OCR
Oxford Cambridge and RSA

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Wednesday 2 November 2016 – Morning

GCSE MATHEMATICS B

J567/03 Paper 3 (Higher Tier)

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Geometrical instruments
- Tracing paper (optional)

Duration: 1 hour 45 minutes

J567703

6420689532

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

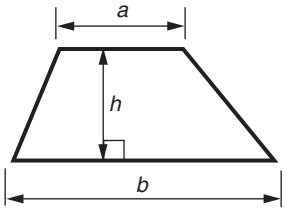
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- Quality of written communication is assessed in questions marked with an asterisk (*).
- The total number of marks for this paper is **100**.
- This document consists of **20** pages. Any blank pages are indicated.

WARNING

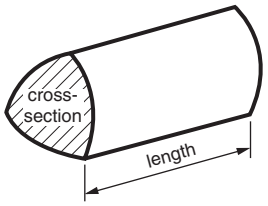
No calculator can be used for this paper

Formulae Sheet: Higher Tier

Area of trapezium $= \frac{1}{2}(a + b)h$



Volume of prism = (area of cross-section) × length

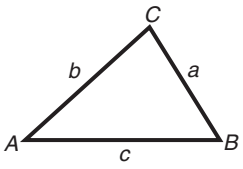


In any triangle *ABC*

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

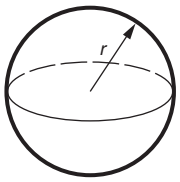
Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

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



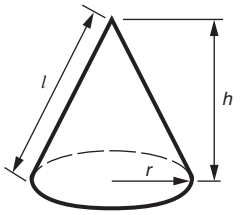
Volume of sphere $= \frac{4}{3}\pi r^3$

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



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

Curved surface area of cone $= \pi rl$



The Quadratic Equation

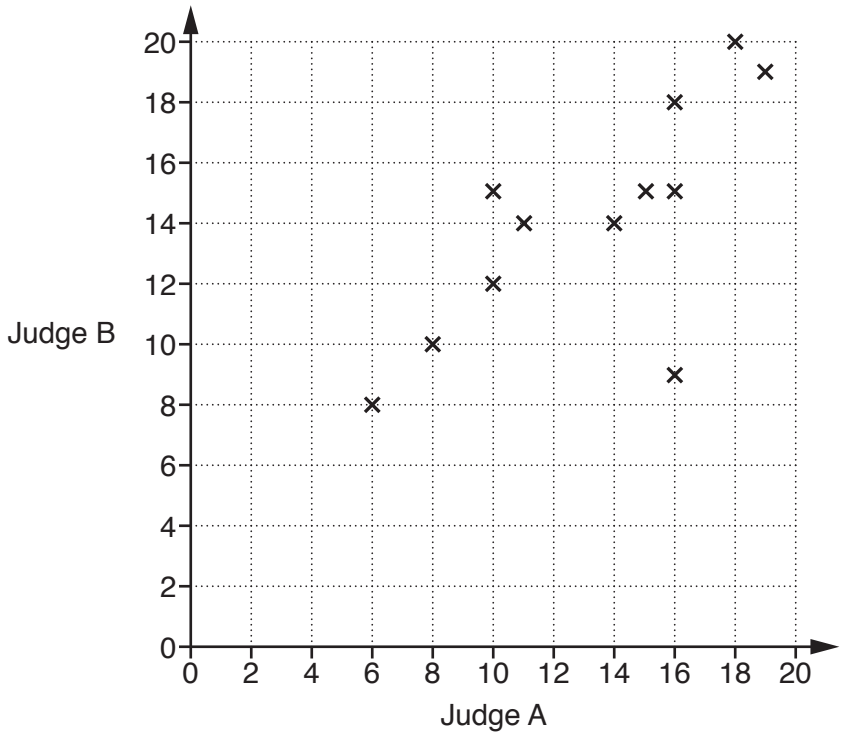
The solutions of $ax^2 + bx + c = 0$,
where $a \neq 0$, are given by

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

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** the questions.

1 There are two judges, judge A and judge B, in a dance competition.
They each gave a score out of 20 for each competitor.
The scatter diagram shows the scores that the judges gave for twelve of the competitors.



(a) The scores for one competitor did not fit the pattern for all of the other pairs of scores.

Circle the point on the diagram representing this competitor. **[1]**

(b) Ruta also took part in the competition.
Judge A gave Ruta a score of 12 for her dance.

Draw a line of best fit and use it to estimate the score that judge B gave to Ruta.

(b) ..... **[2]**

2 **(a)** Work out the value of $5p + p^2$ when

(i) $p = 4$,

(a)(i) ..... **[1]**

(ii) $p = -3$.

(ii) ..... **[2]**

(b) Factorise fully.

$10t^2 + 15qt$

(b) ..... **[2]**

(c) Solve.

$7x - 9 = 4x + 15$

(c) $x =$ ..... **[3]**

(d) Rearrange this formula to make k the subject.

$m = 8k + 3$

(d) ..... **[2]**

3 **(a)** The scale diagram shows the positions of two schools, A and B.

Scale: 2 cm represents 1 km

School A accepts students who live less than 2 km from the school.
School B accepts students who live less than 2.5 km from the school.

Construct and shade the region in which students live who could be accepted by **both** school A and school B. **[3]**

(b) Sam leaves home at 07 55 to walk 1.8 km to school.
He arrives at school at 08 15.

Work out Sam's average speed in kilometres per hour.

(b) ..... km/h **[3]**

4 **(a)** The ages of the first 20 people who visited a gym one morning are listed below.

42	53	37	29	21	31	40	62	26	39
20	35	48	57	65	28	31	36	47	41

(i) Complete this stem and leaf diagram to represent the data.

2	
3	
4	
5	
6	

Key: 4 \| 2 represents 42

[3]

(ii) Find the median age.

(a)(ii) ..... **[2]**

(iii) Work out the percentage of these people who were aged under 30.

(iii) ..... % **[2]**

(b) Arjun is doing a survey of the members of the gym.

(i) He wants to find out what time of the day people usually arrive at the gym.
The gym is open every day between 0600 and 2300.

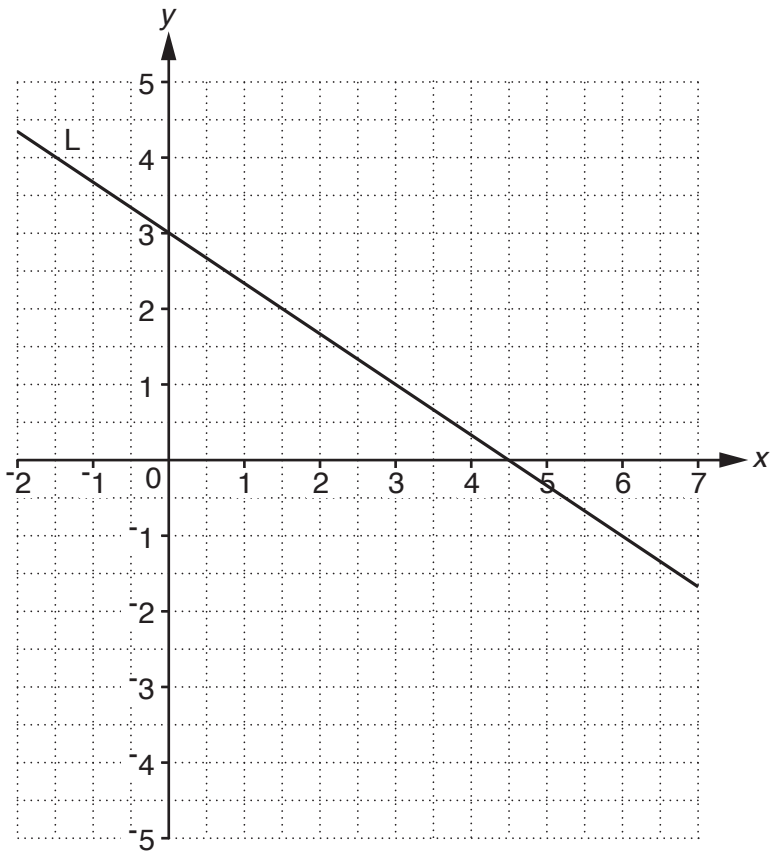
Write a suitable question Arjun could ask and include suitable option boxes. **[2]**

(ii) The gym has 500 members, 280 of them are male and 220 are female.
Arjun plans to survey a representative stratified sample of 50 people.

Work out the number of males Arjun should include in his survey.

(b)(ii) ..... **[2]**

5 The line L is drawn on the grid below.



(a) Find the gradient of the line L.

(a) ..... **[2]**

(b) Draw the graph of $y = 2x - 1$ on the same grid. **[3]**

(c) Write down the coordinates of the point of intersection of $y = 2x - 1$ and the line L.

(c) (..... , ...) **[1]**

6 Fraser makes a snack mix.
He mixes cashew nuts, almonds and cranberries in the ratio 5 : 3 : 2.

A 250 g bag of cashew nuts costs £4.75.
A 100 g bag of almonds costs £2.15.
A 100 g bag of cranberries costs £1.90.

Work out how much it costs Fraser to make 1 kg of the snack mix.

£ ..... **[4]**

7 **(a)** Write $\frac{1}{9}$ as a decimal.

(a) ..... **[1]**

(b) Work out.

$$1\frac{1}{3} \times \frac{2}{5}$$

(b) ..... **[2]**

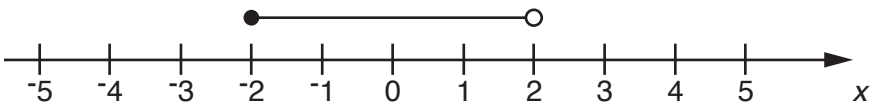
8 **(a)** Solve this inequality.

$$2(y - 3) > 5$$

(a) ..... **[3]**

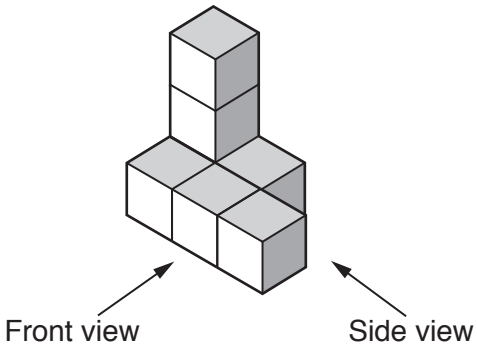
(b) A different inequality is represented on the number line below.

Write down all of the integers that satisfy this inequality.



(b) ..... **[1]**

9 This solid is made from seven one-centimetre cubes.



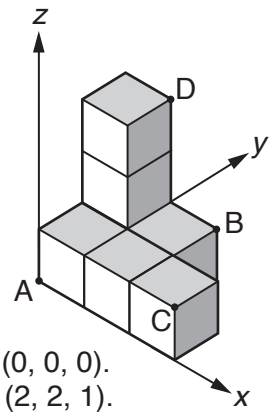
(a) Draw the front view and the side view of the solid on the grids below.

Front view

Side view

[2]

(b) The solid is placed on a set of axes as shown.



The coordinates of point A are (0, 0, 0).
The coordinates of point B are (2, 2, 1).

Write down the coordinates of

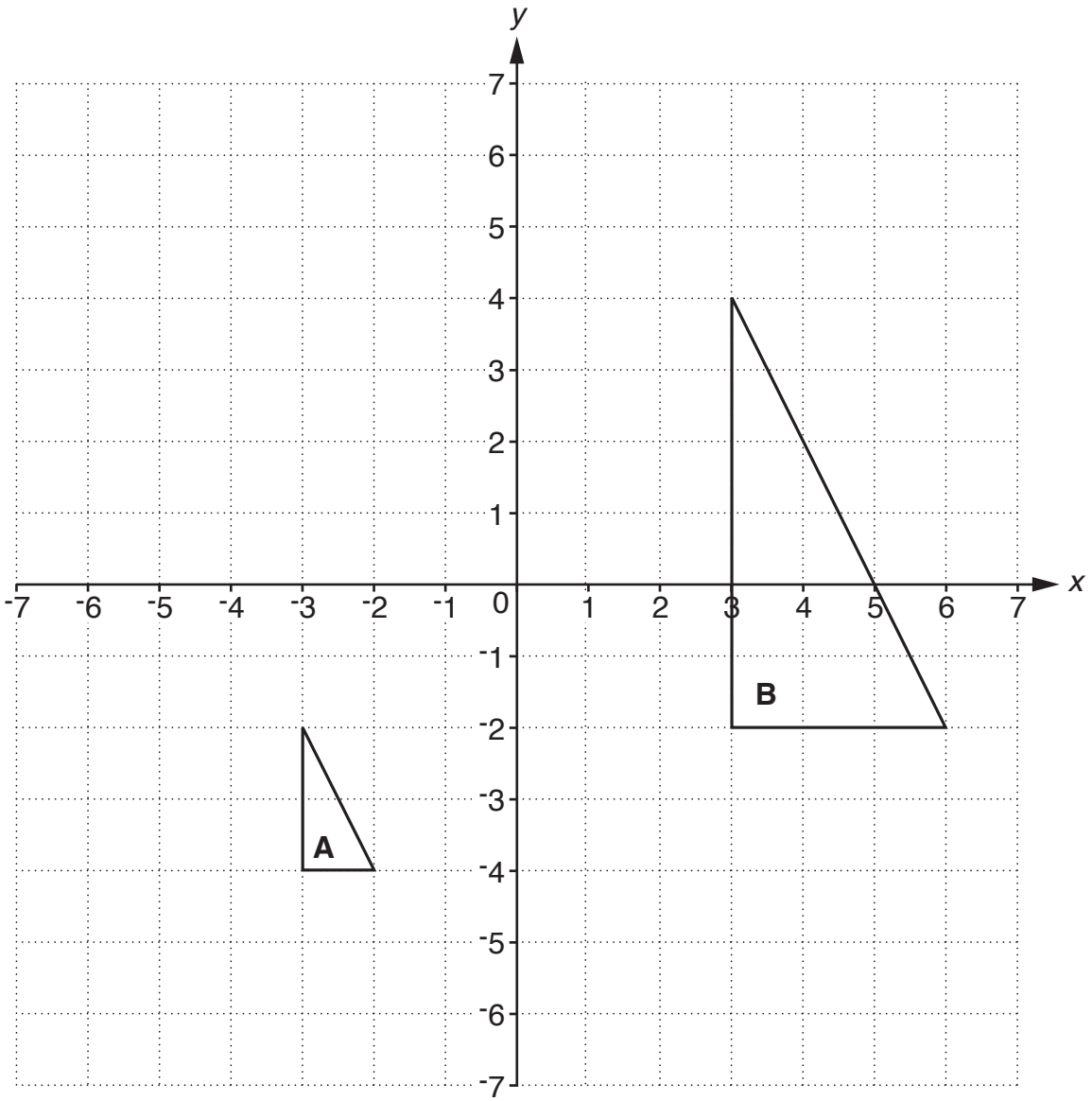
(i) point C,

(b)(i) (..... , ... , ...) **[1]**

(ii) point D.

(ii) (..... , ... , ...) **[1]**

10 Triangles **A** and **B** are drawn on the grid.



(a) Triangle **B** is an enlargement of triangle **A**.

Describe fully the enlargement that maps triangle **A** onto triangle **B**.

..... **[2]**

(b) Describe fully the **single** transformation that is equivalent to

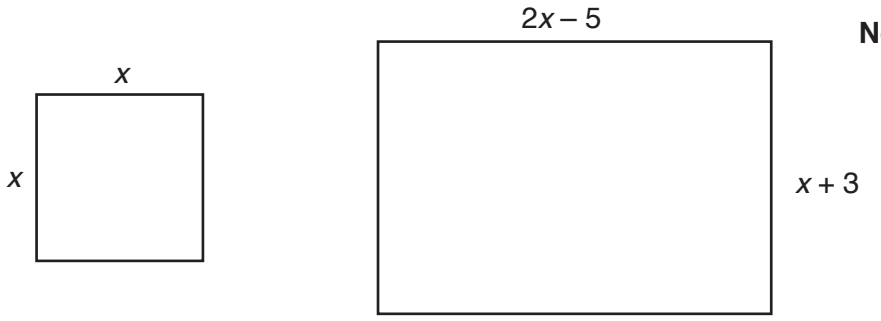
- a rotation of 90° clockwise about the origin, followed by
- a rotation of 90° clockwise about (-1, 1).

You may use the grid above for your working.

.....

..... **[3]**

11 The diagram shows a square and a rectangle with the lengths of the sides in centimetres.



Not to scale

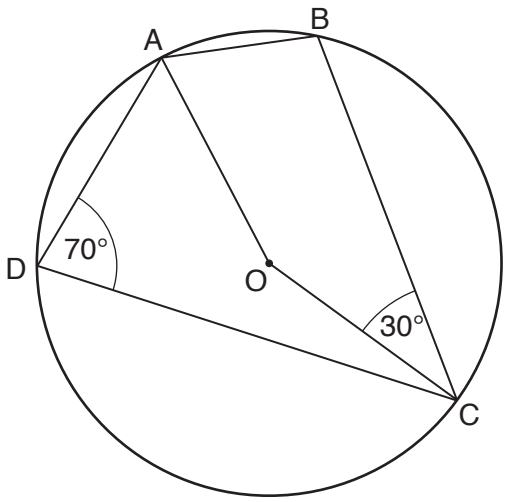
The area of the rectangle is twice the area of the square.

Find the length and the width of the rectangle.

Length = ... cm

Width = ... cm **[5]**

12* In the diagram, A, B, C and D are points on the circle that has centre O.
Angle ADC = 70° and angle BCO = 30°.



Not to scale

Work out angle OAB.
Give a reason for each step of your working.

..... ° **[5]**

13 The table shows the number of miles travelled in 2013 on roads in Great Britain by different types of vehicle.

Type of vehicle	Number of miles
Cars	2.40×10^{11}
Light goods vehicles	4.26×10^{10}
Heavy goods vehicles	1.57×10^{10}
Other vehicles	5.50×10^{9}
All motor vehicles	3.038×10^{11}

(a) Write the number of miles travelled by heavy goods vehicles as an ordinary number.

(a) ..... **[1]**

(b) Work out how many more miles were travelled by cars than by light goods vehicles.
Write your answer in standard form.

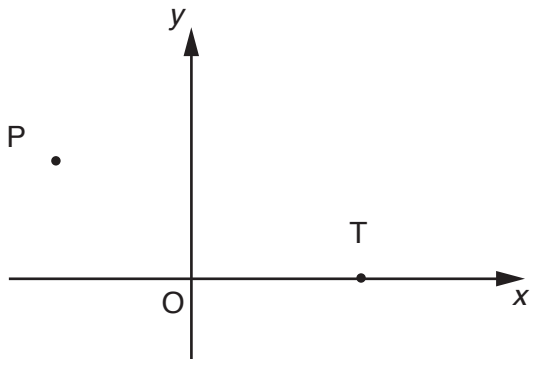
(b) ..... **[2]**

(c) The number of miles travelled by all motor vehicles in 1993 was 2.543×10^{11}.

Estimate the percentage increase in the number of miles travelled by all motor vehicles from 1993 to 2013 by rounding the values to two significant figures.

(c) ..... % **[3]**

14 P is the point (–3, 4) and T is the point (5, 0) in the sketch below.



Not to scale

(a) Find the coordinates of the midpoint of the line PT.

(a) (..... , ...) **[2]**

(b) Work out the length of the line PT.

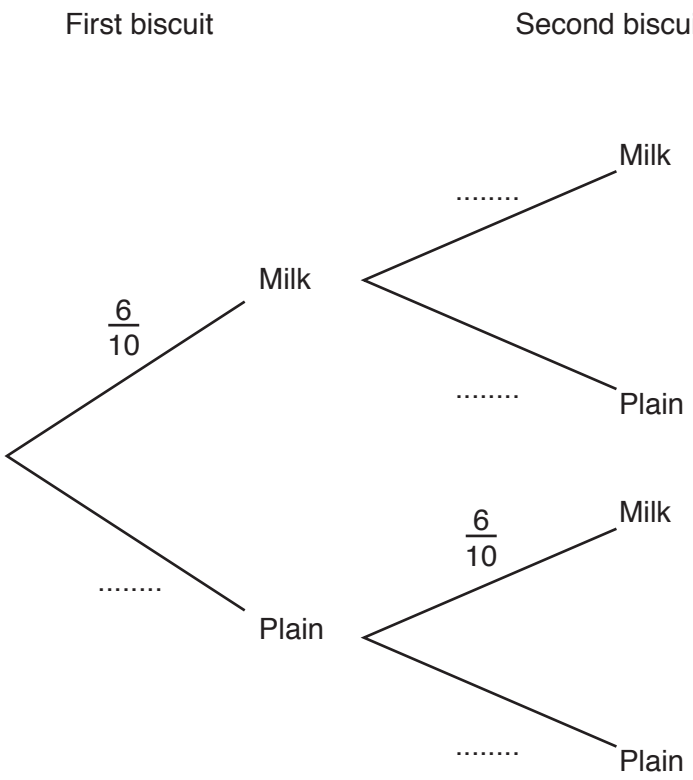
Give your answer in the form $a\sqrt{b}$ where a and b are integers and b is as small as possible.

(b) ..... **[4]**

15 A box contains 10 chocolate biscuits.
6 of them are milk chocolate and 4 of them are plain chocolate.

Ruby takes a biscuit at random from the box.
If the biscuit is milk chocolate, she eats it and takes another biscuit at random.
If the biscuit is plain chocolate, she puts it back and takes another biscuit at random.

(a) (i) Complete the tree diagram.



[2]

(ii) Work out the probability that the first two biscuits are both milk chocolate.

(a)(ii) ..... **[2]**

(b) If Ruby takes a plain chocolate biscuit she always puts it back.
She always takes biscuits at random.

Work out the probability that Ruby takes **three** plain chocolate biscuits, one after the other.

(b) ..... **[2]**

16 Vector $\mathbf{m} = \begin{pmatrix} -2 \\ 3 \end{pmatrix}$ and vector $\mathbf{n} = \begin{pmatrix} 1 \\ -4 \end{pmatrix}$.

(a) Calculate

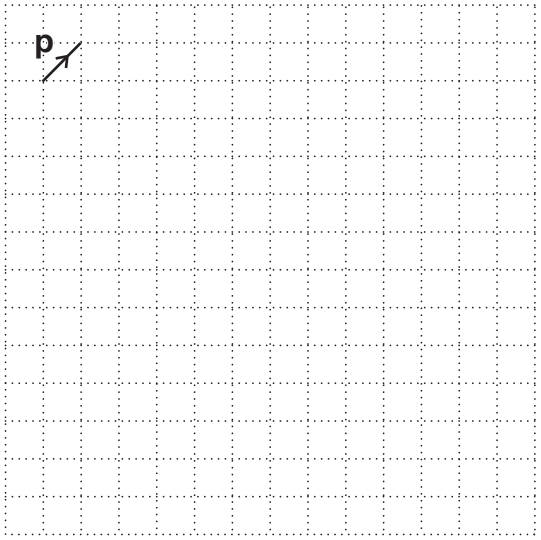
(i) $4\mathbf{m}$,

(a)(i) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ **[1]**

(ii) $\mathbf{m} - \mathbf{n}$.

(ii) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ **[1]**

(b) The vector $\mathbf{p} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$ is shown on the grid below.



Draw the vector $2\mathbf{m} + 3\mathbf{n}$ on the grid. **[2]**

17 Express as a single fraction.

$$\frac{3}{x} - \frac{2}{y}$$

..... **[2]**

18 **(a)** Evaluate.

(i) 8^0

(a)(i) ..... **[1]**

(ii) $\left(\frac{1}{27}\right)^{-\frac{1}{3}}$

(ii) ..... **[2]**

(b) Expand and simplify.

$$(3+\sqrt{2})^2$$

(b) ..... **[2]**

19 Solve algebraically these simultaneous equations.

$y = x^2 - x - 4$

$y = 2x + 6$

$x =$ ..... $y =$ .....

$x =$ ..... $y =$ ..... **[5]**

END OF QUESTION PAPER