Pre Paper 3H Practice Paper
June 2018
GCSE Mathematics (AQA style)

Higher Tier

Name   …………………………………………………………………

Class   …………………………………………………………………

INSTRUCTIONS TO CANDIDATES

- Read each question carefully. Make sure you know what you have to do before starting your answer.
- You are permitted to use a calculator in this paper.
- You may use the π button on your calculator or you may take the value of π to be 3.142.
- Do all rough work in this book.

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets at the end of each question or part question on the Question Paper**.**
- You are reminded of the need for clear presentation in your answers.
- The questions included in this collection have been selected from parts of the specification not tested in Paper 1H or Paper 2H. You should not assume, however, that because a topic appeared on Paper 1H or Paper 2H, it will not appear on Paper 3H, nor can the topics here be regarded as an exhaustive list of those to be examined on Paper 3H.

Included with each question is the statement from the specification to which it applies (where "basic foundation content" is in normal type, "additional foundation content" is in underlined type, and "higher content" is in **bold type**); content in *italics* is taken from the 'notes' sections of the specification. **All** content can be assessed on Higher tier question papers.

Question	Mark	out of
1		1
2		1
3		1
4		1
5		4
6		2
7		3
8		4
9		4
10		4
11		3
12		3
13		4
14		3
15		4
16		3
17		5
18		5
19		5
20		1
21		4
22		4
23		4
24		7
Total		80

Answer **all** questions in the spaces provided

1   **G3** understand and use alternate and corresponding angles on parallel lines; *colloquial terms such as Z angles are not acceptable and should not be used*
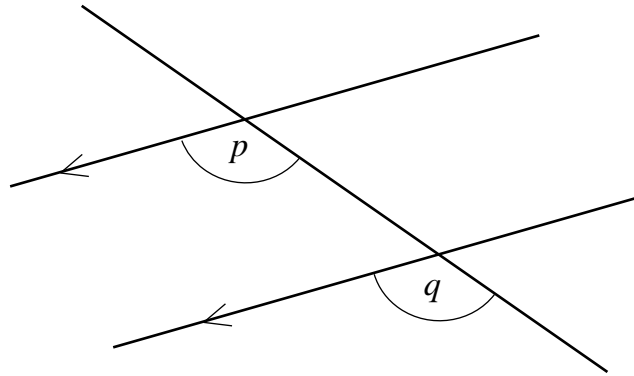
The diagram shows a pair of parallel lines, crossed by a third straight line.

What word describes the pair of angles p and q?

Circle your answer.

[1 mark]

alternate   corresponding   exterior   reflex

2   **N5** apply systematic listing strategies **including use of the product rule for counting**

I have these five cards. I am going to use them to make a five digit number.
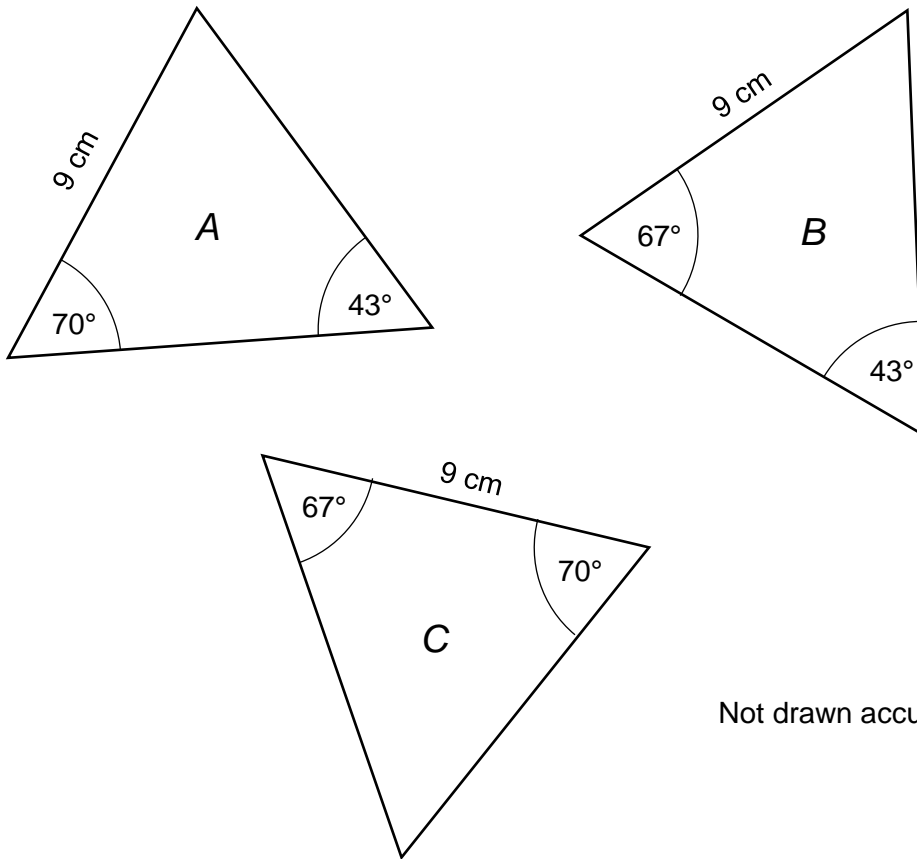
In how many ways can I do this?

Circle your answer.

[1 mark]

5   10   25   120

3

Here are three triangles, *A*, *B* and *C*.

Not drawn accurately

Which of the following statements is correct?

Tick a box

[1 mark]

☐   Only triangles *A* and *B* are congruent.

☐   Only triangles *A* and *C* are congruent.

☐   Only triangles *B* and *C* are congruent.

☐   Triangles *A*, *B* and *C* are all congruent.

4

Which of the following is equal to $\sqrt{4 \times 10^{2k}}$?

Circle your answer.

[1 mark]

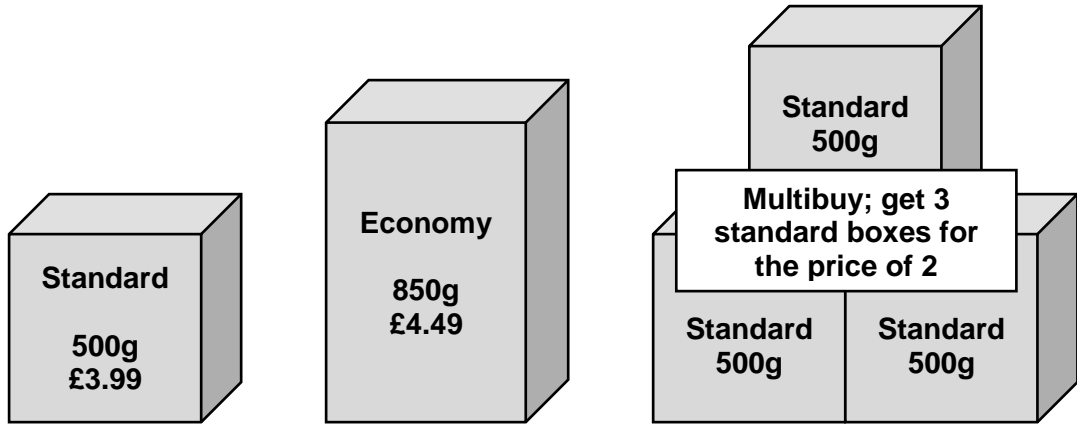2×10^{k} $\qquad$ 4×10^{k} $\qquad$ 20 $\qquad$ 2×10^{2k}

5   **R6** apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations) *including better value or best-buy problems* **R11** use compound units such as speed, rates of pay, unit pricing *including making comparisons*

Soap powder is sold in three sizes.

Which of the three offers for boxes of box soap powder is the best value for money?

Tick a box.

You must show your working out.

[4 marks]

☐   Standard.

☐   Economy.

☐   Multibuy.

6

The identity $a(x + 2) − x \equiv 3x + 8$ is true for all values of x.

Find the value of a.

[2 marks]

_____

_____

_____

Answer   _____

7   **A4 simplify and manipulate algebraic expressions (including those involving surds and algebraic fractions) by expanding products of two or more binomials**

Expand and simplify
$$(2x + 7)(x − 3)(x + 2).$$

[3 marks]

_____

_____

_____

Answer   _____

8   R5 divide a given quantity into two parts in a given part : part or part : whole ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)

Concrete is made from a mixture of cement, gravel and sand.

I want to make as much concrete as possible.

The cement, gravel and sand must be in the ratio 1 : 4 : 3.

I have the following amounts of each.

cement	gravel	sand
800 kg	3 tonnes	2100 kg

How much concrete can I make?

[4 marks]

_____

_____

_____

_____

Answer   _____

9

A machine is designed to cut pieces of wood to a length of 2.4 metres.

The lengths to which it cuts 40 pieces of wood in a sample were recorded.

Length (x cm)	Frequency		
$230 < x \leq 235$	5		
$235 < x \leq 240$	18		
$240 < x \leq 245$	14		
$245 < x \leq 250$	3		

Work out an estimate of the mean length of a piece of wood cut by the machine.

Give your answer to the nearest millimetre.

[4 marks]

_____

_____

_____

_____

        Answer   _____

10   In 2016 the population of the United Kingdom was 64.9 million.

The table shows the population in each country of the United Kingdom

Country	Population
England	53.0 million
Northern Ireland	2.4 million
Scotland	5.8 million
Wales	3.7 million

10 (a)   **R9** express one quantity as a percentage of another

In 2016, what percentage of the population of the United Kingdom lived in Scotland?

[2 marks]

Answer _____ %

10 (b)   **R9** work with percentages greater than 100%; solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics

Between 1966 and 2016, the population of England increased by 31%.

What was the population of England in 1966?

[2 marks]

Answer _____ million

11

Solve $\dfrac{x}{2} + 2 = \dfrac{x+1}{3}$.

You must show your working.

[3 marks]

Answer _____

12

Rearrange the expression $z = \dfrac{w-4}{w+7}$

to make w the subject.

[3 marks]

Answer _____

13

2.8 cm

R   Q

4.5 cm

P
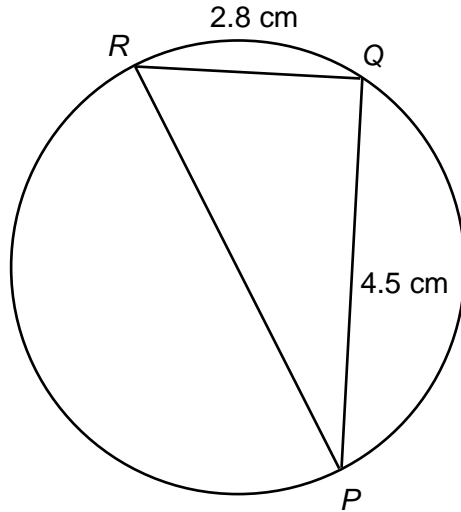
Not drawn accurately

PQR is a triangle whose vertices lie on a circle.

PR is a diameter of the circle.

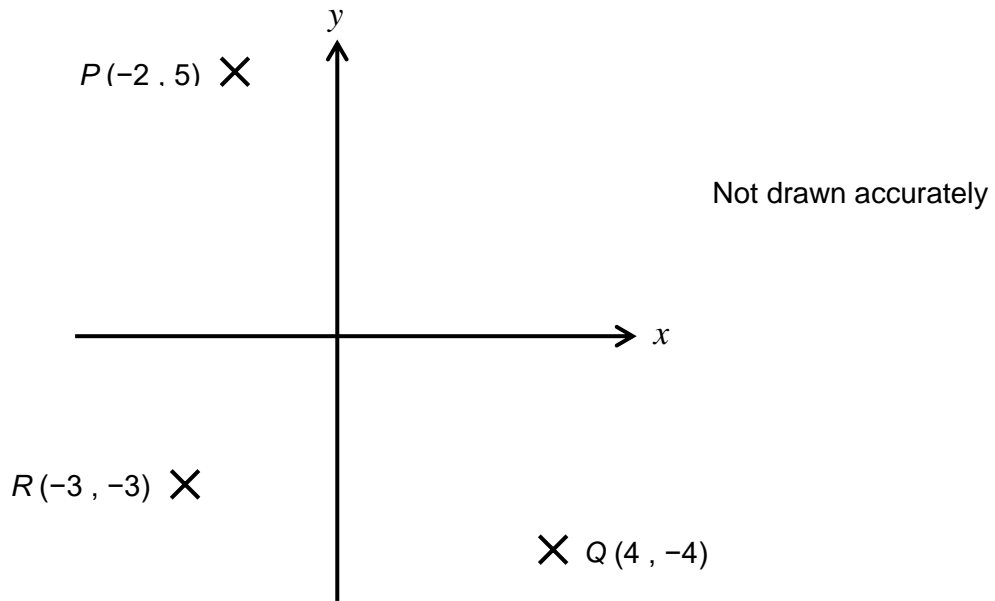Find the area of the circle.

[4 marks]

Answer _____ cm²

14

Use algebra to prove the difference between the squares of any two consecutive positive integers is equal to the sum of the two integers.

[3 marks]

_____

_____

_____

_____

_____

_____

_____

_____

15 **use the form $y = mx + c$ to identify perpendicular lines**

$P(-2 , 5)$ ✗

y

Not drawn accurately

x

$R(-3 , -3)$ ✗

✗ $Q(4 , -4)$

On the diagram, point P has co-ordinates $(-2 , 5)$, point Q has co-ordinates $(4 , -4)$ and point R has co-ordinates $(-3 , -3)$.

Find the equation of the straight line that is perpendicular to PQ and passes through point R.

[4 marks]

Answer _____

**16**   **A18** solve quadratic equations algebraically **by completing the square and by using the quadratic formula**

Solve the equation $x^2 + 6x - 5 = 0$.

Give each of your solutions to two decimal places.

[3 marks]

_____

_____

_____

_____

17   **G7** identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement *including using column vector notation for translations*
G8 describe the changes and invariance achieved by combinations of rotations, reflections and translations *including using column vector notation for translations*

The diagram shows a quadrilateral, *L*.
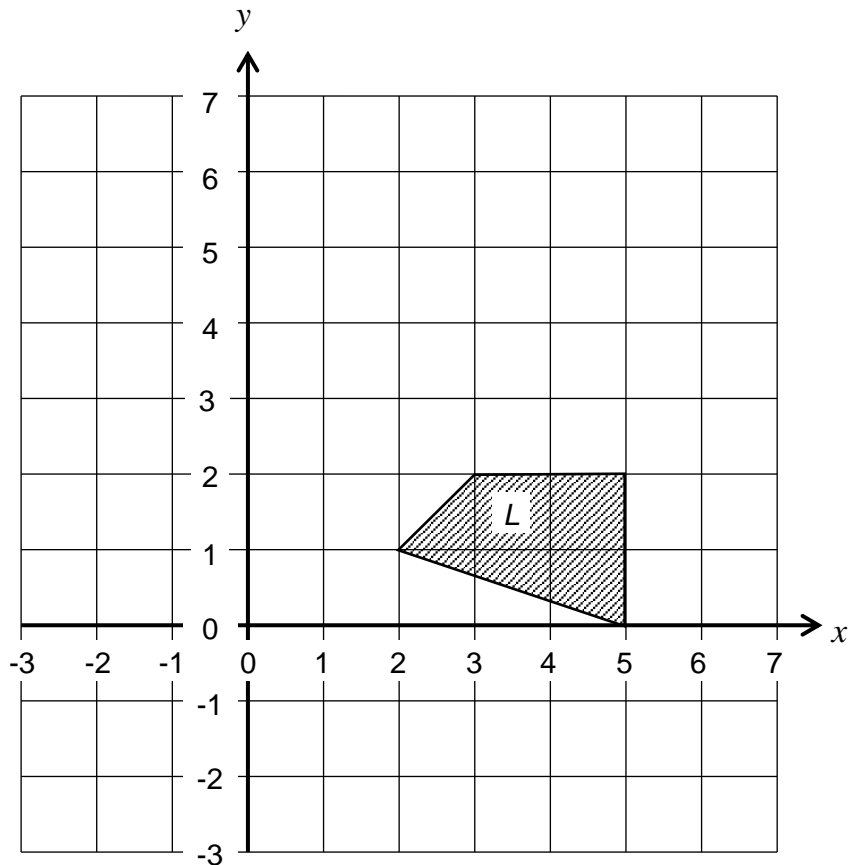
17 (a)   Translate quadrilateral *L* using the vector $\begin{pmatrix} 1 \\ 4 \end{pmatrix}$.

Label your image *M*.

[2 marks]

17 (b)   Translate *M* using the vector $\begin{pmatrix} -6 \\ 1 \end{pmatrix}$.

Label your image *N*.

[1 mark]

17 (c)   What single transformation would transform quadrilateral *L* to quadrilateral *N*?

[2 marks]

Answer _____

_____

_____

18   A20 find approximate solutions to equations numerically using iteration, *including the use of suffix notation in recursive formulae*

18 (a)   Show that the equation

$$x^2 + \frac{10}{x} = 16$$

has a solution between $x = 3$ and $x = 4$.

[2 marks]

_____

_____

_____

_____

18 (b)   An approximate solution to the equation $x^2 + \frac{10}{x} = 16$ can be found using the iterative formula
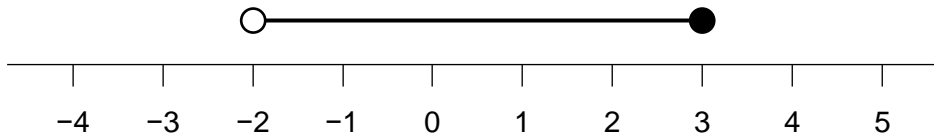
$$x_{n+1} = \sqrt[3]{16x_n - 10}.$$

Using a suitable value for x_1, find a solution of $x^2 + \frac{10}{x} = 16$ to one decimal place.

[3 marks]

_____

_____

_____

_____

_____

Answer   _____

19 (a)

The number line shows the solution set of an inequality.

What is the inequality?

Circle your answer.

[1 mark]

$-2 < x < 3$ $\quad\quad$ $-2 < x \leq 3$ $\quad\quad$ $-2 \leq x < 3$ $\quad\quad$ $-2 \leq x \leq 3$

19 (b)
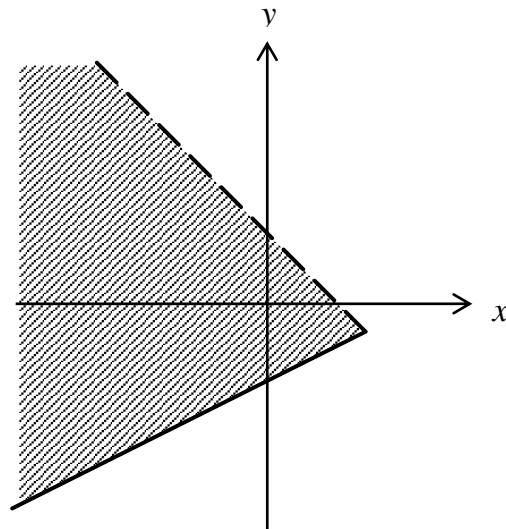
Not drawn accurately

The diagram shows a region bordered by parts of the lines $x + y = 2$ and $2y = x - 4$.

Which two inequalities are satisfied by points in this region?

Circle your answer

[1 mark]

$x + y \leq 2$	$x + y > 2$	$x + y < 2$	$x + y \geq 2$
$2y > x - 4$	$2y \geq x - 4$	$2y \geq x - 4$	$2y < x - 4$

19 (c)

Solve the inequality $x^2 - x - 30 > 0$

[3 marks]

Answer _____

20
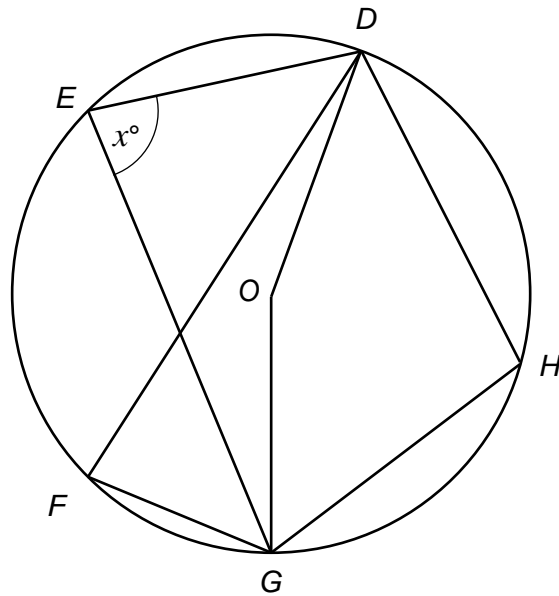
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The diagram shows five points, *E*, *F*, *G* and *H* which lie on a circle.
The centre of the circle is at *O*.

Angle *GED* is $x°$

Which of the following angles **must** also be equal to $x°$?

Circle your answer.

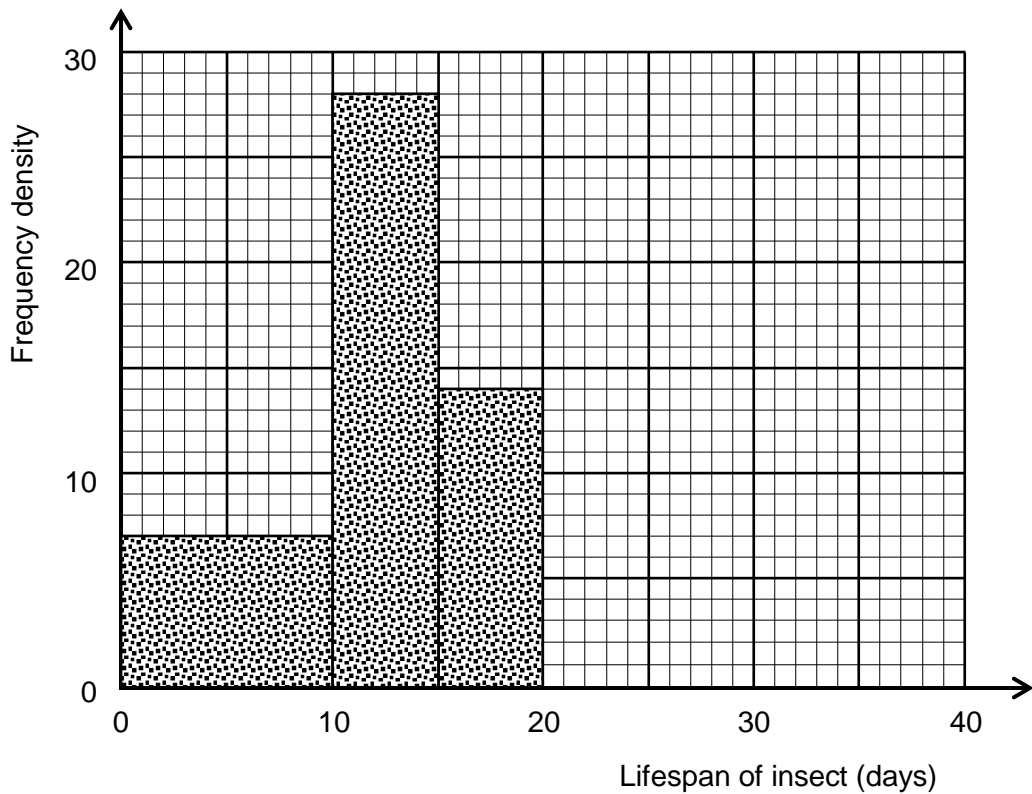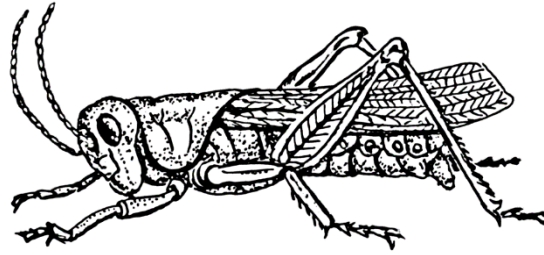**[1 mark]**

      DHG   *EDF*   *GFD*   *GOD*

21 S3 construct and interpret diagrams for grouped discrete data and continuous data, ie histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use

In an experiment, the lifespans of a sample of 400 insects were recorded using a histogram.

None of the insects lived for longer than 40 days.

The histogram is not complete.

21 (a) Here are four statements about the histogram.

Tick the boxes next to the **two** statements that are true.

[1 mark]

☐ 28 insects had a lifespan of between 10 and 15 days.

☐ 70 insects had a lifespan of less than 10 days.

☐ Twice as many insects had a lifespan of between 10 and 15 days as had a lifespan of between 15 and 20 days.

☐ Twice as many insects had a lifespan of between 15 and 20 days as had a lifespan of less than 10 days.

21 (b) There were twice as many insects that had a lifespan of over 25 days as had a lifespan of between 20 and 25 days.
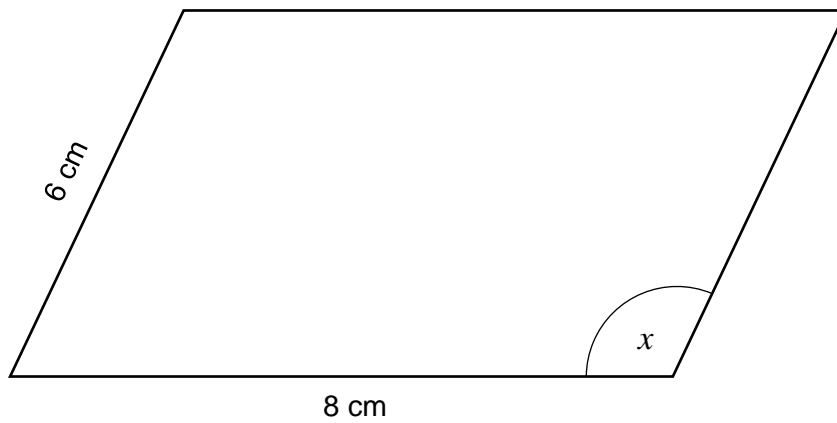
Complete the histogram.

[3 marks]

22 G23 know and apply Area = $\frac{1}{2}ab\sin C$ to calculate the area, sides or angles of any triangle

The parallelogram has an area of 40 cm².
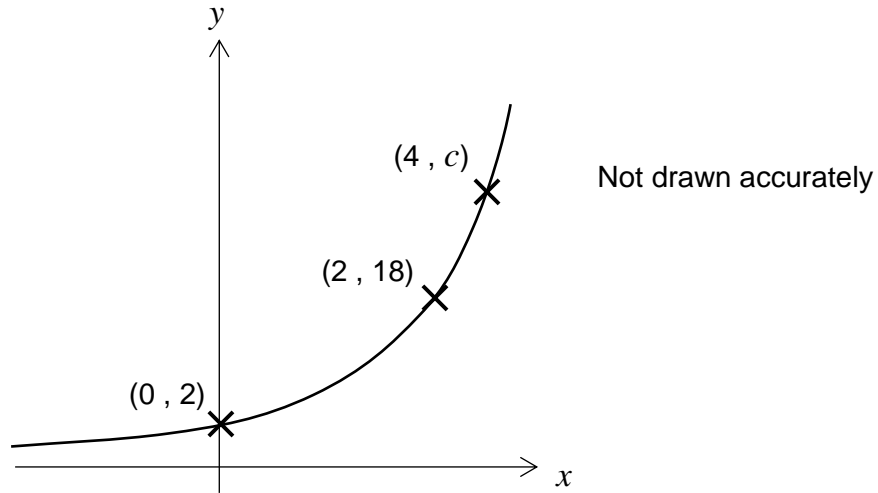
Find the size of the obtuse angle, marked x.

6 cm

8 cm

Not drawn accurately

x

[4 marks]

Answer _____ °

23   **A12** recognise, sketch and interpret graphs of linear functions and quadratic functions
     including exponential functions $y = k^x$ for positive values of k
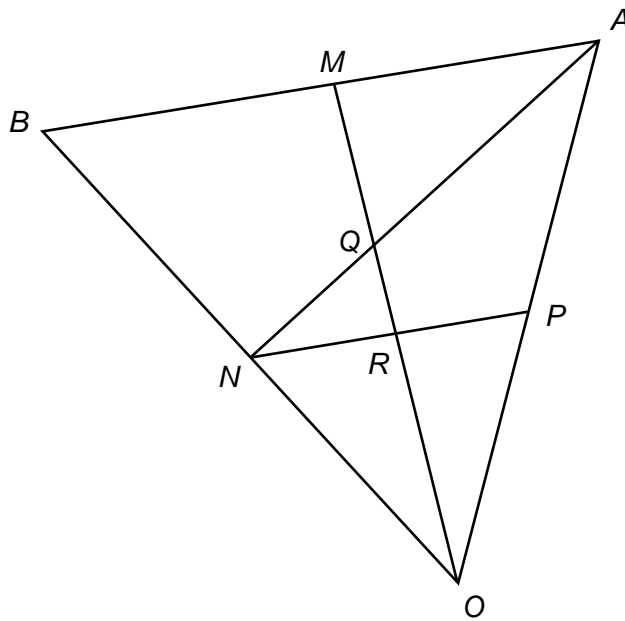

The diagram shows part of the graph of $y = ab^x$.
The co-ordinates of two of the points on the graph are given.

Find the value of c.

[4 marks]

_____

_____

_____

_____

_____

_____

        Answer   _____

Not drawn accurately

In the diagram, *AOB* is a triangle.

M is the midpoint of *AB*, *N* is the midpoint of *BO* and *P* is the midpoint of *OA*.
The lines *OM* and *AN* intersect at *Q*. The lines *OM* and *NP* intersect at *R*.

The vector $\overrightarrow{OA}$ is denoted **a**.

The vector $\overrightarrow{OB}$ is denoted **b**.

24 (a)   Find, in terms of **a** and **b**, an expression for the vector $\overrightarrow{MA}$.

[2 marks]

_____

_____

Answer   _____

24 (b) compare lengths, areas and volumes using ratio notation, scale factors; make links to similarity (including trigonometric ratios)

Use a geometrical argument to prove that that $\overrightarrow{OQ} = \frac{2}{3} \overrightarrow{OM}$.

[2 marks]

_____

_____

_____

_____

Answer _____

24 (c) Find, in terms of **a** and **b**, an expression for the vector $\overrightarrow{QA}$.

[3 marks]

_____

_____

_____

_____

Answer _____