UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTER NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

2560117593

MATHEMATICS (US) **0444/31**

Paper 3 (Core) **May/June 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Geometrical instruments
Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Center number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
If work is needed for any question it must be shown in the space provided.
Electronic calculators should be used.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant digits.
Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142.

The number of points is given in parentheses [ ] at the end of each question or part question.
The total of the points for this paper is 104.

Write your calculator model in the box below.

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

Formula List

Area, A, of triangle, base b, height h.	$A = \frac{1}{2}bh$
Area, A, of circle, radius r.	$A = \pi r^2$
Circumference, C, of circle, radius r.	$C = 2\pi r$
Lateral surface area, A, of cylinder of radius r, height h.	$A = 2\pi rh$
Surface area, A, of sphere of radius r.	$A = 4\pi r^2$
Volume, V, of prism, cross-sectional area A, length l.	$V = Al$
Volume, V, of cylinder of radius r, height h.	$V = \pi r^2 h$
Volume, V, of sphere of radius r.	$V = \frac{4}{3}\pi r^3$

1 **(a)** **(i)** Write down all the factors of 22.

Answer(a)(i) ..... [2]

(ii) Write down a multiple of 13 between 30 and 50.

Answer(a)(ii) ..... [1]

(b) 1 2 6 9 15 17 19 21 27

(i) Write down all the prime numbers in this list.

Answer(b)(i) ..... [2]

(ii) Write down a cube number from this list.

Answer(b)(ii) ..... [1]

(c) **(i)** Write 0.0035 in scientific notation.

Answer(c)(i) ..... [1]

(ii) Calculate $(6.3 \times 10^6) \div (1.5 \times 10^2)$.
Write your answer in scientific notation.

Answer(c)(ii) ..... [2]

2 **(a)** On a map, the height of Hillibar Station is 1047 m and the height of Sular Junction is 29

(i) Calculate the difference in these heights.

Answer(a)(i) ..... m [1]

(ii) The temperature falls by 1°C for every 100 m increase in height.
One day the temperature in Sular Junction is 19°C.

Work out the temperature at Hillibar Station.

Answer(a)(ii) ..... °C [1]

(iii) Write 297 correct to the nearest ten.

Answer(a)(iii) ..... [1]

(iv) Write 1047 correct to the nearest hundred.

Answer(a)(iv) ..... [1]

(b) **(i)** Kim arrives at Hillibar Station at 12:35.
The taxi to her hotel takes 27 minutes.

Work out the time Kim arrives at her hotel.

Answer(b)(i) ..... [1]

(ii) Henry takes 17 minutes to walk from his home to Sular Junction.
He must arrive there by 10:43.

Work out the latest time he can leave home.

Answer(b)(ii) ..... [1]

(c) Here is part of a train timetable.
Each journey from Sular Junction to Hillibar Station takes the same time.

Sular Junction	*departs*	10:59	12:32	14:48
Hillibar Station	*arrives*	12:35	14:08	

(i) Complete the timetable. [2]

(ii) The distance between Sular Junction and Hillibar Station is 64 km.

Calculate the average speed, in kilometres per hour, of a train between these two stations.

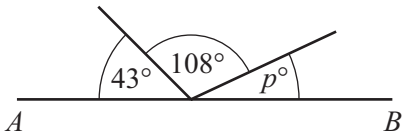
Answer(c)(ii) ..... km/h [2]

(iii) Joel arrives at Sular Junction at 11:48.

At what time is the next train to Hillibar Station due to depart?

Answer(c)(iii) ..... [1]

3 **(a)**



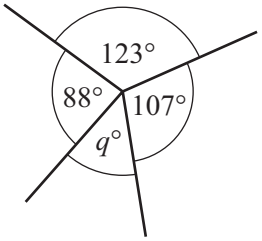
NOT TO SCALE

AB is a straight line.

Find the value of *p*.

Answer(a) $p =$ ..... [1]

(b)

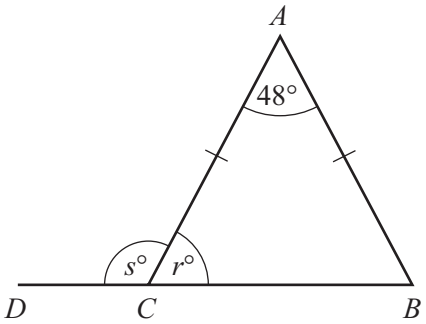


NOT TO SCALE

Find the value of *q*.

Answer(b) $q =$ ..... [1]

(c)



NOT TO SCALE

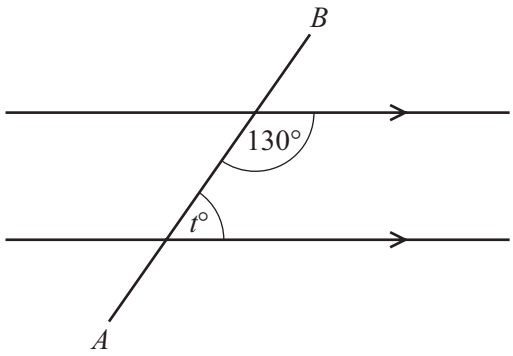
DCB is a straight line and *AB* = *AC*.

Find the values of *r* and *s*.

Answer(c) $r =$ .....

$s =$ ..... [2]

(d)



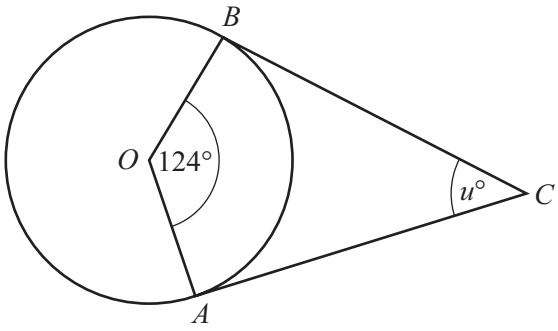
NOT TO SCALE

The straight line AB intersects two parallel lines.

Find the value of t.

Answer(d) $t =$ ..... [1]

(e)



NOT TO SCALE

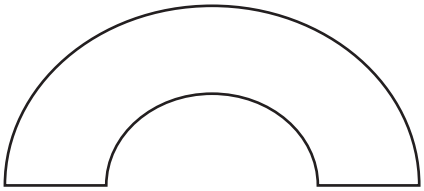
A and B lie on a circle, center O.
AC and BC are tangents to the circle.

Find the value of u.

Answer(e) $u =$ ..... [2]

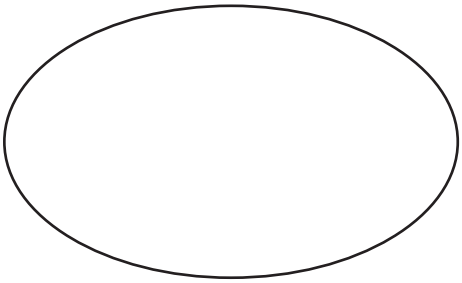
4 **(a)** On each of the following shapes draw any lines of symmetry.

(i)



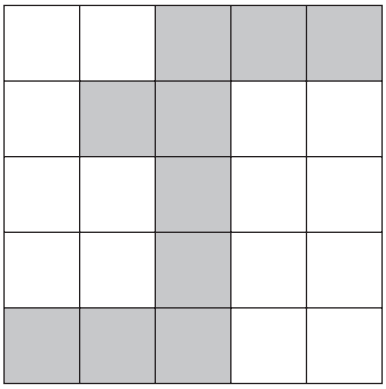
[1]

(ii)



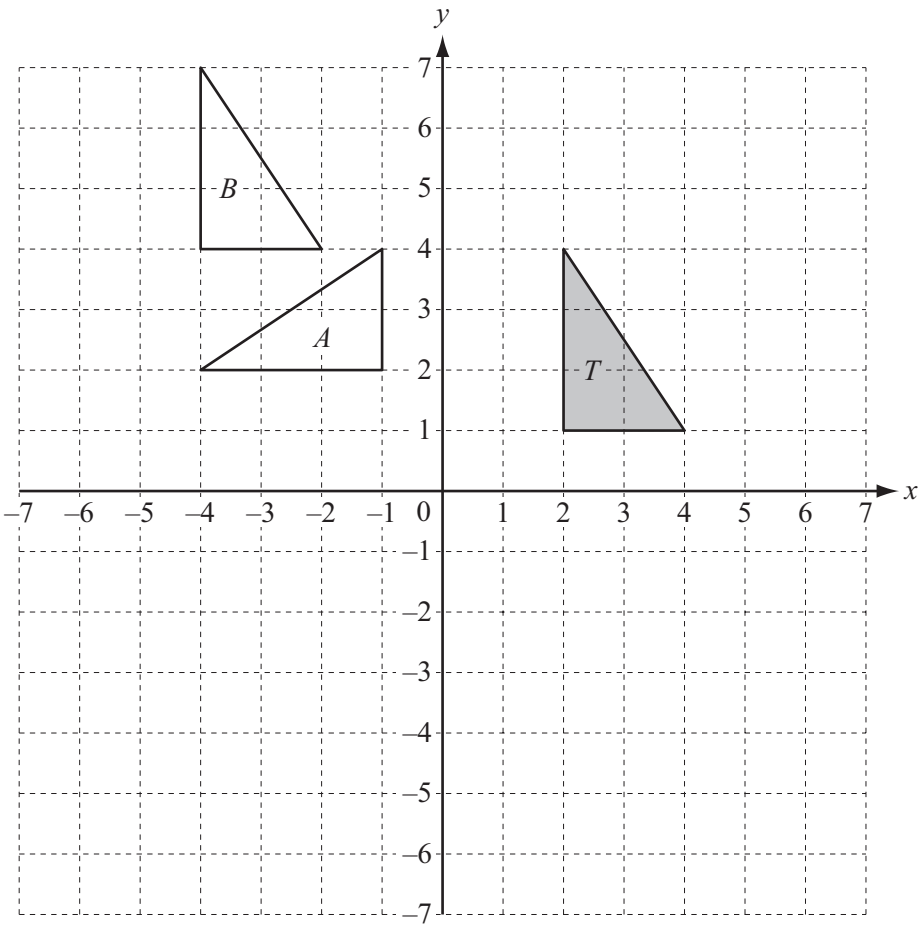
[2]

(b) Complete this shape by shading **one** square so that it has rotational symmetry of order 2.



[1]

(c)



On the grid, draw the image of triangle T after a

(i) reflection in the line $x = 4$, [2]

(ii) translation by the vector $\begin{pmatrix} -5 \\ -4 \end{pmatrix}$, [2]

(iii) rotation, center (4, 1) through 180°. [2]

(d) Describe fully the **single** transformation that maps

(i) triangle T onto triangle A,

Answer(d)(i) ..... [3]

(ii) triangle T onto triangle B.

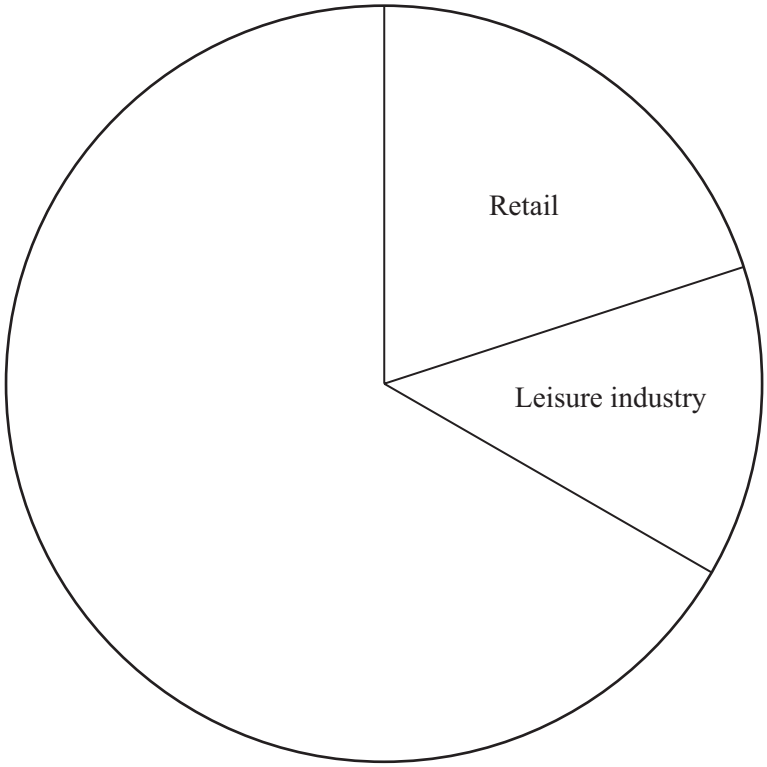
Answer(d)(ii) ..... [2]

5 The table shows a summary of the types of employment for 90 people.

Employment	Frequency	Pie chart sector angle
Retail	18	72°
Leisure industry	12	48°
Public service	35	
Other	25	

(a) (i) Complete the table. [2]

(ii) Complete the pie chart and label the sectors.



[2]

(b) Here are the ages of the people working in the leisure industry.

16 17 19 23 23 24 27 31 33 40 45 56

(i) Work out the range.

Answer(b)(i) ..... years [1]

(ii) Calculate the mean.

Answer(b)(ii) ..... years [2]

(iii) Sabrina wants to interview someone working in the leisure industry.
She chooses one person at random.

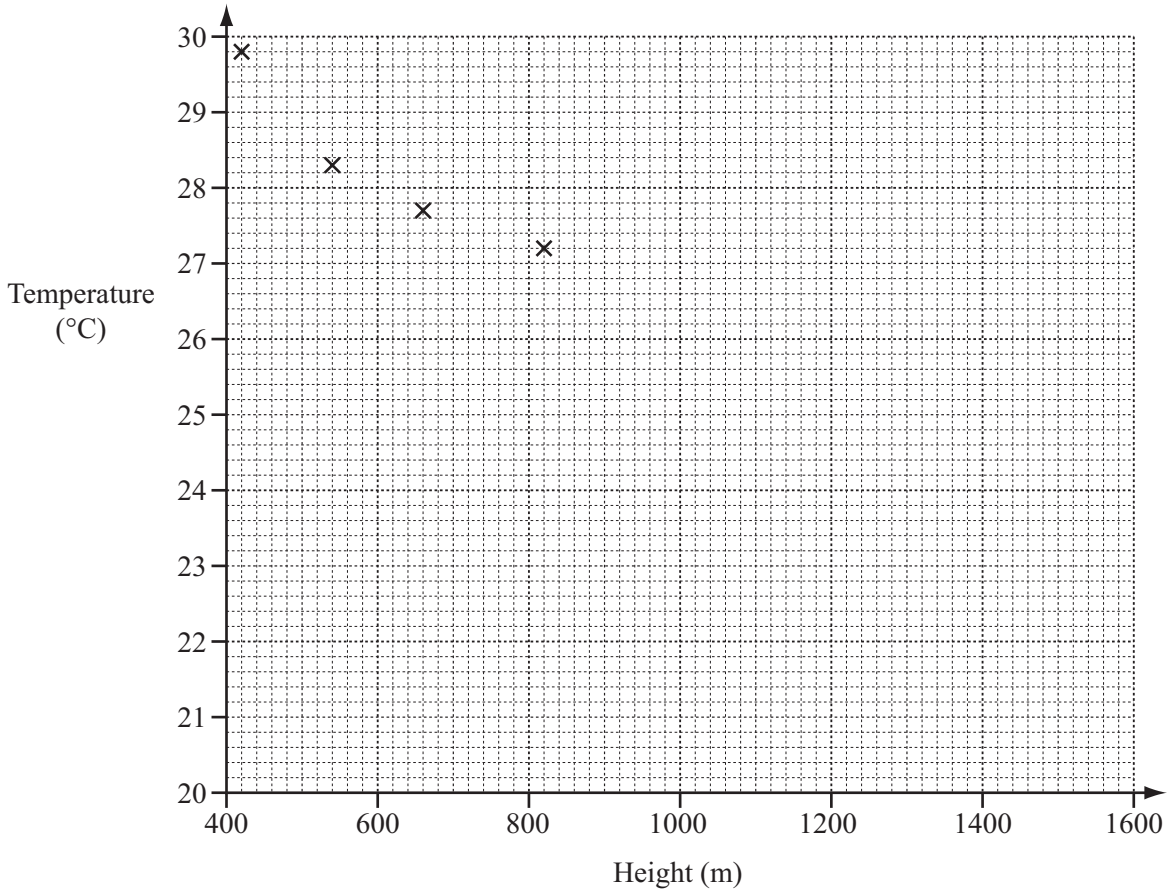
Write down the probability that the person chosen is under 30 years old.

Answer(b)(iii) ..... [1]

6 The table shows the height, in meters, above sea-level and the temperature, in °C, at midday [illegible] places on a mountain.

Height above sea-level (m)	420	540	660	820	960	1100	1240	1580
Temperature (°C)	29.8	28.3	27.7	27.2	25.4	25.0	24.2	21.0

(a) Complete the scatter plot for these results.
The first four points have been plotted for you.



[2]

(b) What type of correlation does this scatter plot show?

Answer(b) ..... [1]

(c) On the grid, draw the line of best fit. [1]

(d) Use your line of best fit to estimate the temperature at a height of 1400 m.

Answer(d) ..... °C [1]

7 **(a)** In 2001 Arnold was x years old.
Ken is **34 years younger** than Arnold.

(i) Complete the table, in terms of x, for Arnold's and Ken's ages.

	2001	2013
Arnold's age	x	
Ken's age		

[3]

(ii) In 2013 Arnold is **three** times as old as Ken.

Write down an equation in x and solve it.

Answer(a)(ii) $x =$ ..... [4]

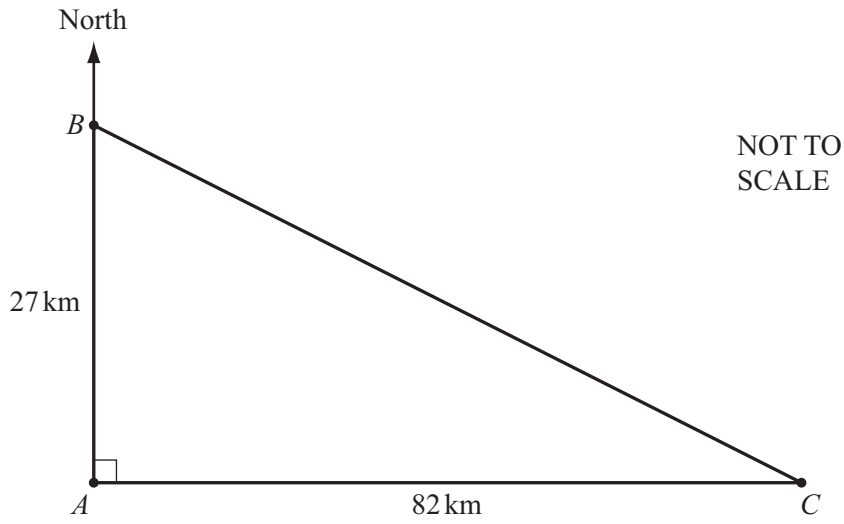
(b) Solve the system of linear equations.

$$3x + 2y = 18$$
$$2x - y = 19$$

Answer(b) $x =$ .....

$y =$ ..... [3]

8



The diagram shows the positions of three towns A, B and C.
B is 27 km north of A and the distance between A and C is 82 km.

(a) Calculate BC.

Answer(a) $BC =$ ..... km [2]

(b) Write down the **three digit** bearing of C from A.

Answer(b) ..... [1]

(c) **(i)** Use trigonometry to calculate angle ABC.

Answer(c)(i) Angle $ABC =$ ..... [2]

(ii) Work out the bearing of C from B.

Answer(c)(ii) ..... [1]

(d) (i) Calculate the area of triangle *ABC*.

Answer(d)(i) ..... km^2 [2]

(ii) The land forming the triangle *ABC* is valued at \$8400 for each square kilometer.

Calculate the value of this land.

Answer(d)(ii) \$ ..... [1]

9 Ben and Ruth own a company.

(a) The company's profits of \$43 680 are shared in the ratio Ben : Ruth = 2 : 5 .

Calculate Ruth's share of the profits.

Answer(a) \$ ..... [2]

(b) Ruth invests \$15 000 at a rate of 4% per year simple interest.

Calculate how much her investment is worth at the end of 3 years.

Answer(b) \$ ..... [3]

(c) The company employs 450 people.
14% of these people work in sales.

Calculate the number of people who work in sales.

Answer(c) ..... [2]

(d) Every year Ben travels 32 000 km on business.

(i)

Car-rent

Cost ($) = 600 + 0.35$d$

where d is the distance travelled in kilometers

Calculate the cost of hiring a car from Car-rent to travel 32 000 km.

Answer(d)(i) $ ..... [2]

(ii)

Drive-easy

Cost = $100 plus $4 for every 10 km travelled

Calculate the cost of hiring a car from Drive-easy to travel 32 000 km.

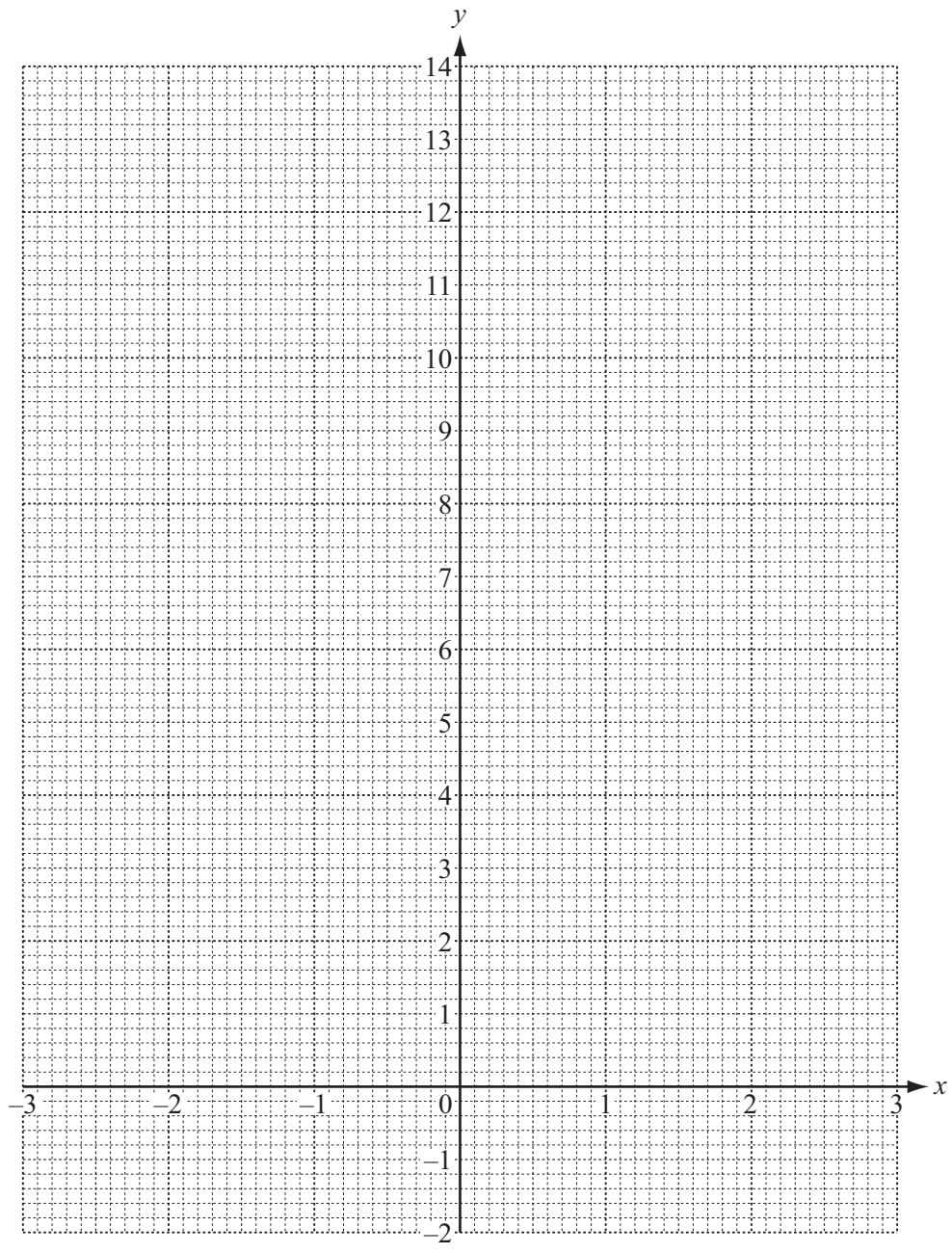
Answer(d)(ii) $ ..... [2]

10 (a) (i) Complete the table of values for $y = x^2 + x$.

x	–3	–2	–1	0	1	2	3
y	6		0	0		6	

[2]

(ii) On the grid, draw the graph of $y = x^2 + x$ for $-3 \leqslant x \leqslant 3$.



[4]

(iii) On the grid, draw the line $y = 10$. [1]

(iv) Use both your graphs to solve $x^2 + x = 10$ for $-3 \leqslant x \leqslant 3$.

Answer(a)(iv) $x =$ ..... [1]

(b) Another line, L, has the equation $y = \frac{2}{3}x - 5$.

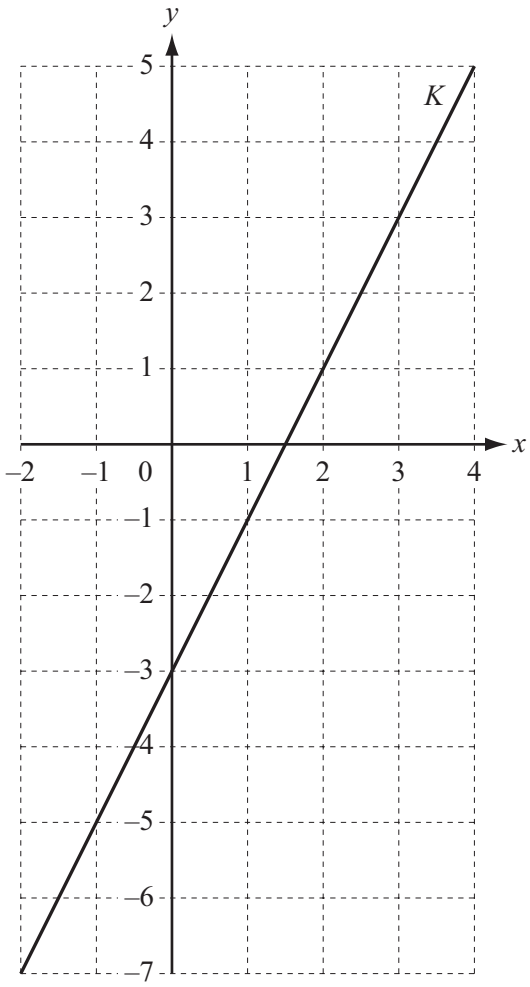
(i) Write down the slope of L.

Answer(b)(i) ..... [1]

(ii) Write down the equation of a straight line that is parallel to L.

Answer(b)(ii) ..... [1]

(c)



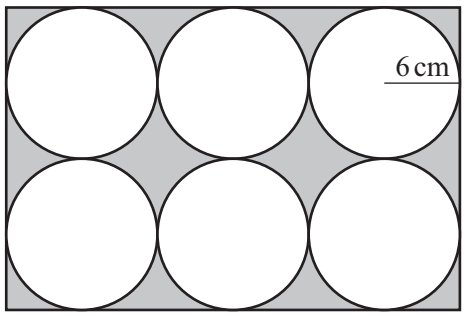
Write the equation of the line, K, in the form $y = mx + b$.

Answer(c) $y =$ ..... [3]

11 **(a)** Calculate the area of a circle of radius 6 cm.

Answer(a) ..... cm^2 [2]

(b)



NOT TO
SCALE

Each circle in this rectangle has a radius of 6 cm.
The circles fit exactly in the rectangle.

Calculate the shaded area.

Answer(b) ..... cm^2 [4]