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MATHEMATICS (US)

0444/41

Paper 4 (Extended)

May/June 2023

2 hours 30 minutes

You must answer on the question paper.

You will need: Geometrical instruments

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, center number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You may use tracing paper.
- You must show all necessary work clearly.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.
- For π , use either your calculator value or 3.142.

INFORMATION

- The total mark for this paper is 130.
- The number of marks for each question or part question is shown in parentheses [].

This document has **20** pages. Any blank pages are indicated.

Formula List

For the equation

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Lateral surface area, A , of cylinder of radius r , height h .

$$A = 2\pi rh$$

Lateral surface area, A , of cone of radius r , sloping edge l .

$$A = \pi rl$$

Surface area, A , of sphere of radius r .

$$A = 4\pi r^2$$

Volume, V , of pyramid, base area A , height h .

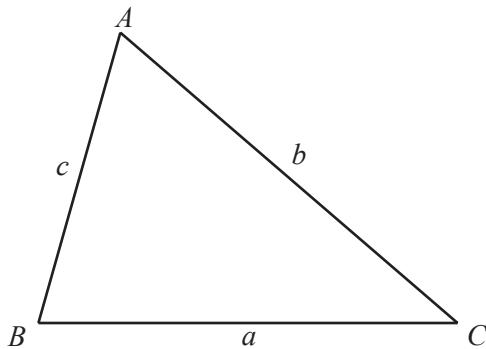
$$V = \frac{1}{3}Ah$$

Volume, V , of cone of radius r , height h .

$$V = \frac{1}{3}\pi r^2 h$$

Volume, V , of sphere of radius r .

$$V = \frac{4}{3}\pi r^3$$



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

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

$$\text{Area} = \frac{1}{2}bc \sin A$$

1 30 students take a test.

The table shows the results.

Score	4	5	6	7	8	9	10
Frequency	2	4	3	5	5	7	4

(a) Find

(i) the mode

..... [1]

(ii) the median

..... [1]

(iii) the mean.

..... [3]

(b) Find the percentage of students whose scores are at least 5.

..... % [1]

(c) 30% of the students score less than x .

Find the value of x .

$x =$ [2]

(d) Two students are picked at random.

Find the probability that one student has a score of less than 6 and one student has a score of more than 6.

..... [3]

2 (a) An orchard has 1250 trees.

The trees are in the ratio apple : pear : cherry = 12 : 9 : 4.

(i) Calculate the number of apple trees.

..... [2]

(ii) Last year in the orchard, the mean mass of fruit produced was 64 kg per tree.

Calculate the total mass of fruit produced last year.

Give your answer in tonnes.

[1 tonne = 1000 kg]

..... tonnes [2]

(iii) Last year, the mean mass of pears produced was 54 kg per tree.

This was a decrease of 10% on the mean mass of pears produced per tree from the year before.

Calculate the mean mass of pears produced by each pear tree the year before.

..... kg [2]

(iv) The orchard loses $\frac{1}{5}$ of its total number of trees in a storm.

Calculate the number of trees that remain.

..... [2]

(b) Paulo buys some pears from a market.
Pears cost \$0.54 each or 0.51 euros each.

(i) Paulo pays **in dollars** for 12 pears.

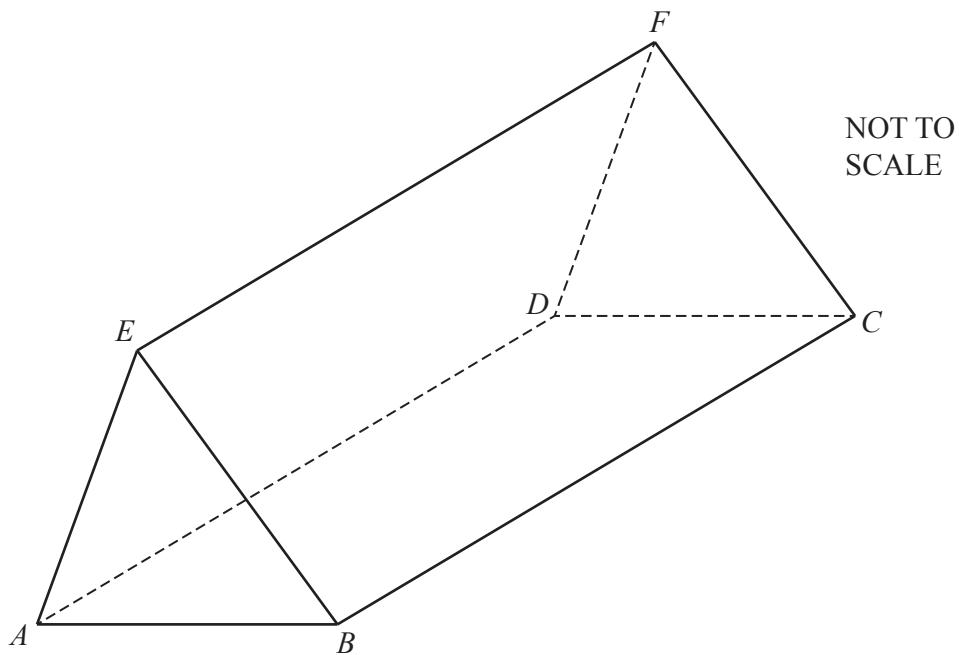
Calculate the change he receives from \$10.

\$ [2]

(ii) The exchange rate is \$1 = 0.826 euros.

Calculate how much more Paulo pays for **each** pear when he pays in euros.
Give your answer in dollars, correct to the nearest cent.

\$ [3]



The diagram shows a solid triangular prism $ABCDEF$ of length 15 cm. $AB = 6.4$ cm, $EB = 5.7$ cm and the volume of the prism is 145 cm^3 .

(a) The prism is made of plastic with density 938 kg/m^3 .

Calculate the mass of the prism in **grams**.
[Density = mass \div volume]

..... g [3]

(b) M is the point on AB that is vertically below E .

Calculate EM .

$$EM = \dots \text{ cm} \quad [3]$$

(c) Calculate angle EBA .

$$\text{Angle } EBA = \dots \quad [2]$$

(d) Calculate EA .

$$EA = \dots \text{ cm} \quad [3]$$

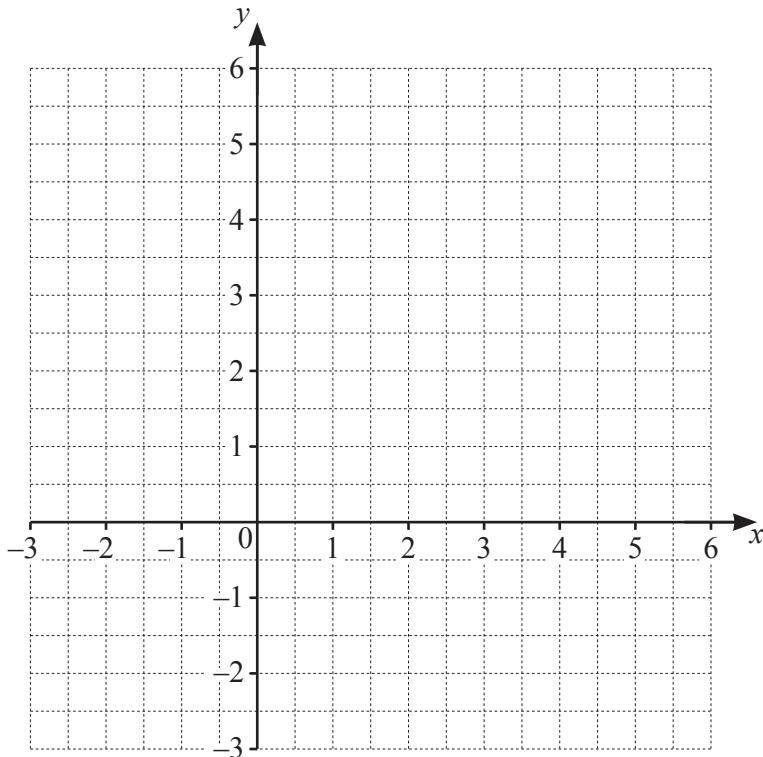
(e) Calculate the total surface area of the prism.

$$\dots \text{ cm}^2 \quad [3]$$

4 (a) In the square $ABCD$, A has coordinates $(-2, 1)$ and B has coordinates $(1, 5)$. C has coordinates (a, b) , where a and b are both positive integers.

Find the coordinates of C and the coordinates of D .

You may use the grid to help you.



$C (\dots , \dots)$

$D (\dots , \dots)$ [4]

(b) P has coordinates $(-1, 3)$ and Q has coordinates $(6, 4)$.

(i) Find the coordinates of the midpoint of PQ .

(..... ,) [2]

(ii) Find the length PQ .

..... [3]

(iii) Find the slope of PQ .

..... [2]

(iv) Find the equation of the line parallel to PQ that crosses the x -axis at $x = 2$.

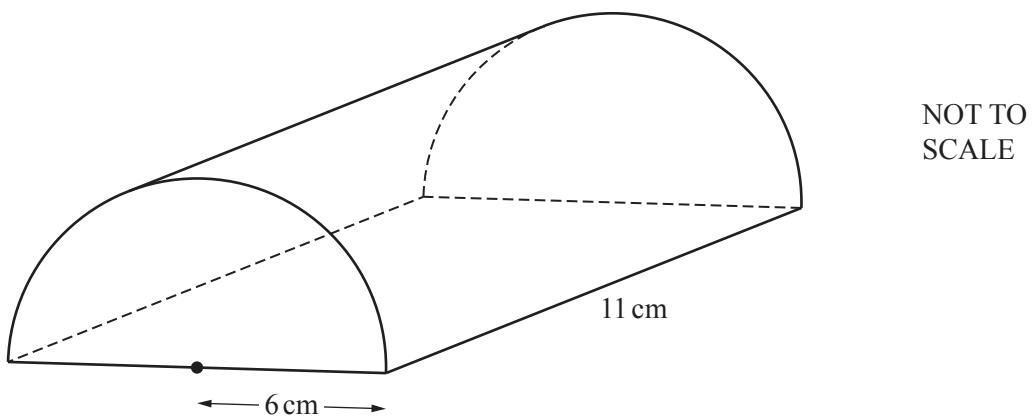
..... [3]

5 (a) A cone has a base radius of 5 cm and a perpendicular height of 12 cm.

Calculate the lateral surface area of this cone.

..... cm^2 [3]

(b)

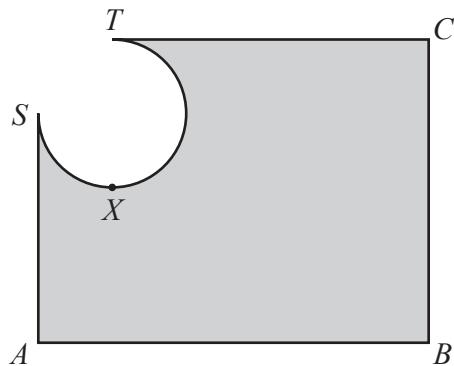
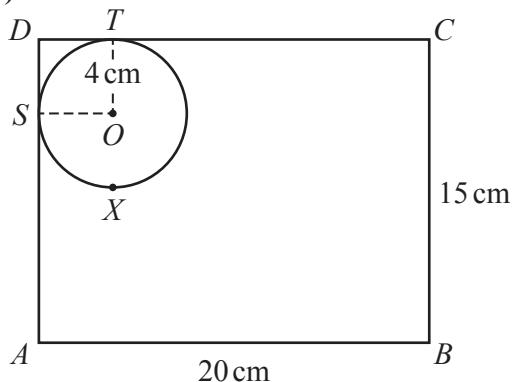


The diagram shows a half-cylinder of radius 6 cm and length 11 cm.

Calculate the volume of the half-cylinder.

..... cm^3 [2]

(c)



(i) $ABCD$ is a rectangle with $AB = 20 \text{ cm}$ and $BC = 15 \text{ cm}$.
 S , X and T are points on a circle center O , such that DSA and DTC are tangents to the circle.
The radius of the circle is 4 cm and TX is a diameter of the circle.
The shape $DSXT$ is removed from the corner of the rectangle, leaving the shaded shape shown in the second diagram.

Calculate the area of the shaded shape.

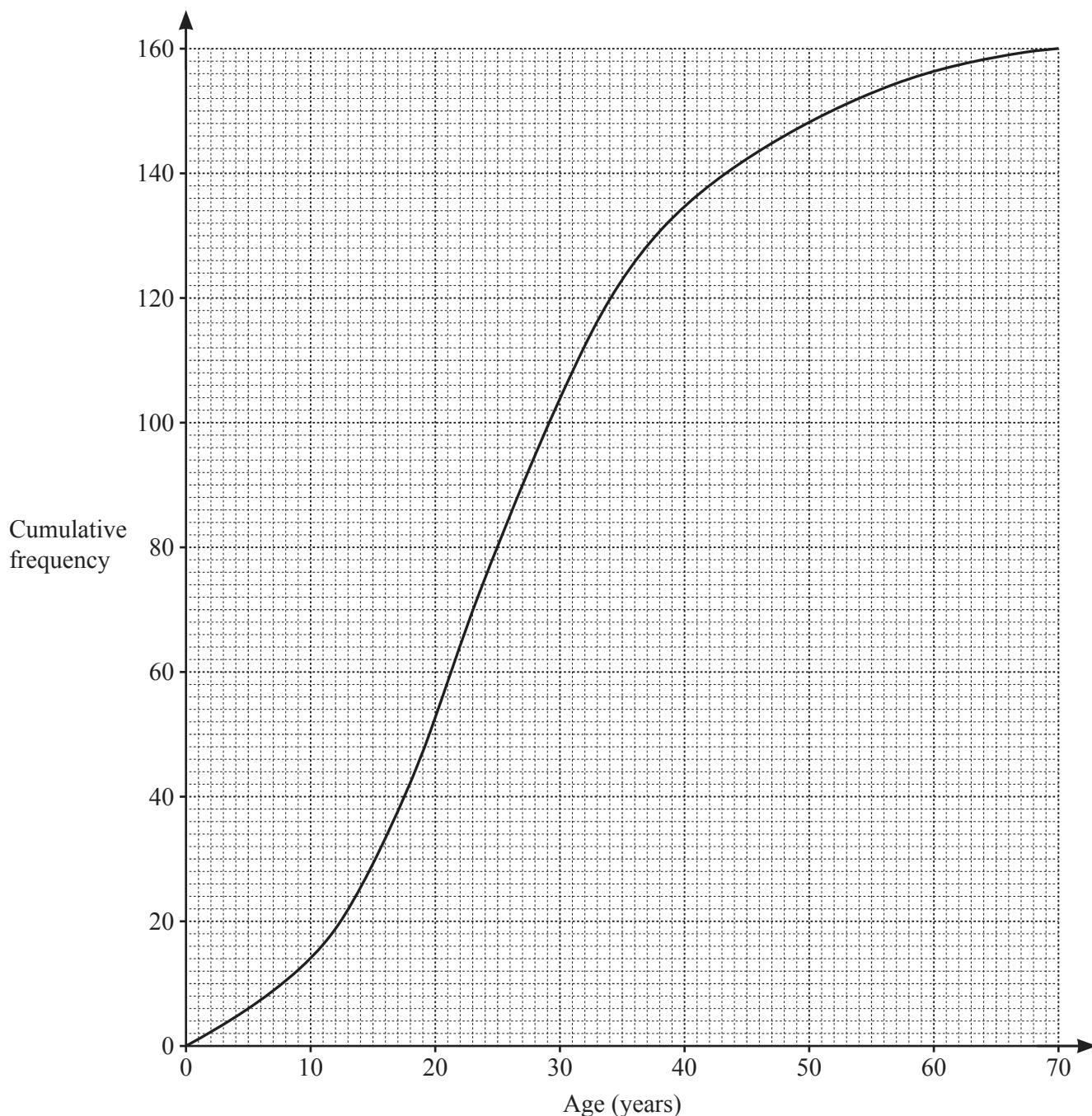
..... cm^2 [5]

(ii) Calculate the perimeter of the shaded shape.

..... cm [3]

6 (a) There are 160 people in a village.

The cumulative frequency diagram shows information about their ages.



Find an estimate for

(i) the median age

..... [1]

(ii) the lower quartile

..... [1]

(iii) the number of people who are 50 or more years of age

..... [2]

(iv) the 65th percentile.

..... [2]

(b) The frequency table shows information about the age of each person in another village.

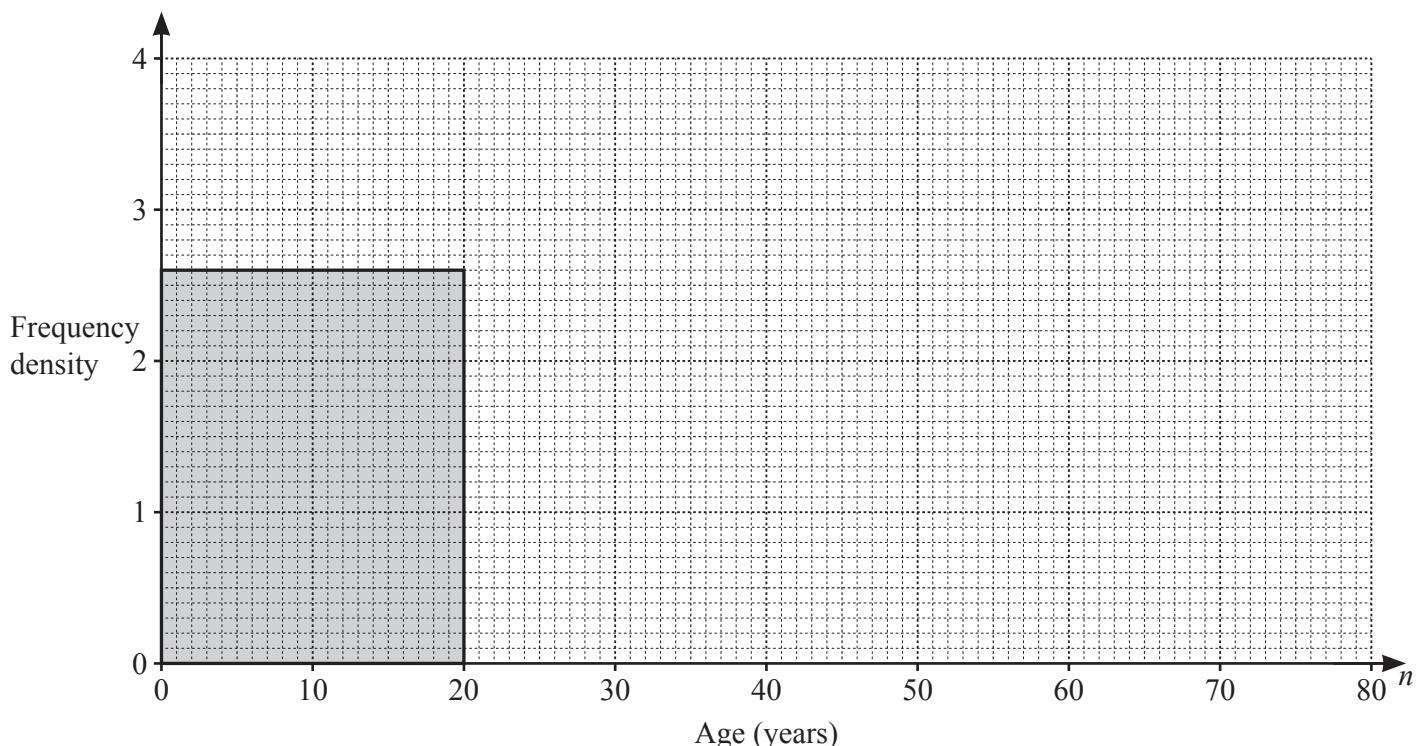
Age (n years)	$0 < n \leq 20$	$20 < n \leq 30$	$30 < n \leq 50$	$50 < n \leq 80$
Frequency	52	37	24	60

(i) Calculate an estimate of the mean age.

..... [4]

(ii) On the grid, complete the histogram to show this information.

The first block has been drawn for you.



[3]

7

$$f(x) = x - 4 \quad g(x) = 2x + 5 \quad h(x) = 3^x$$

(a) Find $f(-3)$.

..... [1]

(b) Find $g^{-1}(x)$.

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

(c) The domain of $h(x)$ is $-3 \leq x \leq 5$.

Find the range of $h(x)$.

..... $\leq h(x) \leq$ [2]

(d) Find $f(x) \times g(x) - f(g(x))$.

Give your answer in the form $ax^2 + bx + c$.

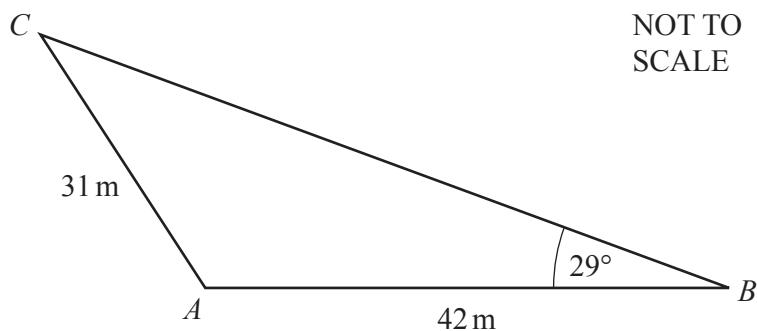
..... [4]

(e) Find x when $h(x) = g(f(2))$.

$x = \dots$ [2]

(f) Find x when $h^{-1}(x) = -2$.

$x = \dots$ [2]



(a) B is due east of A .

Find the bearing of

(i) C from B

..... [1]

(ii) B from C .

..... [2]

(b) Calculate obtuse angle BAC .

Angle BAC = [4]

9 (a) Factor fully.

(i) $27y^2 - 3$

..... [3]

(ii) $2m - pk + 2k - pm$

..... [2]

(b) Write $\frac{x-1}{x+1} + \frac{5}{x-1} - 1$ as a single fraction in its simplest form.

..... [4]

(c) Solve $4x^2 - 3x - 2 = 0$.

You must show all your work and give your answers correct to 2 decimal places.

$x = \dots$ or $x = \dots$ [4]

10 (a) Solve for k .

$$\frac{k}{m} = 4 + kp$$

$$k = \dots \quad [4]$$

(b) Solve $\sqrt{x^2 + 64} = 10$.

$$\dots \quad [3]$$

(c) (i) Write $x^2 + 10x - 3$ in the form $(x + a)^2 + b$.

$$\dots \quad [2]$$

(ii) Write down the minimum value of $x^2 + 10x - 3$.

$$\dots \quad [1]$$

11 A tailor makes x dresses and y shirts in one week.
In one week

- he makes at least 4 dresses
- he makes no more than 7 shirts
- he makes less than 14 dresses and shirts altogether
- the number of shirts he makes is more than $\frac{2}{3}$ of the number of dresses.

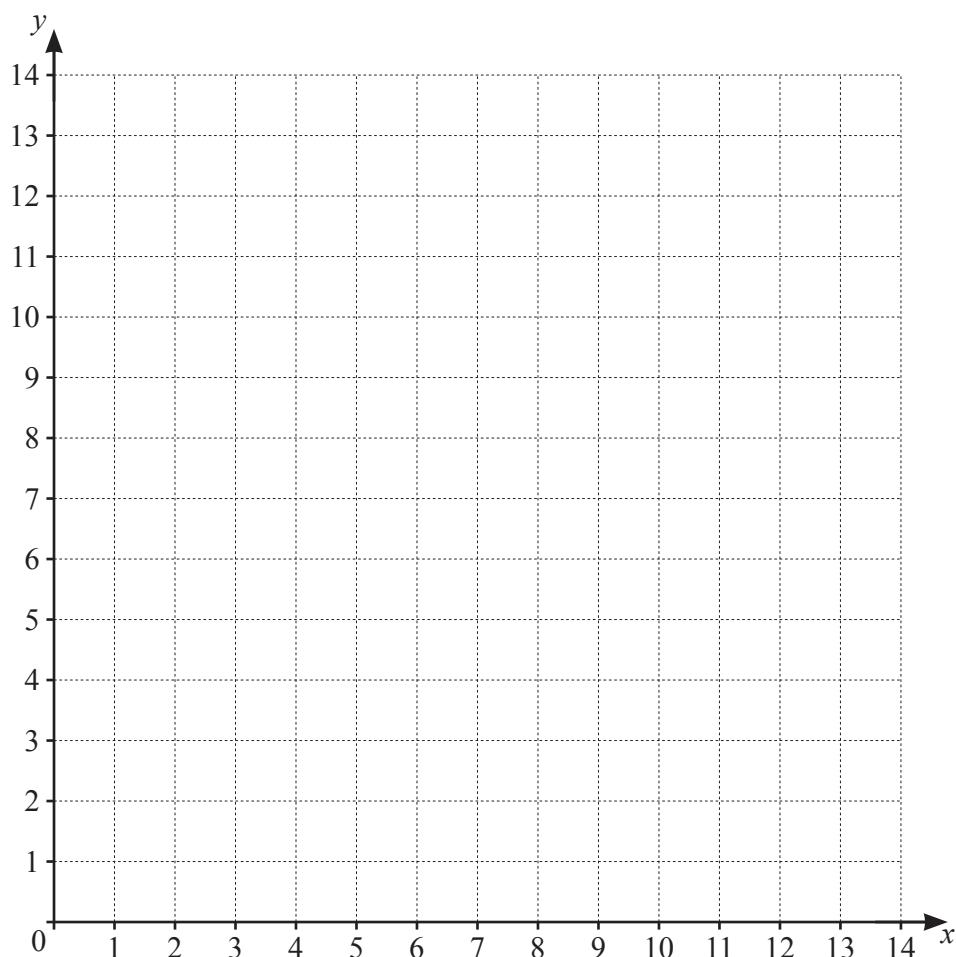
One of the inequalities that shows this information is $x \geq 4$.

(a) Write down the other three inequalities in x and/or y .

.....

[3]

(b)



On the grid, show the four inequalities by drawing four straight lines.
Label the region R that satisfies the 4 inequalities.

[6]

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