(b) The third and the sixth terms of a geometric sequence are 18 and 486 respectively. Find the first term and the common ratio of the sequence. (3 marks)

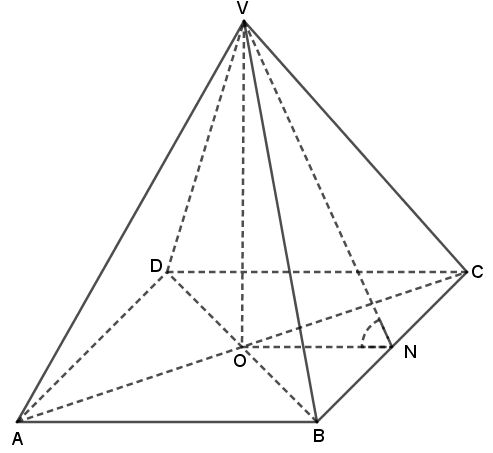
(c) The first and the last terms of an arithmetic progression are and respectively. If the sum of the first terms of this arithmetic progression is , find the number of terms in the progression (2 marks)

(d) The second, fourth and seventh terms of an arithmetic progression are the first three terms of a geometric progression. Find the common ratio of the geometric progression if the first term of the arithmetic progression is 2 (4 marks)

1. (a) Three variables and are such that varies partly as the square of and partly inversely as the square root of . Determine:
2. The relationship between and given that when and and also when , and (4 marks)
3. when and (2 marks)

(b) Four quantities and are such that varies jointly with , the square root of and inversely as the square of . Find the percentage change in if increases by 21%, decreases by 36% and increases by 10% (4 marks)

1. A particle moves along a straight line such that its displacement metres from a given point   
    where is time in seconds. Calculate:
2. The displacement of the particle at (2 marks)
3. The velocity of the particle when (3 marks)
4. The values of when the particle is momentarily at rest (3 marks)
5. The acceleration of the particle (2 marks)
6. The figure below shows a right pyramid standing on a rectangular base ABCD. AB=8 cm, BC=15 cm and each slant edge is 12 cm long. N is the midpoint of BC



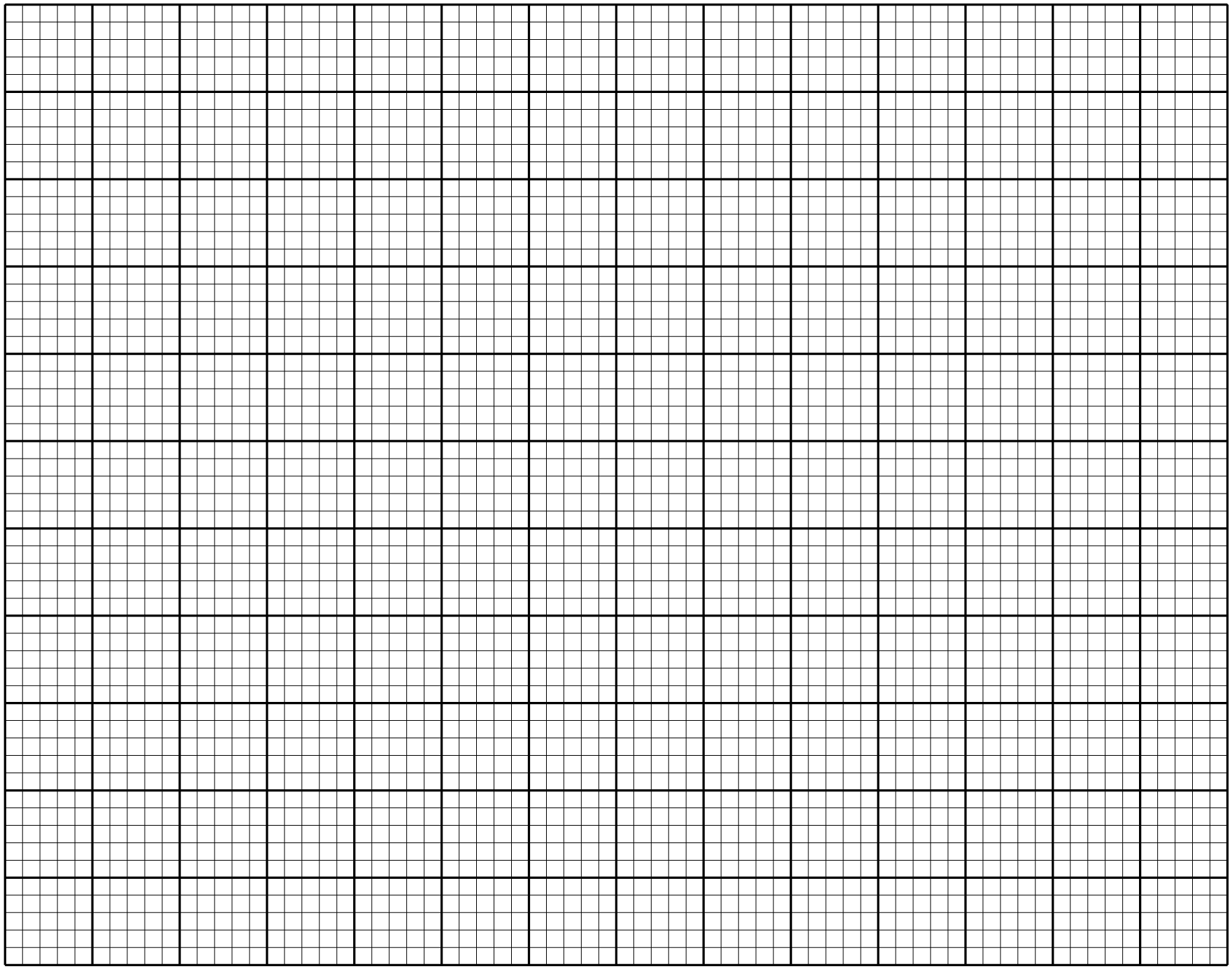
Calculate to two decimal places

1. The vertical height of the pyramid (3 marks)
2. The volume of the pyramid. (1 mark)
3. The obtuse angle between the planes VBC and VAD of the pyramid (4 marks)
4. The angle between line VD and the base (2 marks)
5. (a) Complete the table below giving the values correct to 2 decimal places. (2 marks)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | 0.50 |  |  | 0.87 |  | 0.00 |  | -0.87 |  |  | -0.50 |  | 0.50 |
|  | 1.73 |  | 0.00 |  | -1.73 |  | -1.73 |  | 0.00 |  |  | 2.00 | 1.73 |

(b) On the same set of axes, draw the graphs of and for .

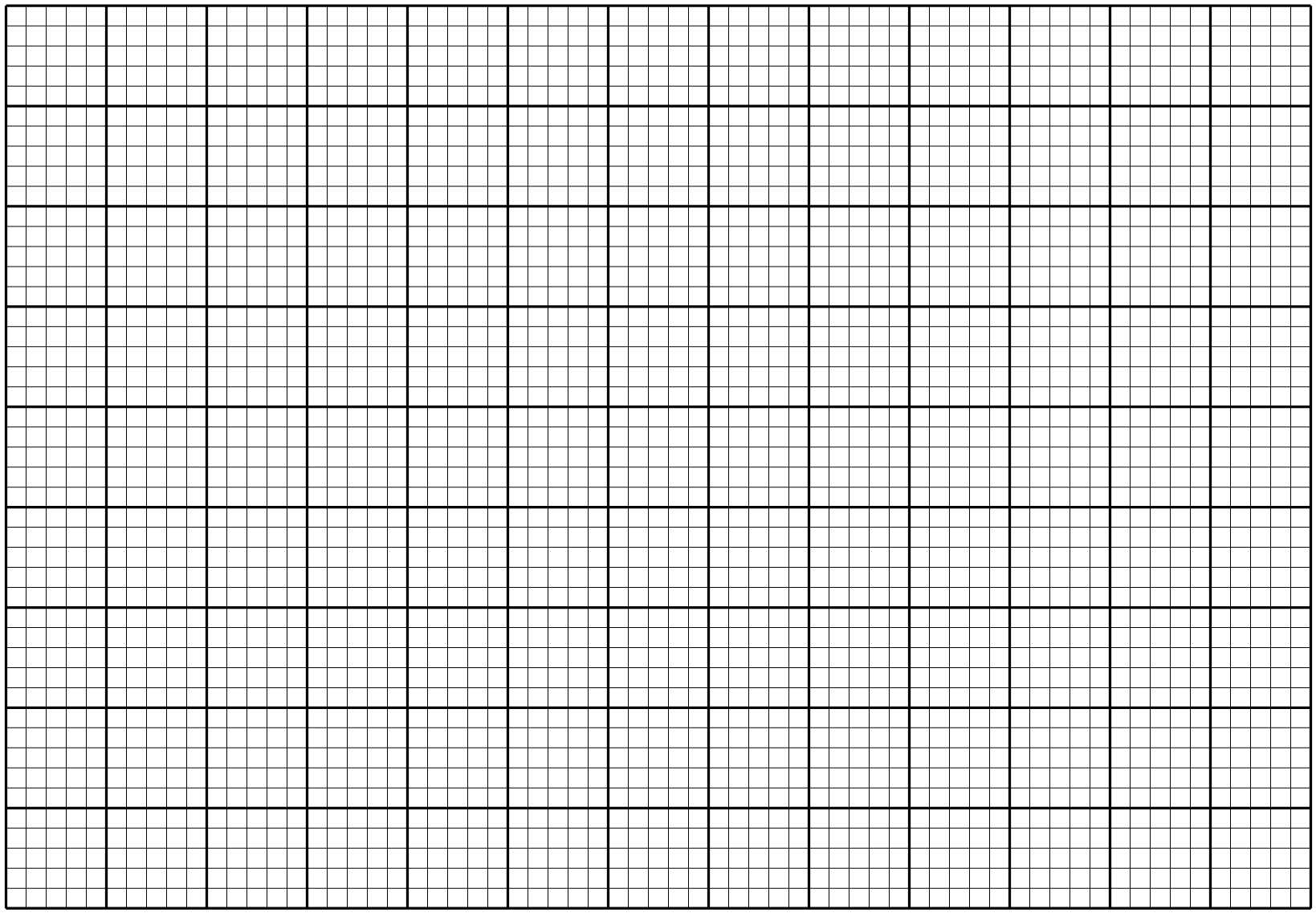
Use the scales *x*-axis; 1 cm to represent 300 and *y*-axis; 2 cm to represent 1 unit. (5 marks)



1. Use you graphs to solve the equation (2 marks)
2. State the amplitude of (1 mark)
3. A triangle OPQ, R and S are points on and respectively, such that and . and intersect at T. Given that and .
4. Express in terms and
5. (1 mark)
6. (1 mark)
7. Given that and , express in terms of
8. and (2 marks)
9. and (2 marks)
10. Find the values of and (4 marks)
11. The test scores obtained by 40 students were recorded as shown in the table below

|  |  |
| --- | --- |
| Marks | No. of Students |
| 61 – 65 | 4 |
| 66 – 70 | 5 |
| 71 – 75 | 9 |
| 76 – 80 | 8 |
| 81 – 85 | 8 |
| 86 – 90 | 6 |

1. Using a working mean of 73, calculate
2. the mean mark (4 marks)
3. the standard deviation (3 marks)
4. (i) On the grid provided, draw an ogive to represent the information in the table (3 marks)



(ii) Us the ogive to estimate the marks scored by the 25th student. (1 mark)