Kingdom of Lesotho
Ministry of Education and Training

EXAMINATIONS COUNCIL OF LESOTHO
Lesotho General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	CANDIDATE NUMBER

MATHEMATICS
Paper 4(Extended)

0178/04
October/November 2023
2 hours 30 minutes
Marks: 130

Candidates answer on the Question Paper.

Additional Materials: Electronic Calculator
Geometrical Instruments
Tracing Paper (optional)

READ THESE INSTRUCTIONS FIRST

Write your name, centre number and candidate number in the relevant spaces provided at the top of this page.
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.
Electronic calculators should be used.
If working is needed for any question, it must be shown below that question.
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.

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

This document consists of **20** printed pages.

1 **(a)** Evaluate $[5 + (-2)^3] - [24 - (-31)] \times 2$.

Show **all** the steps.

..... [3]

(b) Calculate $\frac{501.4}{\sqrt[3]{160}}$.

Give **all** the digits displayed on the calculator.

.....[2]

(c) Hence write $\frac{501.4}{\sqrt[3]{160}}$ correct to **three** significant figures.

.....[1]

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2 $\mathscr{E} = \{x : x \text{ is an integer and } \frac{7}{2} < x \leq 12\}$

$A = \{x : x \text{ is a multiple of 2}\}$

$B = \{x : 16 \leq 3x - 5 < 31\}$

List the elements of set $\mathscr{E}$, set A and set B.

$\mathscr{E} = \{$.....$\}$ [1]

$A = \{$.....$\}$ [1]

$B = \{$.....$\}$ [2]

3 The table shows a number pattern and two sequences ***S*** and ***T***.

Number pattern	Sum of terms (**S**)	$\mathbf{T} = S + 2$
2	2	4
2, 3, 2	7	9
2, 3, 4, 3, 2	14	16
2, 3, 4, 5, 4, 3, 2	23	25
.....	.....	.....

(a) Complete the table. [3]

(b) Find

(i) the sum in which 9 is the middle term in the pattern,

..... [1]

(ii) the value of k if $S = 2 + 3 + \ldots + (k-1) + k + (k-1) + \ldots + 3 + 2 = 98$.

$k =$..... [2]

(c) Both the middle term of the number pattern and ***T*** may be expressed in terms of n.

Express, in terms of n

(i) the nth term for ***T***,

..... [2]

(ii) the middle term of the number pattern.

..... [1]

4 **(a)** Subtract $2a - b$ from $4b - 3a$.

..... [2]

(b) $L = h + hTx$.
Given that $L = 100.198$, $h = 100$ and $T = 165$,

find the value of x, giving the answer in standard form.

$x =$ ..... [2]

(c) Factorise fully

(i) $x^2 + 2x - 48$,

..... [2]

(ii) $(x + y)^2 - 4$.

.....[2]

---

5 Solve the following equations.

(a) $(3a - 1)(a + 4) = 0$.

$a =$ ..... or ..... [2]

(b) $Cos\, x = \sqrt{\frac{2.549}{3.876}}$.

$x =$ ..... [2]

---

6 A farmer invested M12 000 into a fund which pays compound interest of 4% per annum **compounded half-yearly**.

Calculate the total interest earned in 5 years.

M ..... [4]

---

7 Point A has coordinates (4,1) and point B lies on the line $y = 2x + 1$ and has coordinates (a, b).
The distance between the two points is $\sqrt{20}$.

Find any possible value of a.

$a =$ ..... [3]

---

8 Given $f(x) = \frac{2}{3}x - 4$ and $g(x) = 7 - 3x$.

(a) Find

(i) $f(-6)$,

$f(-6) =$..... [1]

(ii) $g^{-1}(x)$,

$g^{-1}(x) =$..... [2]

(iii) $gf(x)$.

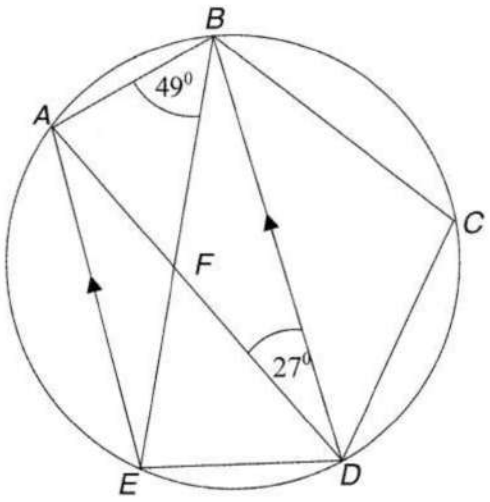
$gf(x) =$..... [2]

(b) $f(x) \times g(x) = 0$ can be expressed in the form $ax^2 + bx + c = 0$.

Show that this reduces to $-6x^2 + 50x - 84 = 0$.

[2]

9 The diagram shows a circle that passes through *A*, *B*, *C*, *D* and *E*.
The lines *AE* and *BD* are parallel.
The angle $ADB = 27^0$ and the angle $ABE = 49^0$.



NOT TO SCALE

(a) Find the size of angle

(i) *AEB*,

.....° [1]

(ii) *AFE*,

.....°[2]

(iii) *BCD*.

.....° [2]

10 The table shows daily consumption of bananas and potatoes for different age groups.

Age in (years)	Bananas	Potatoes
5 – 7	1	1
8 – 13	2	2
14 – 18	3	3

The information in the table is represented by matrix $\mathbf{M} = \begin{pmatrix} 1 & 1 \\ 2 & 2 \\ 3 & 3 \end{pmatrix}$

(a) One banana has a mass of 136 g and potatoes has mass of 225 g.
Write a 2×1 matrix $\mathbf{N}$, to represent this information.

..... [1]

(b) Evaluate the matrix $\mathbf{T} = \mathbf{MN}$.

..... [2]

(c) State what the elements of $\mathbf{T}$ represent.

.....

..... [1]

(d) A total mass of 600 kg of bananas and potatoes is ordered at the boarding.
Calculate the mass of bananas and potatoes consumed by age group aged $8 - 13$.

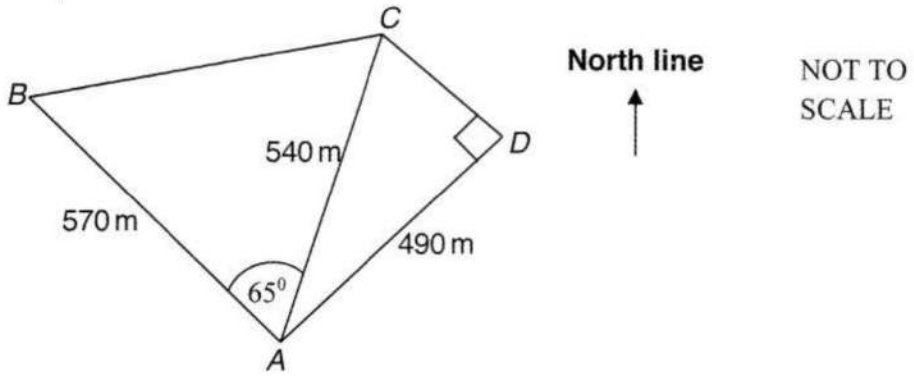
.....kg [2]

11 The diagram shows a yard *ABCD* on a horizontal ground, with a path *AC*.

$AB = 570\,\text{m}$, $AC = 540\,\text{m}$ and $AD = 490\,\text{m}$.

$B\hat{A}C = 65°$ and $C\hat{D}A = 90°$.

The bearing of *C* from *B* is 079° and the bearing of *D* from *C* is 134°.



(a) Show that the length $CD = 227\,\text{m}$, correct to the nearest whole number.

[2]

(b) Calculate the bearing of *A* from *C*.

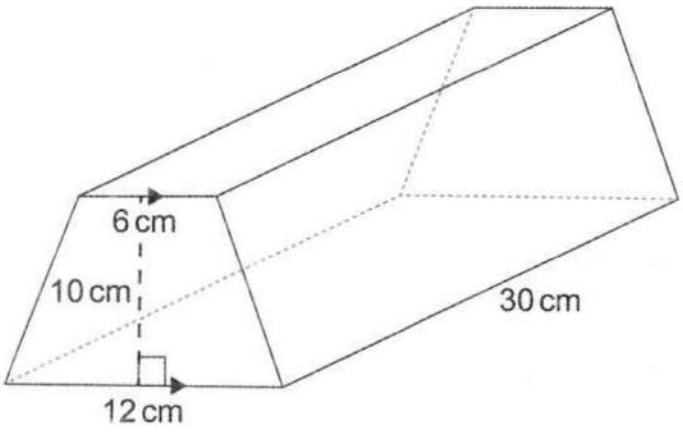
.....° [3]

(c) A bird is hovering vertically above the point *D*.
The angle of depression of *A* from the bird is 2.6°.

Calculate the angle of depression of *C* from the bird.

.....° [4]

12 The diagram shows a solid prism in a shape of a trapezium (**Solid A**).
Solid A is moulded into a solid cylinder of radius 7 cm (**Solid B**).



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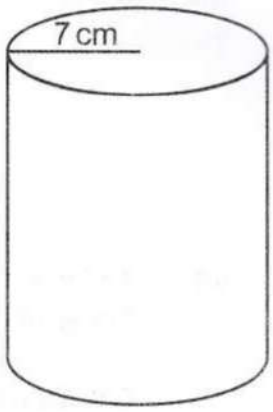


Solid A **Solid B**

Calculate

(a) the volume of the cylinder,

.....cm^3 [2]

(b) the height of the cylinder.

..... cm [2]

13 D is the point $(-2,1)$, E is $(h,6)$ and $\overrightarrow{AB} = \begin{pmatrix}7\\1\end{pmatrix}$.

(a) Express $\overrightarrow{DE}$, in terms of h, as a column vector.

..... [1]

(b) Find the value of h given that

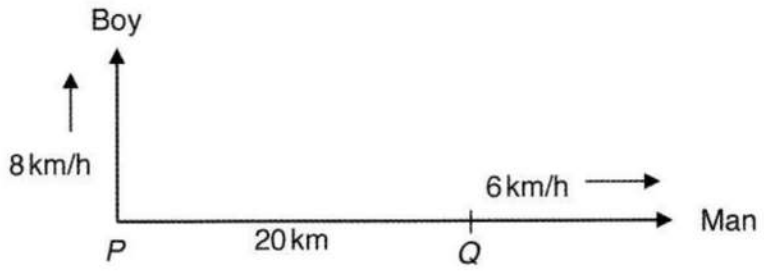
(i) $\overrightarrow{DE}$ is parallel to $\overrightarrow{AB}$,

$h =$..... [2]

(ii) $\left|\overrightarrow{DE}\right| = \left|\overrightarrow{AB}\right|$.

$h =$..... or ..... [3]

14 Q is the point 20 km due East of P.
A boy walks from P, at a constant speed of 8 km/h due North.
At the same time, a man walks from Q, at a constant speed of 6 km/h due East.



(a) Write, in terms of t, the distance of

(i) the boy from P after t hours,

.....km [1]

(ii) the man from P after t hours.

.....km [1]

(b) It is given that after t hours, the man and the boy are 30 km apart.
Form an equation in t and show that it reduces to $5t^2 + 12t - 25 = 0$

[3]

(c) Solve $5t^2 + 12t - 25 = 0$, correct to two decimal places.

t =.....or ..... [4]

(d) Hence, find the value of t, in **hours and minutes**, correct to the nearest minutes, when the boy and the man are 30 km apart.

..... hours .....minutes [2]

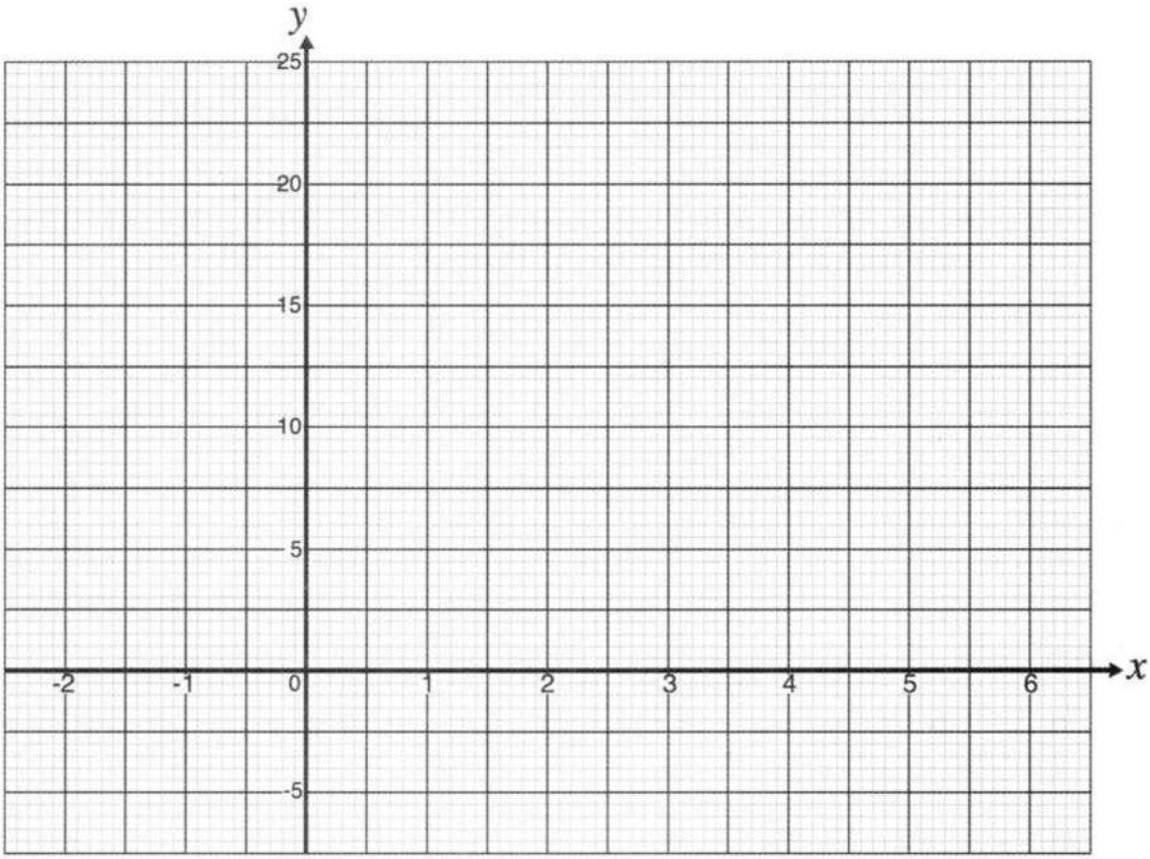
15 The table gives some values of x and the corresponding values of y of $y = x(1 + x)(5 - x)$.

x	-2	-1	-0.5	1	2	3	4	5
y	14	0	-1.4	8	18	p	20	0

(a) Find the value of p.

$p =$..... [1]

(b) Draw the graph of $y = x(1 + x)(5 - x)$ for $-2 \leq x \leq 6$. [3]



(c) **(i)** On the same axes, draw the line $y = -2x + 12$ for $-2 \leq x \leq 6$. [1]

(ii) Write the x - coordinates of the points where the line intersects the curve.

$x =$..... or ..... [2]

(d) The x-coordinates of the points where the two graphs intersect are solutions of the equation $x^3 + Ax^2 + Bx + 12 = 0$, where A and B are integers.

Find the value of A and the value of B.

A =.....

B =..... [3]

16 The table shows information about ages of 240 people at the party.

Age (n years)	Frequency
$15 \leq n < 20$	95
$20 \leq n < 25$	90
$25 \leq n < 30$	35
$30 \leq n < 35$	15
$35 \leq n \leq 40$	5

(a) State the modal class.

..... [1]

(b) The information is drawn on a pie chart.

Calculate the sector angle for $20 \leq n < 25$ interval.

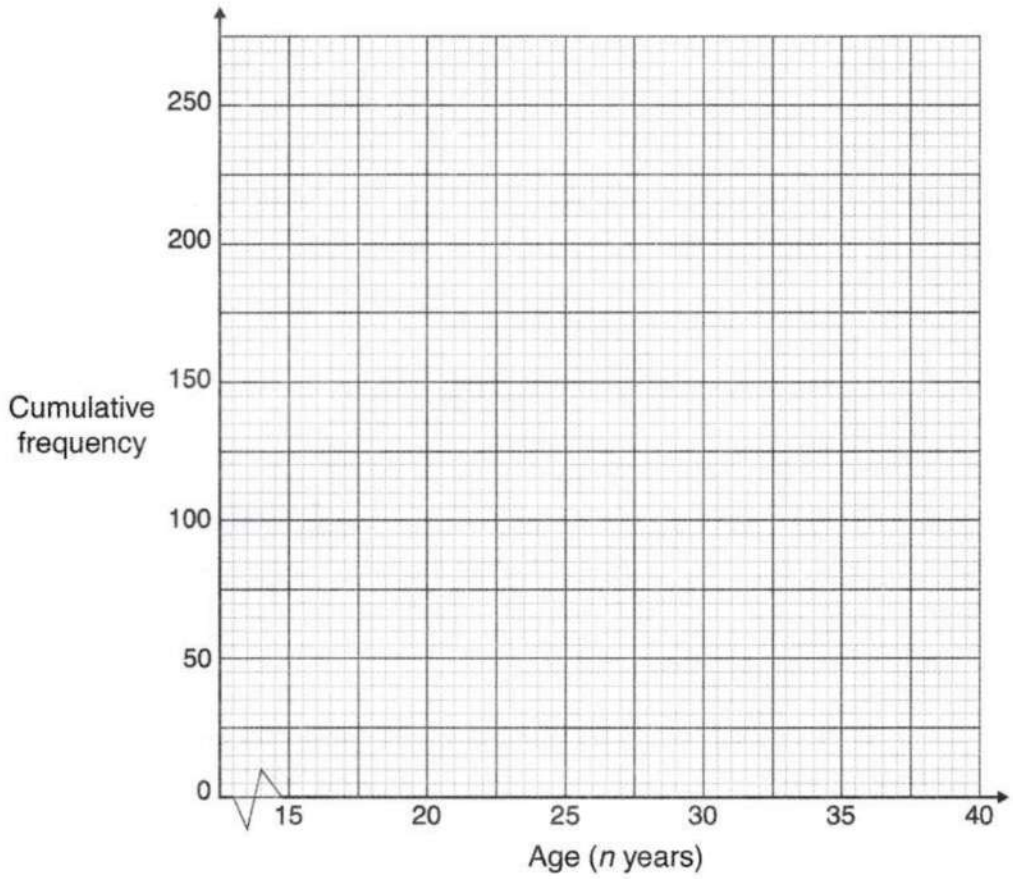
.....° [2]

(c) Complete the cumulative frequency table.

Age (n years)	Cumulative frequency
< 20	95
< 25	
< 30	
< 35	
≤ 40	240

[2]

(d) On the grid, draw the cumulative frequency curve.



[3]

(e) Using the curve, find

(i) an estimate for the median age,

..... [1]

(ii) the interquartile range,

..... [2]

(iii) the number of people above 31 years.

..... [2]

17 **(a)** The table shows the distance travelled by 1400 cars during the holidays.

Distance (km)	$0 \leq d < 300$	$300 \leq d < 400$	$400 \leq d < 500$	$500 \leq d < 1000$
Frequency	240	360	400	400

(i) A car is chosen at random.

Calculate the probability that the car travelled less than 300 km.

..... [1]

(ii) Two cars are now chosen at random.

Calculate the probability that they travelled less than 400 km.

..... [2]

(b) There are two sets of independent traffic lights.
The probability of a car stopping at the first set of traffic lights is 0.6.
If the car does not stop, the probability of stopping at the next set of traffic light is 0.45.
Otherwise the probability that it will stop will be 0.3.

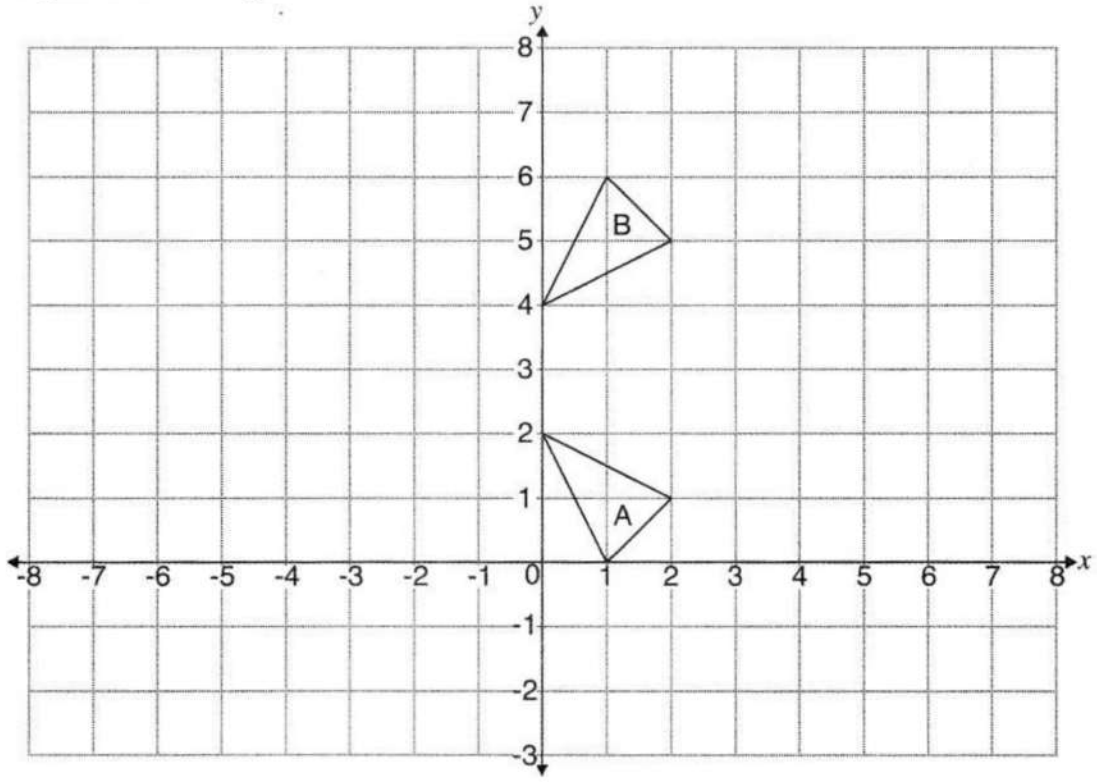
(i) Draw a tree diagram to represent this information

[2]

(ii) Calculate the probability that the car would stop at the second set of the traffic lights.

.....[2]

18 The grid shows triangles A and B.



(a) Describe fully the transformation that maps ΔA onto ΔB.

.....

.....

..... [2]

(b) Enlarge ΔA with centre $(-1,2)$ and scale factor -2. [2]

(c) Transformation H is a shear with shear factor 2 and invariant line $y = 0$.
Transformation M is the reflection along line $x = -1$.

Draw ΔA after $MH(A)$. [3]

19 The dimensions of a rectangular floor of a proposed building are such that:

- the length is at most twice the width
- the sum of the width and the length is more than 8 m but less than 20 m.

Let x be the width and y be the length.

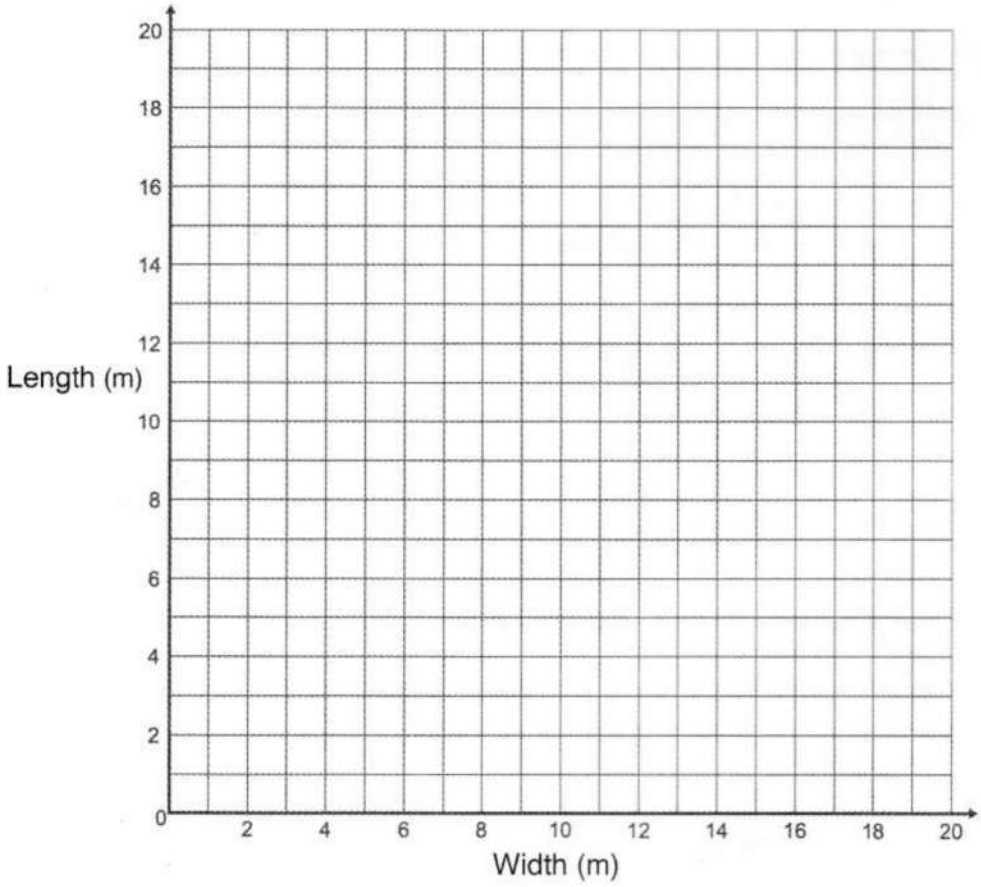
(a) One of the inequalities is $8 < x + y$.

Write the other **two** inequalities.

.....

..... [2]

(b) Represent the inequalities on the grid. [3]



(c) Find the value of x and the value of y that would produce the maximum possible area of the floor.

$x =$ ..... [1]

$y =$ ..... [1]