NORTH VISTA SECONDARY SCHOOL
Preliminary Examination 2024
Secondary 4 Express/ 5 Normal Academic

90

CANDIDATE NAME

CLASS

INDEX NUMBER

MATHEMATICS 4052/01

Paper 1 **19 August 2024**

2 hours 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
The number of marks is given in brackets [ ] at the end of each question or part question.

If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The total of the marks for this paper is **90**.

The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π , use either your calculator value or 3.142.

For Examiner's Use	
Category	**Question**
Accuracy	
Brackets	
Fractions	
Units	
Others	
Marks Deducted	

This document consists of 20 printed pages.

Mathematical Formulae

Compound Interest

$$\text{Total amount} = P\left(1+\frac{r}{100}\right)^n$$

Mensuration

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Volume of a sphere = $\frac{4}{3}\pi r^3$

Area of triangle ABC = $\frac{1}{2}ab\sin C$

Arc length = $r\theta$, where θ is in radians

Sector area = $\frac{1}{2}r^2\theta$, where θ is in radians

Trigonometry

$$\frac{a}{\sin A}=\frac{b}{\sin B}=\frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

Statistics

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

$$\text{Standard deviation} = \sqrt{\frac{\sum fx^2}{\sum f} - \left(\frac{\sum fx}{\sum f}\right)^2}$$

Answer **all** the questions.

1 Calculate $\dfrac{13.5+14.04}{-0.31+\sqrt[3]{15.625}}$, giving your answer correct to one significant figure.

Answer ……... [1]

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2 Alex buys a shirt at a price of £14.75.
Paul buys a shirt at a price of $21.99.
The exchange rate is $1 = £0.73.
Calculate how much more Paul pays than Alex.

Answer …...…….……... [2]

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3 **(a)** Simplify $5(3^3 \times 5^4)^2$.

Give your answer in the form $3^a \times 5^b$.

Answer …...…….……... [1]

(b) $$2^{100} - 4 \times 2^{97} = 2^k$$

Use laws of indices to find the value of *k*.
Show your working.

Answer k = ……..……... [2]

4 **(a)** A number p has exactly 12 factors. Two of the factors are 4 and 15.
Find the value of p.

Answer p = ……... [1]

(b) **(i)** Express 525 as the product of its prime factors.

Answer ……..…… [1]

(ii) The LCM of 15, x and 35 is 525.
Find two possible values of x between 15 and 100.

Answer x = ……. , …… [2]

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5 Jessica invests \$4540 at a rate of r % per year compound interest.
At the end of 10 years, she has earned \$1328.54 in interest.
Calculate the value of r.

Answer r = ……...…… [3]

6 Ayden claims that a regular polygon can be formed with the ratio

interior angle to exterior angle = 5: 4.

Explain why Ayden is wrong.

……...……

……...……

……...…… [2]

---

7 The expression $x^2 + ax + 17$ can be written in the form $(x-6)^2 + b$.

(a) Find the value of *a* and of *b*.

Answer a = ……..

b = …….. [2]

(b) Explain why when $x = 6$, the expression $x^2 + ax + 17$ has its minimum value.

……...…….

……...……. [1]

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8 A shopkeeper makes a loss of 24% when he sells an article for $136.
Calculate the selling price of the article in order for the shopkeeper to make a profit of 40%.

Answer $……...……. [2]

9 A bag contains some yellow and blue balls.
The ratio of the yellow balls to the blue balls is 1 : 4.
5 yellow balls are removed from the bag and 10 blue balls are added to the bag.
The new ratio of yellow balls to blue balls is 1 : 6.
Find the original number of yellow balls in the bag.

Answer …..…….…… [3]

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10 It is given $P(-4, 2)$, $Q(2, 10)$ and $R(-4, -5)$.

(a) Write down the equation of the line *PR*.

Answer ……... [1]

(b) The line $5y + 10 = mx$ has the same gradient as *QR*.
Find the value of *m*.

Answer m = ……... [2]

11 Each term in this sequence is found by subtracting the same number from the previous term.

78, a, b, c, 42, ……

(a) Find the values of a, b and c.

Answer a = …….

b = …….

c = ……. [2]

(b) Write down an expression, in terms of n for the nth term.

Answer …..……..…… [1]

(c) Write an inequality in n and solve it to find the first negative term of this sequence.

Answer …..……..…… [2]

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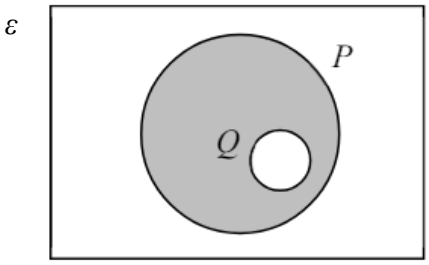
12 **(a)** Write down the set represented by the shaded region.



Answer …..……..…… [1]

12 **(b)** ε = {integer x : $1 \leq x < 15$ }
A = {perfect squares}
B = {prime numbers}

(i) Find $\mathrm{n}(A \cup B)'$.

Answer …..…….…… [1]

(ii) List the elements in $A \cap B'$.

Answer …..…….…… [1]

(iii) Given that $C \subset (A \cap B')$ and n(C) > 0, list the elements in one possible set of C.

Answer …..…… [1]

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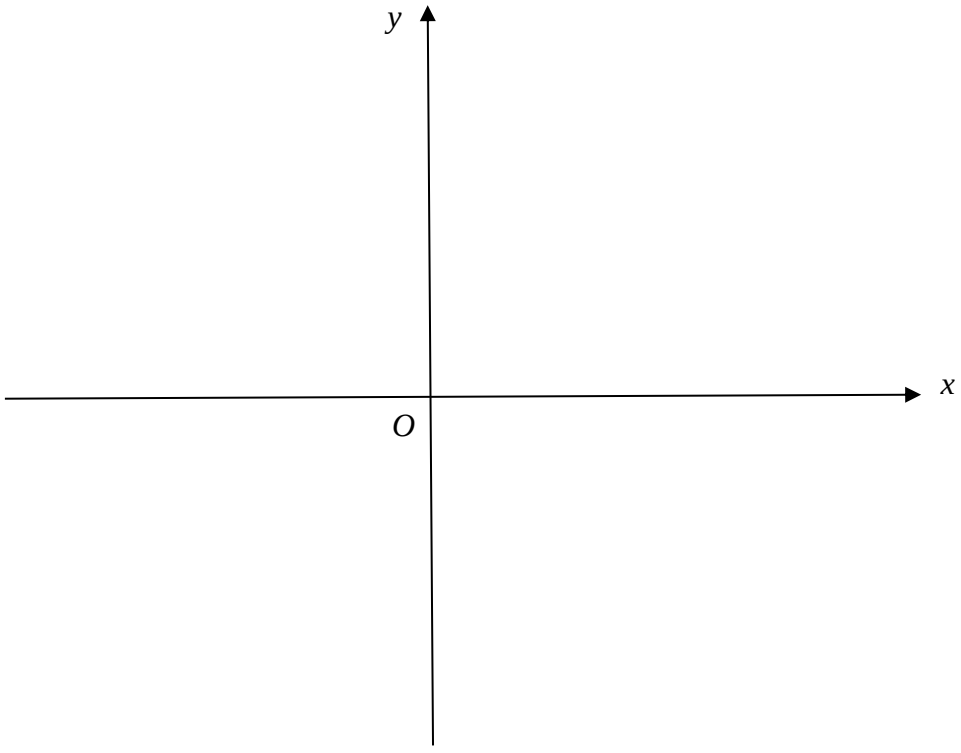
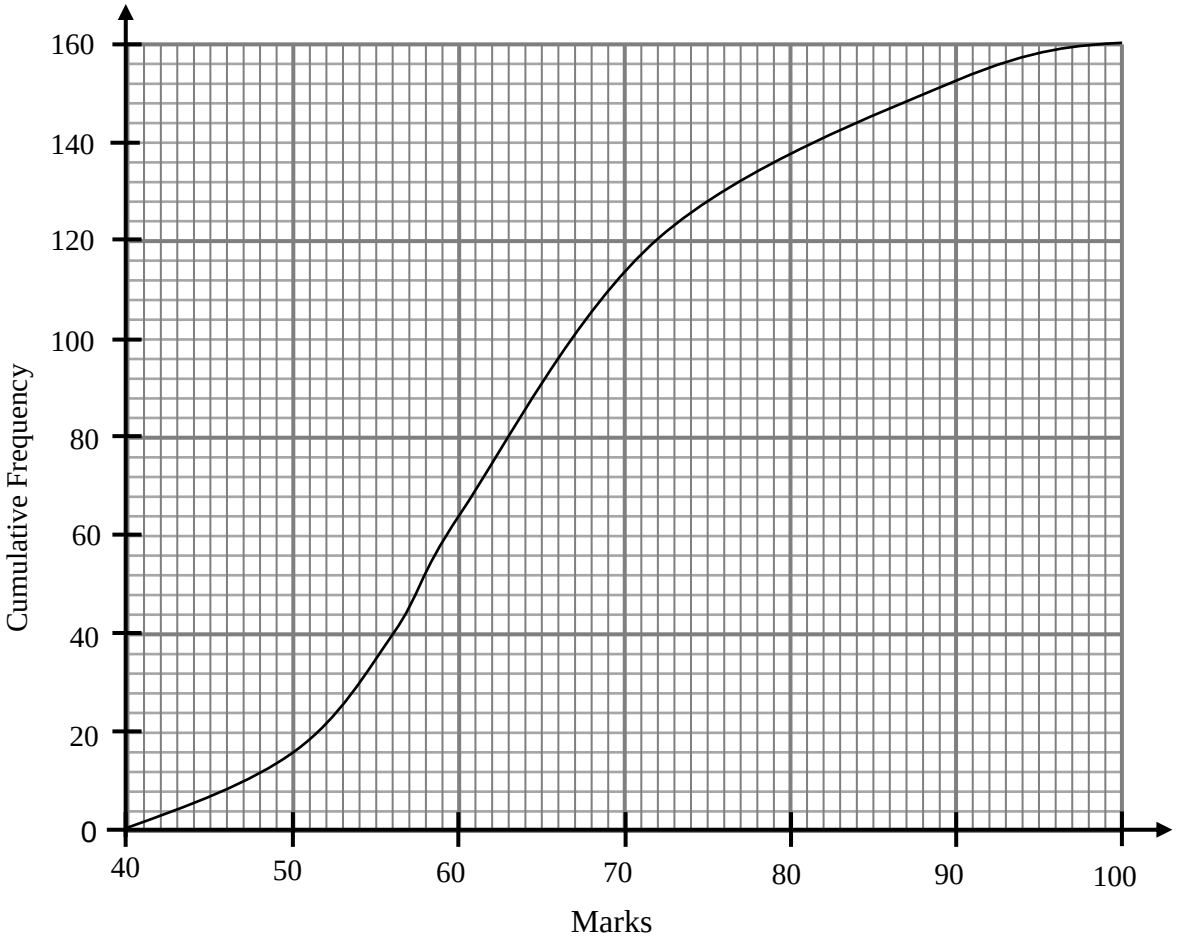
13 Sketch the graph of $y = (4 - x)(2 + x)$.
State clearly the coordinates of the points where the graph crosses the axes and the turning point on the curve. [3]



14 The diagram shows the marks obtained, out of 100, by 160 local students in a Mathematics test. The cumulative frequency curve shows the distribution of the marks.



(a) Use the curve to find

(i) the median mark,

Answer ……... [1]

(ii) the interquartile range of the distribution.

Answer ……... [2]

(b) A group of 160 foreign students took the same test and had the same median as the group of local students but a higher interquartile range.
Describe how the cumulative frequency curve for the group of foreign students may differ from the curve for the group of local students.

……...……...……..

……...……...……...… [1]

[Turn over

15 Write as a single fraction in its simplest form $\frac{x}{x+9}-\frac{4x+3}{x^2-81}$.

Answer ……...…… [2]

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16 **(a)** Expand and simplify $(2x+3y)(7x-5y)$.

Answer ……...…… [2]

(b) Factorise completely.

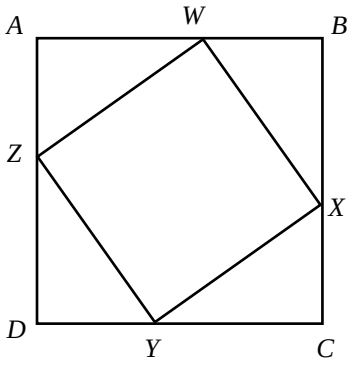
(i) $x^3y^3-xy^3$

Answer ……...…… [2]

(ii) $5ax-3ay-10cx+6cy$

Answer ……...…… [2]

17 Destin folded a square paper napkin, *ABCD*, along the lines *WX*, *XY*, *YZ* and *WZ* as shown. He ensured that $AW = BX = CY = DZ$.



Prove that triangle *AWZ* is congruent to triangle *BXW*.

……..…….

……...……...…….

……...……...……..……... [2]

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18 **(a)** *y* is directly proportional to the cube root of $(x + 1)$.

It is given that $x = 7$ when $y = 1$. Find the value of *y* when $x = 124$.

Answer $y =$ ……... [2]

18 **(b)** *F* is inversely proportional to the square of *d*.

Explain what happens to *F* when *d* is halved.

……..……

……. [2]

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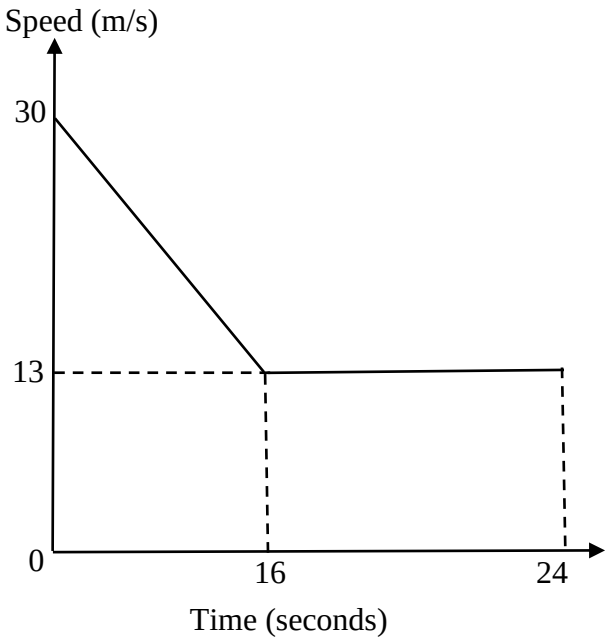
19 The diagram below shows the speed–time graph of part of a car's journey.



Calculate

(a) the deceleration of the car in the first 16 seconds,

Answer …..…….……m/s^2 [1]

(b) the average speed of the car during the 24 seconds.

Answer ……....……m/s [2]

20 The following table shows the amount of flour, butter and sugar in grams needed in making a pandan cake and a marble cake.

	Flour	**Butter**	**Sugar**
Pandan Cake	250 g	250 g	100 g
Marble Cake	400 g	200 g	90 g

(a) The amount of ingredients used in making a pandan cake and a marble cake can be represented by the matrix

$$\mathbf{A} = \begin{pmatrix} 250 & 250 & 100 \\ 400 & 200 & 90 \end{pmatrix}.$$

(i) Evaluate **AB** where $\mathbf{B} = \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix}$.

Answer **AB =** [2]

(ii) Explain what the elements in **AB** represent.

……...

……... [1]

(b) The cost of 100 g of flour is \$0.20, 100 g of butter is x dollars and 100 g of sugar is \$0.30.

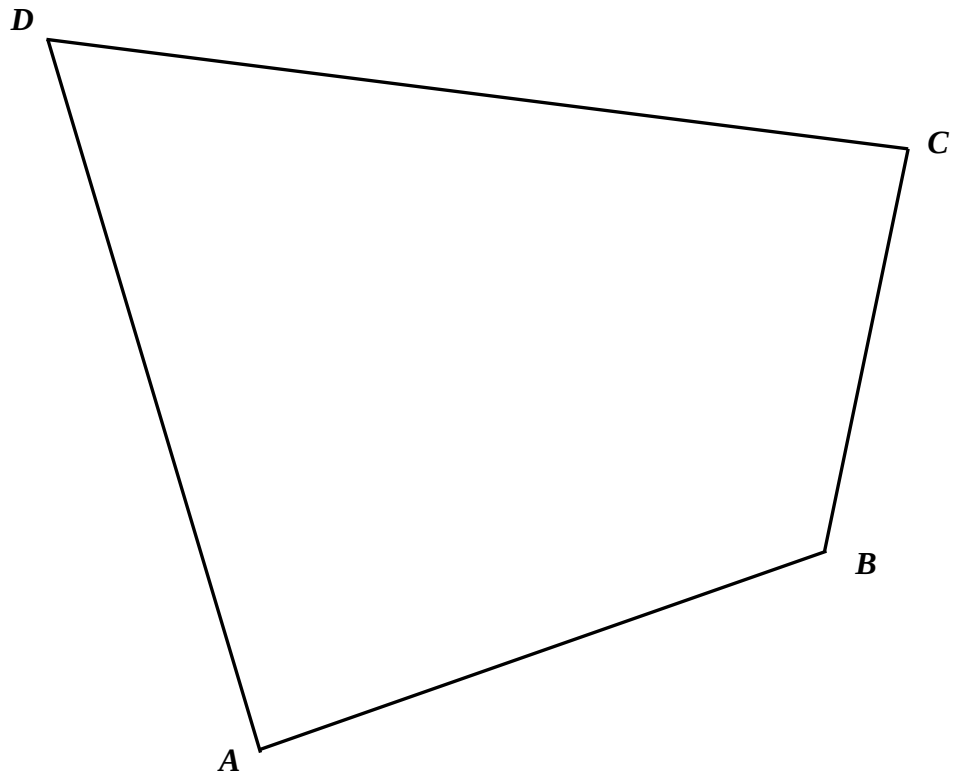
Represent this cost in a 3×1 column matrix **D**.

Answer **D =** [1]

(c) Given that the cost of baking a pandan cake is \$4.25, calculate the value of x.

Answer x = ……..…….... [1]

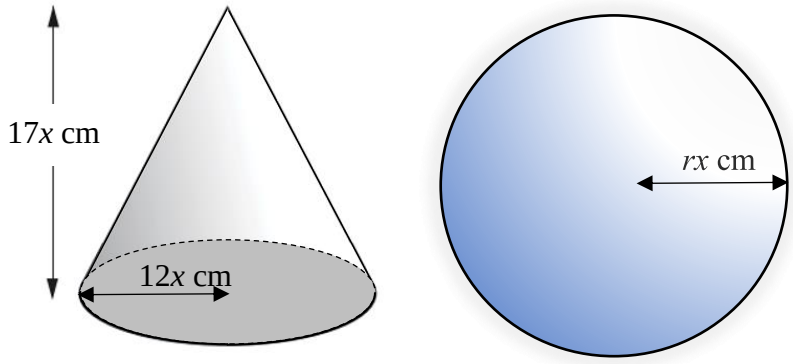
21 A plot of land *ABCD* is given below.



A playground *E*, inside the quadrilateral *ABCD*, is equidistant from *DA* and *CD* and closer to *B* than to *A*.

By construction, using compass and ruler, mark and label a possible position of the playground *E*. [3]

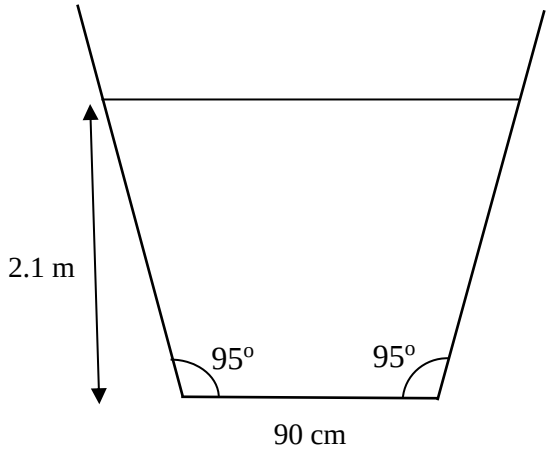
22 The diagram below shows a solid circular cone and a solid sphere.
The cone has radius $12x$ cm and height $17x$ cm.
The sphere has radius rx cm.
The cone has the same total surface area as the sphere.



Calculate the value for r.

Answer r = ... [4]

23 The diagram shows the symmetrical cross-section of a canal containing water.
The angle between the base and each side of the canal is 95°.
The width of the base is 90 cm, and the depth of the water is 2.1 m.
The canal is 100 m long.



(a) Calculate the volume of water in the canal.

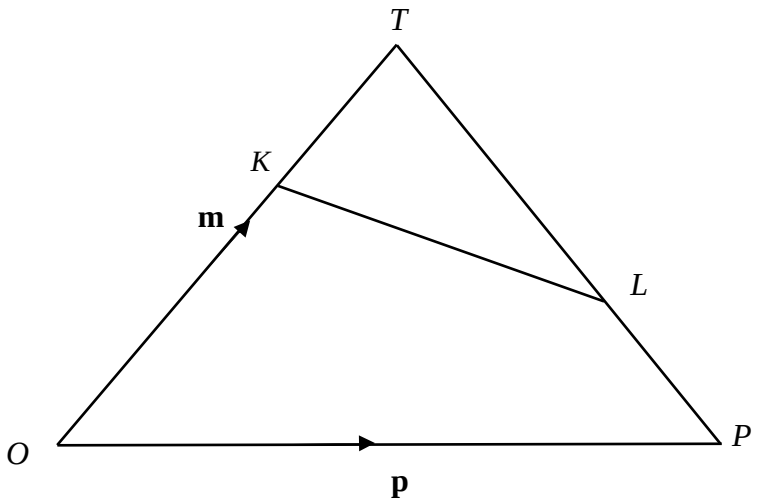
Answer ……..m^3 [4]

(b) Water is pumped out of the canal at a rate of 0.3 m^3 per minute.
Calculate the time taken to empty the canal completely.
Give your answer in hours and minutes, correct to the nearest minute.

Answer ……hours ……minutes [1]

24 The diagram shows triangle *OPT*.

$\overrightarrow{OP}$ = **p** and $\overrightarrow{OT}$ = **m**.
OK : *KT* = 2 : 1 and *TL* : *LP* = 2 : 1.



(a) Find, in terms of **m** and **p**, in its simplest form

(i) $\overrightarrow{PL}$,

Answer ……..… [1]

(ii) $\overrightarrow{KL}$.

Answer ……..… [1]

24 **(b)** *KL* is extended to the point *M*.

$\overrightarrow{KM} = -\frac{2}{3}\mathbf{m} + \frac{4}{3}\mathbf{p}$.

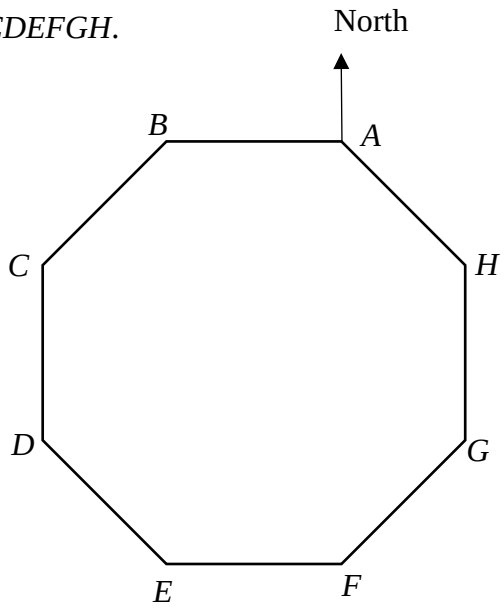
Show that *M* lies on *OP* extended. [3]

Answer

(c) Find the ratio of area of triangle *KTL* : area of triangle *OTP*.

Answer ……..…….…. [2]

25 The diagram shows the route of the Vistarian Roadrun.
The route is in the shape of a regular octagon, *ABCDEFGH*.
B is due west of *A* and *AB* = 0.65 km.



(a) Find the bearing of *H* from *A*.

Answer …… [2]

(b) Calculate the distance of *BH*.

Answer ……km [3]

[Turn over

25 (c) Calculate the area of triangle *BHG*.

Answer ……km^2 [2]

~End of Paper~