



(GCSE Maths)

Specimen Assessment Materials

If you'd like to discuss any aspect of our Specimen Assessment Materials do give us a call on 0161 957 3852.

This commentary highlights some of the key aspects of our specimen papers and shows the strategy behind our clean and clear approach to assessment.

There are a number of features common to all of our papers for this new specification. Our aim is to provide students with a fair opportunity to demonstrate their knowledge and understanding. Some of the ways we're working to achieve this are:

Clear language and layout

We have already removed unnecessary words from our recent exams, and have provided more space between questions to avoid 'frightening' students as they turn the page. These principles apply in this new specification.

Settling students from the start

In each paper, about 8 marks (10%) will be allocated to multiple choice questions. Each paper starts with four of these. They help settle students into the exam, but they are not easy marks. Students will be able to build confidence by giving an answer, but the 'wrong' options will often highlight inappropriate methodology or approach. Including these questions allows us to test a greater breadth of content across our examinations.

Formulae provided as they are required

There are no formulae sheets at the front of our papers. The Department for Education (DfE) requirements mean that students must know certain formulae. These include the trigonometry formulae, the quadratic formula and the formula for the area of a trapezium. A full list of the 'prescribed' formulae is an appendix to the specification. When a formula is required, and we are able to provide it, we will put this in the question, rather than challenging students to remember that they have a formulae sheet.

Gradual ramping of demand as the paper progresses

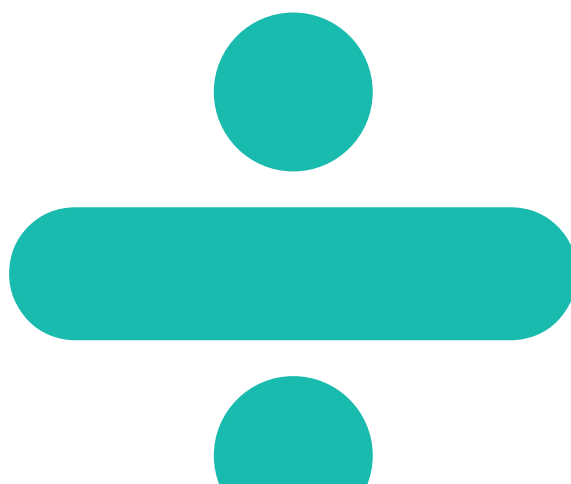
The demand of all AQA Maths papers increases steadily as students work through the paper.

- The first half of each tier F paper should contain many questions where students likely to achieve grades 1 and 2 can show their knowledge. The second half of each tier F paper will focus on questions that are designed to discriminate between grades 3,4 and 5, many of which will be common with tier H.
- The first half of each tier H paper will focus on grades 4,5 and 6, with at least 20 marks common with tier F. The second half of each tier H paper is designed to challenge and discriminate between the highest achieving students, targeting grades 7,8 and 9.

Appropriate marks for each question

Some questions now have fewer marks than they had in the past. This is a deliberate approach based on what we have learned from performance data of current questions and the approach taken in other high achieving countries. This also reflects the changes in assessment objectives. We are very confident that we can assess the full breadth of content and skills in 80 mark papers, ensuring that every mark counts and is focussed on what we want to test.

We also don't want to hide the most accessible AO1 marks behind more difficult AO2 and AO3 marks so we will minimise these where possible, allowing us to ask more single mark AO1 questions elsewhere.



Assessment objectives

Assessment objectives	Weighting	
	Higher	Foundation
AO1 Use and apply standard techniques. Students should be able to:	40%	50%
• accurately recall facts, terminology and definitions		
• use and interpret notation correctly		
• accurately carry out routine procedures or set tasks requiring multi-step solutions		
AO2 Reason, interpret and communicate mathematically. Students should be able to:	30%	25%
• make deductions, inferences and draw conclusions from mathematical information		
• construct chains of reasoning to achieve a given result		
• interpret and communicate information accurately		
• present arguments and proofs		
• assess the validity of an argument and critically evaluate a given way of presenting information		
AO3 Solve problems within mathematics and in other contexts. Students should be able to:	30%	25%
• translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes		
• make and use connections between different parts of mathematics		
• interpret results in the context of the given problem		
• evaluate methods used and results obtained		
• evaluate solutions to identify how they may have been affected by assumptions made		

Paper 1 Higher Tier

Paper 1 illustrates the consistent approach to the opening of papers at both tiers with four multiple choice questions – higher tier assessment is obviously more challenging, but we still feel it is important that the earliest questions are designed to settle students allowing them to see familiarity of style when they turn over that first page in the examination. We recognise that Higher students suffer from examination fear at least as much as Foundation students and we want to ease them into the papers at this tier too.

GCSE MATHEMATICS (8300/1H)

H

Paper 1 Higher tier

Specimen 2015

Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- mathematical instruments

You may **not** use a calculator



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature _____

Answer **all** questions in the spaces provided.

1 (a) Circle the smallest number.

[1 mark]

2.3

$2.\dot{3}$

2.33

2.03

1 (b) Circle the largest number.

[1 mark]

2.3

$2.\dot{3}$

2.33

2.03

2 Here is a sequence.

40

35

30

25

20

Circle the expression for the n th term of the sequence.

[1 mark]

$5n + 35$

$5n - 45$

$45 - 5n$

$n - 5$

3 Which of these is **not** a square number?

Circle your answer.

[1 mark]

4×10^2

4×10^6

9×10^3

9×10^4

4 Work out $64.32 \div 0.12$

[2 marks]

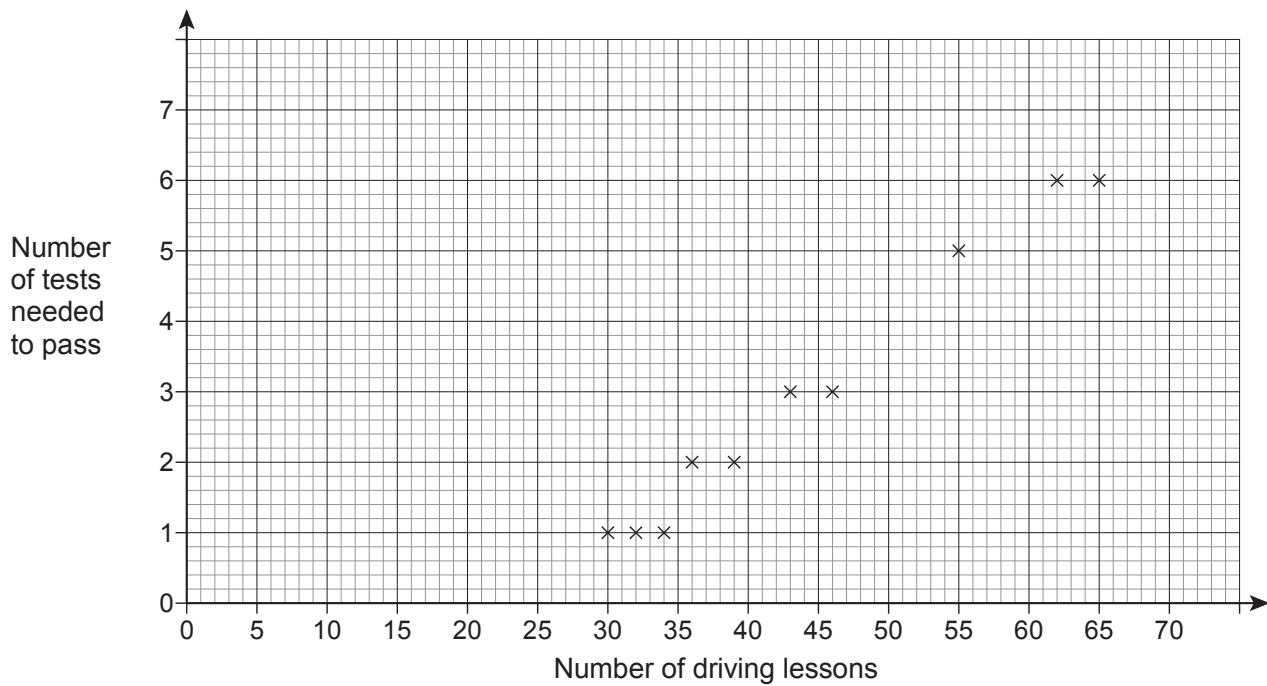
Answer _____

Turn over for the next question



Q4 shows that students at Higher tier will need to be confident and competent in written calculations.

- 5** The scatter graph shows the number of driving lessons and the number of tests needed to pass by 10 people.



- 5 (a)** Describe the correlation.
Circle your answer.

[1 mark]

strong positive

weak positive

weak negative

strong negative

- 5 (b)** Use a line of best fit to estimate the number of tests needed to pass by a person who has 50 lessons.

[2 marks]

Answer _____

5 (c) Meera says,

“I can use the trend to predict the number of driving tests needed to pass for any number of driving lessons.”

Comment on her statement.

[1 mark]

6 Which of $\frac{2}{5}$ or $\frac{5}{8}$ is closer in value to $\frac{1}{2}$?

You **must** show your working.

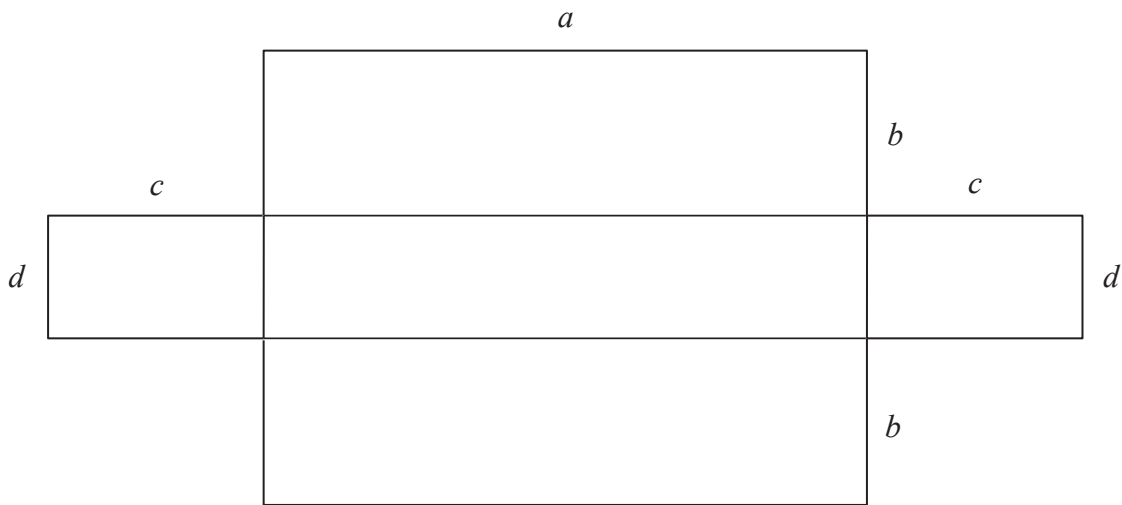
[3 marks]

Answer _____

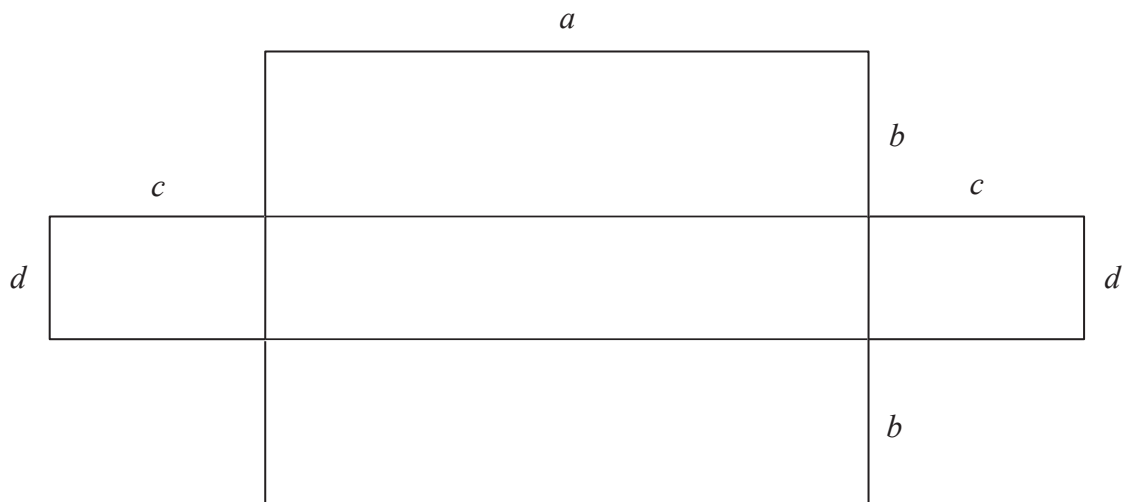
Turn over for the next question

7 A shape is made from rectangles.

7 (a) On the diagram below shade an area represented by the expression $ad + cd$ [1 mark]



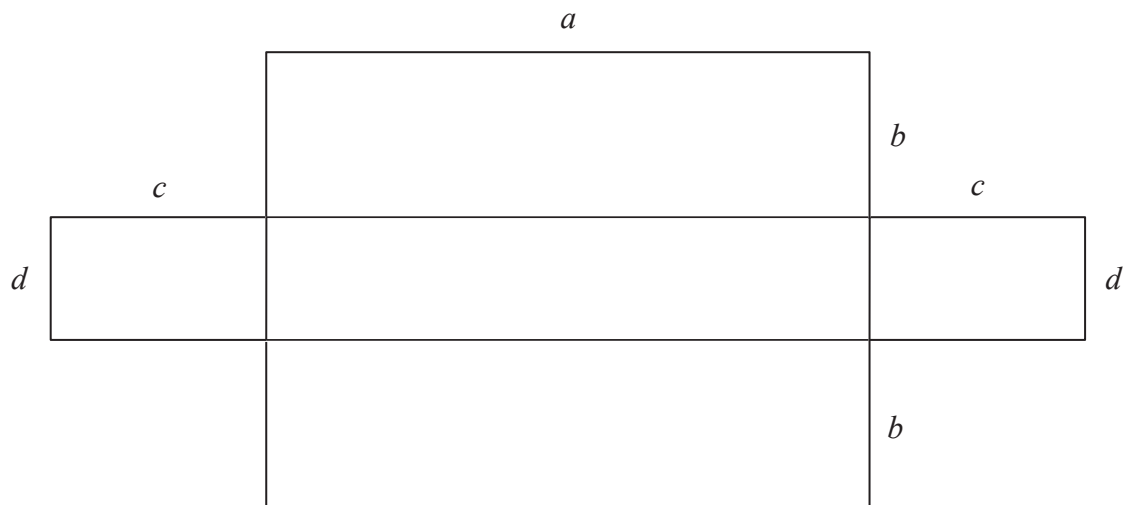
7 (b) On the diagram below shade the area represented by the expression $d(a + 2c)$ [1 mark]



Q7 is common in part to Foundation and connects different areas of mathematics, which is a requirement of the new specification. We have generated the connection, but on other occasions students may need to make it themselves, for example, by setting up an equation to solve a problem in geometry.

- 7 (c) Write down an expression for the area of the whole shape.

[1 mark]



Answer _____

- 8 Circle the value of $\cos 30^\circ$

[1 mark]

$$\frac{1}{\sqrt{3}}$$

$$\frac{1}{2}$$

$$\frac{\sqrt{3}}{2}$$

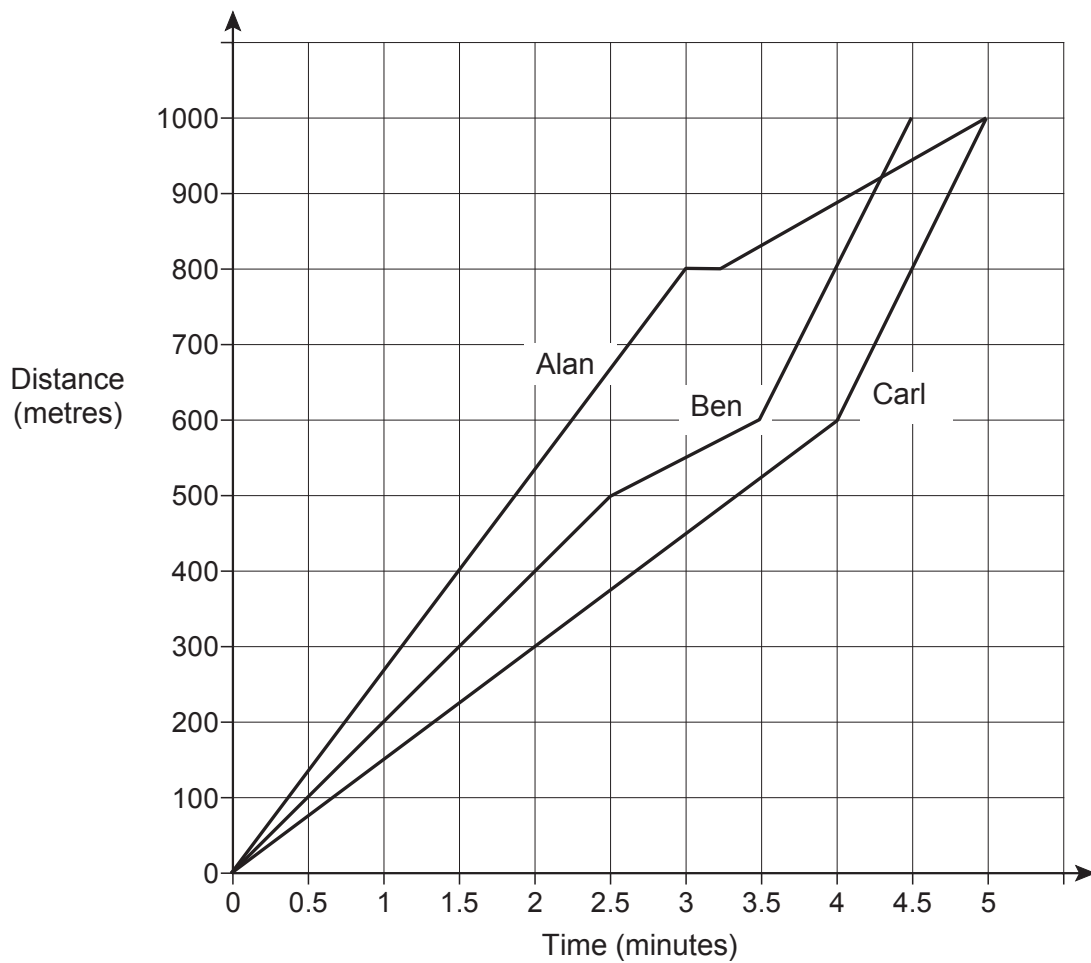
$$\frac{2}{\sqrt{3}}$$

Turn over for the next question



Q8 is a topic new to GCSE and is tested here in a multiple choice question, giving students every chance to remember the required information.

- 9** Alan, Ben and Carl ran a 1000 metre race.
The distance-time graph shows the race.



- 9 (a)** Who won the race?
Give a reason for your answer.

[1 mark]

Answer _____

Reason

9 (b) Describe the race.

[4 marks]

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Turn over for the next question

10

$$2x + 3y = 15.5$$

$$x + y = 6$$

Work out the values of x and y .

[3 marks]

 $x =$ _____ $y =$ _____

11

Five integers have

a mode of 6

a median of 8

a mean of 10

What is the **greatest** possible range of the five integers?

You **must** show your working.

[3 marks]

Answer _____

- 12** Write $2(7x + 4) - 4(x + 6) + 1$ in the form $a(bx + c)$
where a , b and c are integers and $a > 1$

[3 marks]

Answer _____

Turn over for the next question

13 Here is a map of France.



Scale: 1 cm represents 80 km

i Q13 is a development of a Foundation question, but is rather more demanding. Notice that the wording of part (b) is almost identical to that of Assessment Objective AO3.5. In this case the assumptions are given, but questions may ask students to make and evaluate their own assumptions. The benefit of using the language of the Assessment Objective is that we can replicate this in the future so students know what we are asking, rather than changing the language and casting doubt.

13 (a) Estimate the time it would take to drive from Paris to Marseille.

Assume

- the road is straight
- an average speed of 100 km/h

[4 marks]

Answer _____ hours

13 (b) Comment on how each assumption affects the accuracy of your estimate.

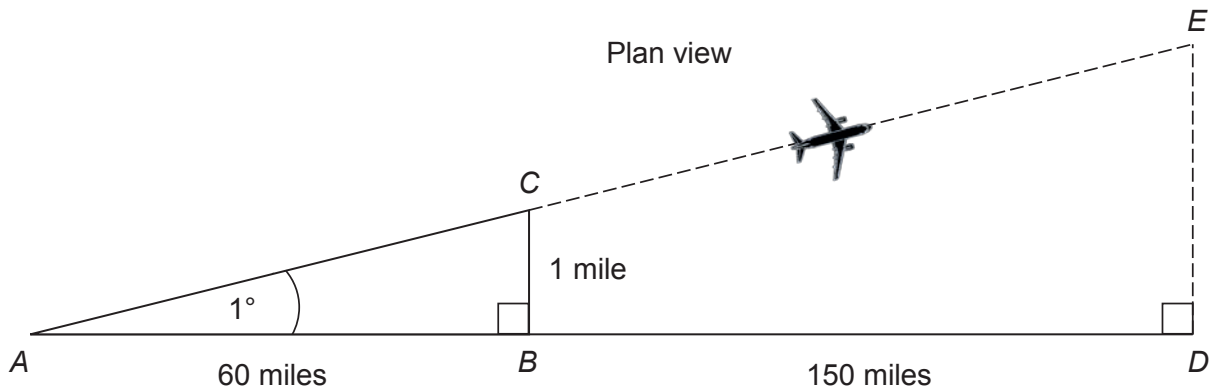
[2 marks]

Assumption 1 _____

Assumption 2 _____

- 14** The pilot of an aircraft wants to fly from A to D .
The aircraft flies from A to E , 1° off course.

Not drawn
accurately



- 14 (a)** The distance BC is 1 mile.

Work out the distance DE .

[2 marks]

Answer _____ miles

- 14 (b)** How should the aircraft have turned at C to fly directly towards D ?

Tick a box.

[1 mark]

1° clockwise

☐

between 1° and 2° clockwise

☐

2° clockwise

☐

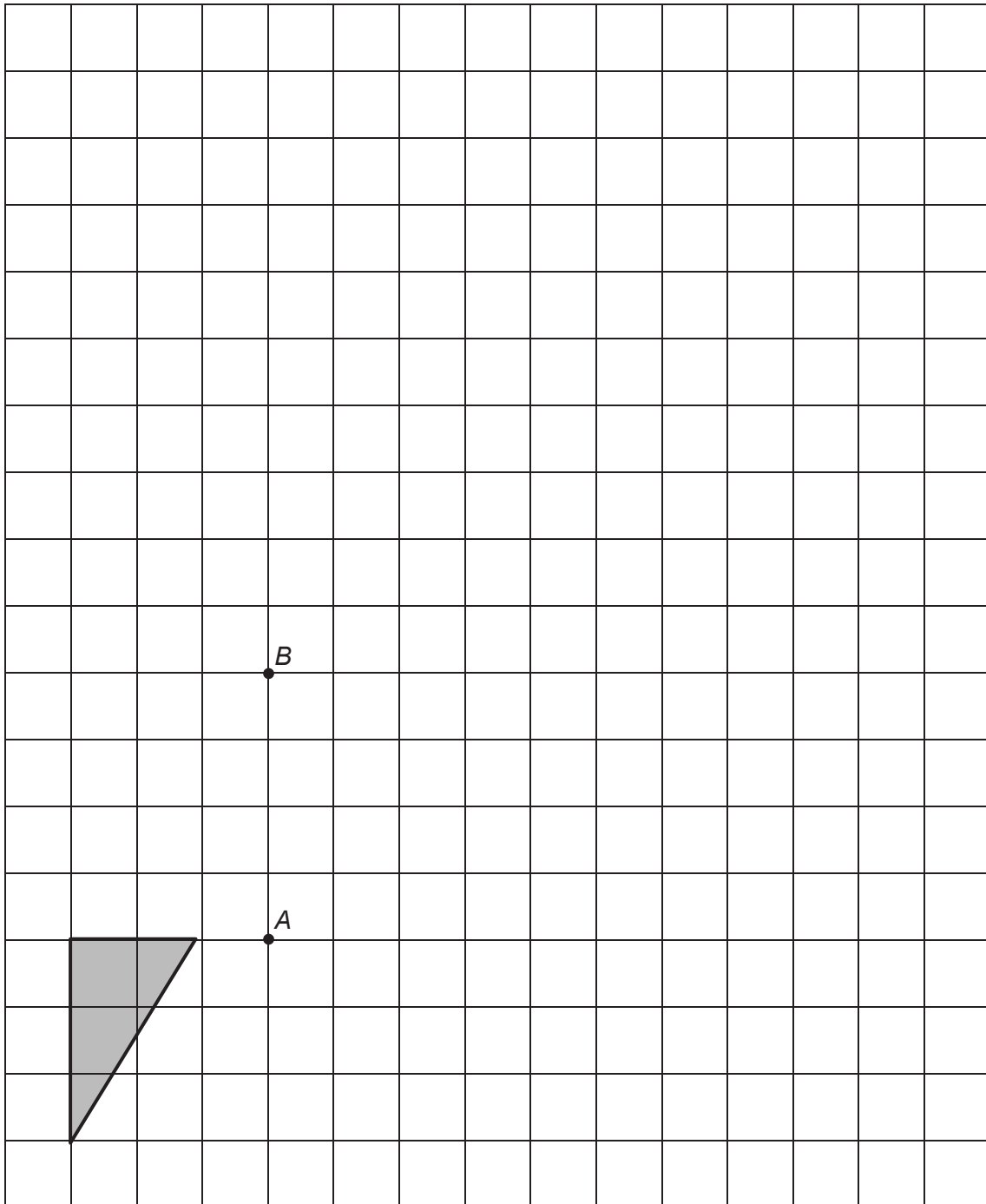
more than 2° clockwise

☐


Q14 is set on the non-calculator paper so students should not be led into attempting a solution using trigonometry. This question meets the requirement that some problems will be set in unfamiliar contexts.

- 15 The shape is **rotated** 90° clockwise about point A .
It is then **enlarged** by scale factor -2 , centre B .
Draw the final shape on the diagram.

[3 marks]



16

Rearrange

$$y = \frac{4 - 3x}{x - 5}$$

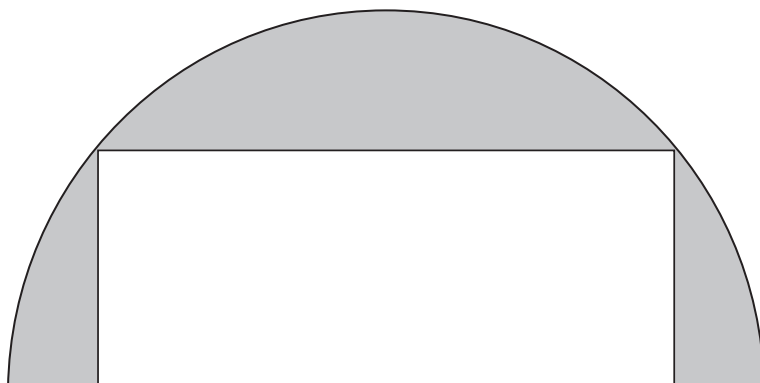
to make x the subject.

[4 marks]

Answer _____

- 17** The diagram shows a rectangle inside a semicircle.
The rectangle has dimensions 16 cm by 6 cm

Not drawn
accurately



Work out the shaded area.
Give your answer in terms of π .

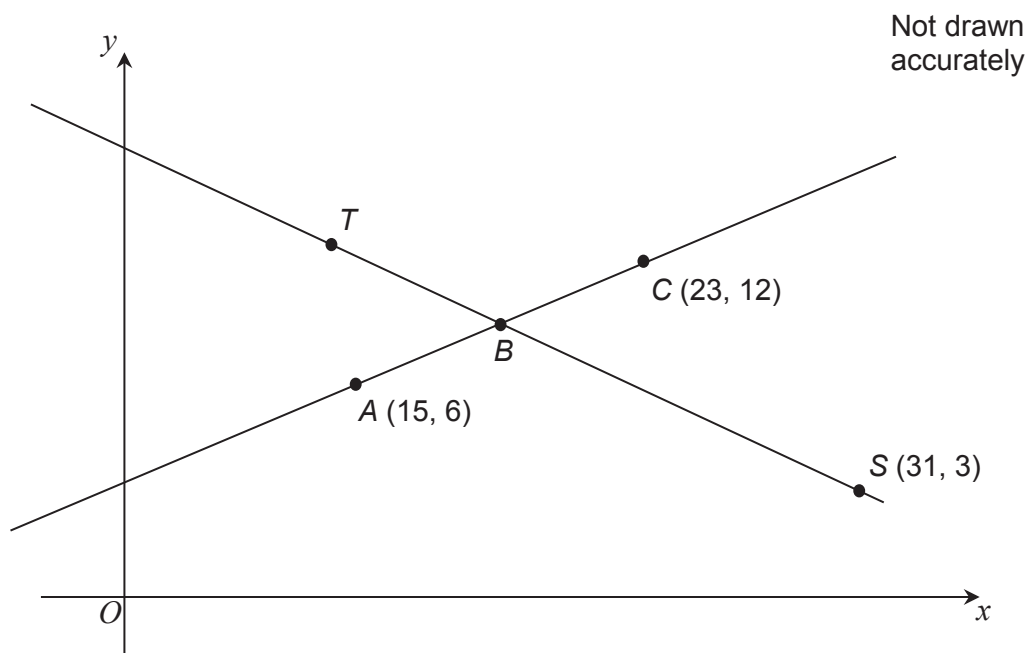
[4 marks]

Answer _____ cm^2

18 Two straight lines are shown.

B is the midpoint of AC .

$$TB : BS = 2 : 3$$



Work out the coordinates of T .

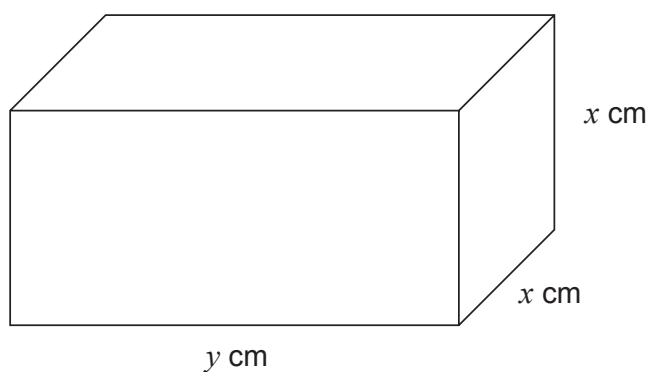
[4 marks]

Answer (_____ , _____)



Q18 is similar at first glance to a Foundation question (1F Q26), but is significantly more demanding and designed to discriminate at the highest grades. The question also demonstrates that ratio and proportion can be assessed in different ways, avoiding repeated testing of fractions and percentages.

- 19** A cuboid has dimensions x cm, x cm and y cm



x is increased by 10%

y is decreased by 20%

Work out and describe the percentage change in the volume of the cuboid.

[4 marks]

Answer _____

20 Circle the value of $9^{-\frac{1}{2}}$

[1 mark]

$$\frac{1}{81}$$

$$\frac{1}{3}$$

$$-3$$

$$-4\frac{1}{2}$$

21 Expand and simplify $(2x + 5)(2x - 5)(3x + 7)$

[3 marks]

Answer _____

22

Write

$$\frac{26}{\sqrt{2}} - \frac{12}{\sqrt{18}}$$
$$+ 2\sqrt{50}$$

in the form $a\sqrt{2}$ where a is an integer.

[4 marks]

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Answer

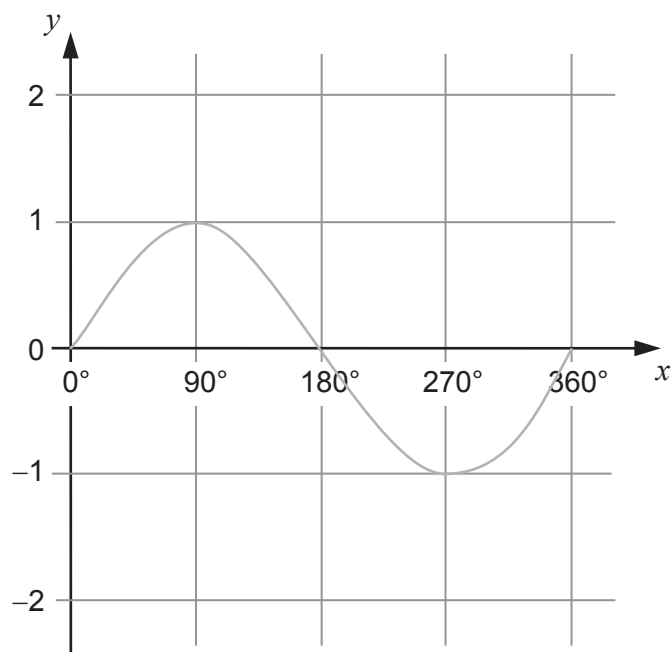


i Q22 requires students to construct a substantial chain of reasoning to obtain a result in a given format. The reasoning and persistence needed to complete this question is significant, as these papers are aiming for greater differentiation and challenge for the most able students. However, note again how clear the maths is and that there is no doubt about what we are testing here.

23 (a) The graph of $y = \sin x$ is shown for $0^\circ \leq x \leq 360^\circ$

On the grid sketch the graph of $y = \sin x - 1$ for $0^\circ \leq x \leq 360^\circ$

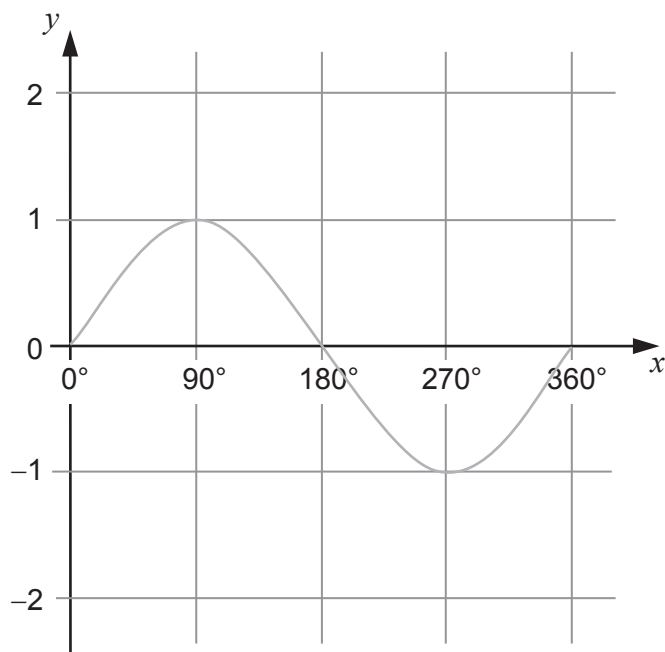
[1 mark]



23 (b) The graph of $y = \sin x$ is shown on the grid for $0^\circ \leq x \leq 360^\circ$

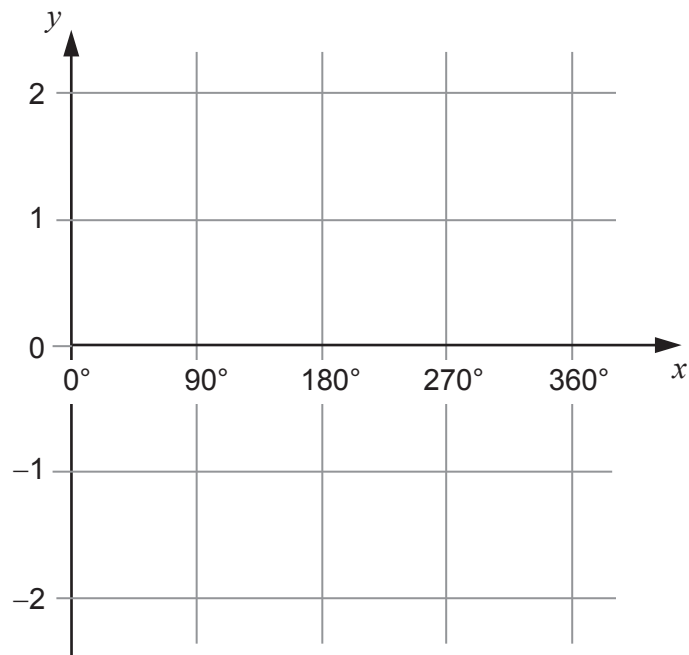
On this grid sketch the graph of $y = -\sin x$ for $0^\circ \leq x \leq 360^\circ$

[1 mark]



23 (c) On this grid sketch the graph of $y = \tan x$ for $0^\circ \leq x \leq 360^\circ$

[1 mark]



Turn over for the next question

- 24** A bag contains n beads.
One bead is black and the rest are white.
Two beads are taken from the bag at random.

- 24 (a)** Show that the probability that **both** beads are white is $\frac{n-2}{n}$


[2 marks]

- 24 (b)** The probability that **both** beads are white is greater than 0.9

Work out the **least** possible value of n .

[3 marks]

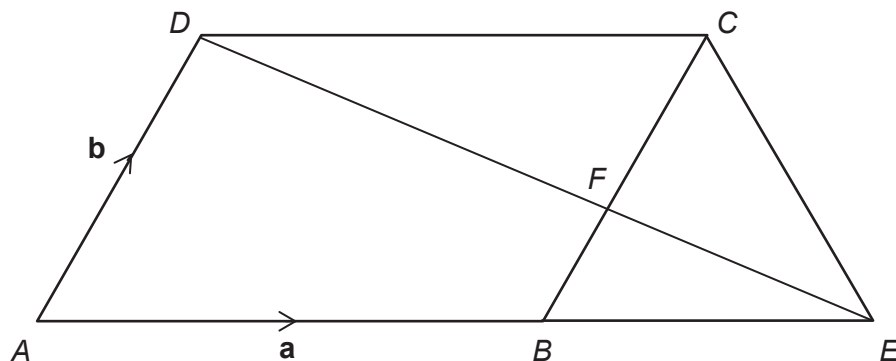
Answer _____

 Q24 includes elements of problem solving. The wording is minimal and designed to allow students to easily access the question and immediately be able to apply their mathematical knowledge to answer it.

- 25** $ABCD$ is a parallelogram.
 ABE is a straight line and $AB : BE = 3 : 2$
 BC and ED intersect at F .

$$\vec{AB} = \mathbf{a} \text{ and } \vec{AD} = \mathbf{b}$$

Not drawn
accurately



- 25 (a)** Work out \vec{ED} in terms of \mathbf{a} and \mathbf{b} .
 Give your answer in its simplest form.

[3 marks]

Answer _____

- 25 (b)** Deduce \vec{EF} in terms of \mathbf{a} and \mathbf{b} .

[2 marks]

Answer _____

END OF QUESTIONS

i Q25 concludes with an AO2 deduction question, which could have been asked as a single question for 4 or 5 marks. However, we are keen to include AO1 question parts even at this late stage of the Higher paper, the question has been structured so that answering part (a) should assist students as they tackle part (b).

Paper 2

Higher Tier

Formal proof is only required (under A02) in Higher tier. Q21 is a good example of how this will appear in our papers. We know that proof is a demanding skill requiring clear steps with reasons given at each stage. It is important that students understand and can deal with the extra demand of proof over and above the less demanding 'show that' style of question.

GCSE MATHEMATICS (8300/2H)

H

Paper 2 Higher tier

Specimen 2015

Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a calculator
- mathematical instruments.



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature _____

Answer **all** questions in the spaces provided.

1 Which of these is used to work out density?

Tick a box.

[1 mark]

mass \times volume

☐

mass² \times volume

☐

mass \div volume

☐

volume \div mass

☐

2 Circle the fraction equivalent to 2.375

[1 mark]

$$\frac{23}{75}$$

$$\frac{9}{4}$$

$$\frac{19}{8}$$

$$\frac{75}{23}$$

- 3** Circle the equation of the x -axis.

[1 mark]

$x + y = 0$

$x - y = 0$

$x = 0$

$y = 0$

- 4** The angles of a quadrilateral are 140° , 80° , 60° and 80°

What type of quadrilateral could it be?

Circle your answer.

[1 mark]

Kite

Parallelogram

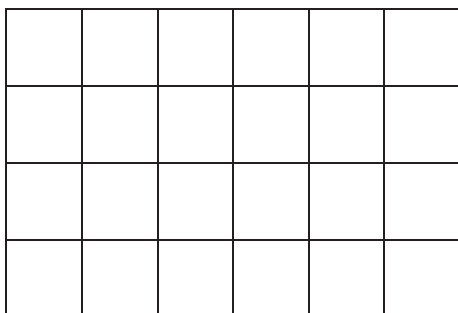
Rhombus

Trapezium

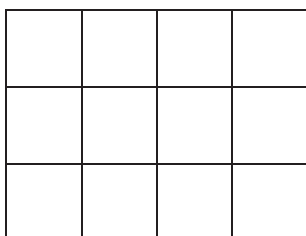
Turn over for the next question

- 5** A solid cuboid is made from **centimetre cubes**.

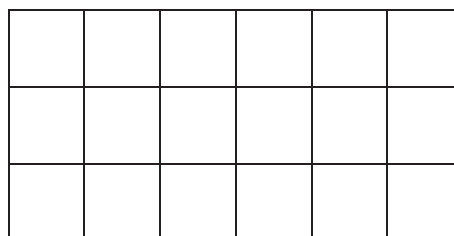
The plan view, front elevation and side elevation are shown.



Plan view



Front elevation



Side elevation

How many centimetre cubes were used to make the cuboid?

[2 marks]

Answer _____

- 6** The times that 80 customers waited at a supermarket checkout are shown.

Time, t (minutes)	Frequency
$0 \leq t < 2$	32
$2 \leq t < 4$	19
$4 \leq t < 6$	20
$6 \leq t < 8$	7
$8 \leq t < 10$	2

- 6 (a)** In which class interval is the median?

Circle your answer.

[1 mark]

$0 \leq t < 2$

$2 \leq t < 4$

$4 \leq t < 6$

$6 \leq t < 8$

- 6 (b)** The manager of the supermarket says,

“90% of our customers wait less than 6 minutes.”

Does the data support this statement?

You **must** show your working.

[2 marks]

Answer _____

7

50 people took a test.

Before the test, they predicted whether they would pass or fail.

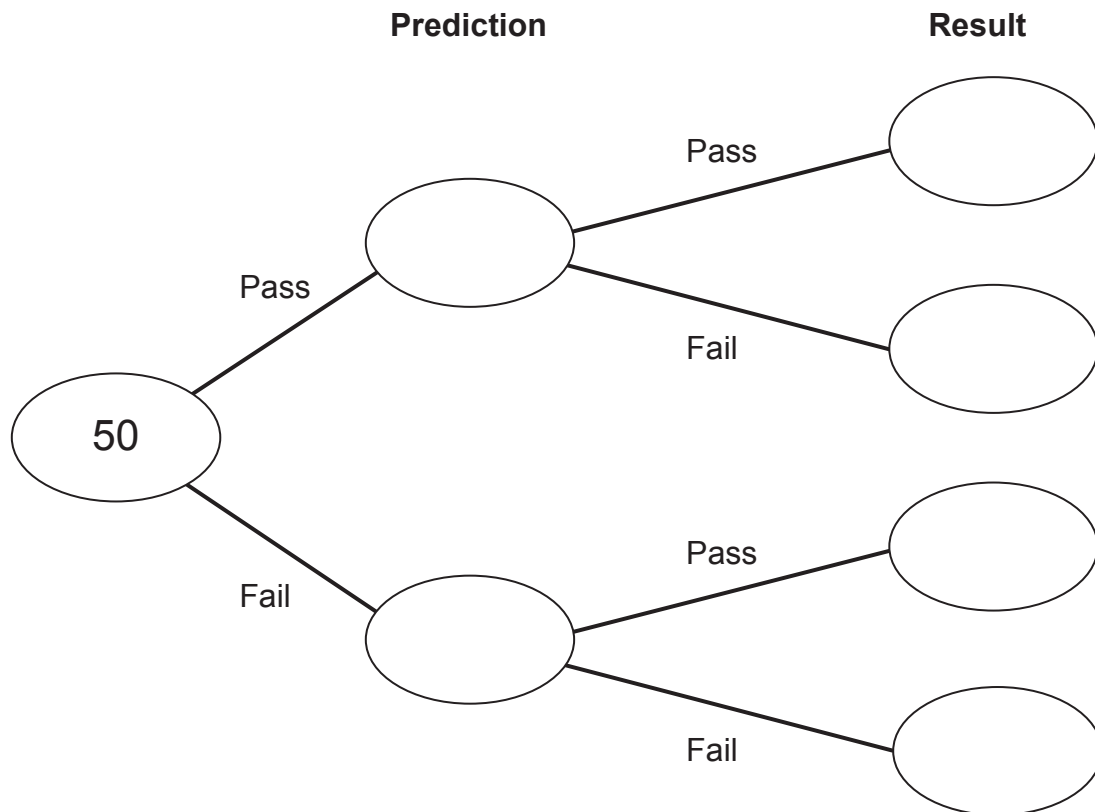
30 people predicted they would pass.

36 people did pass.

Of these 36 people, three times as many predicted pass as predicted fail.

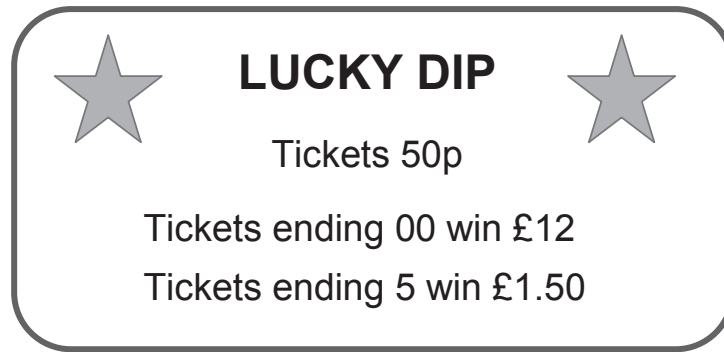
Complete the frequency tree.

[3 marks]



8

Tomas ran a Lucky Dip stall.



There were 750 tickets, numbered 1 to 750

Tomas sold **all** the winning tickets, and **some** of the losing tickets.

He made a profit of £163

How many **losing** tickets did he sell?

[6 marks]

Answer

9

Write 280 as a product of its prime factors.

[2 marks]

Answer _____

10

Expand and simplify

$(y + 5)(y - 4)$

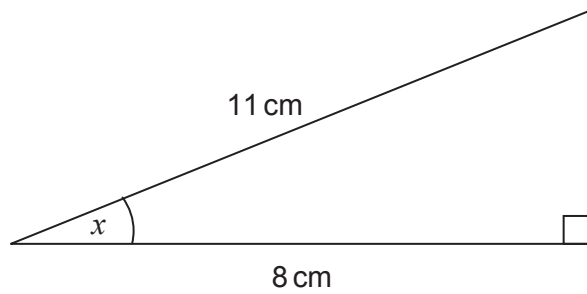
[2 marks]

Answer _____

Turn over for the next question

- 11 (a) Work out the size of angle x .

Not drawn
accurately

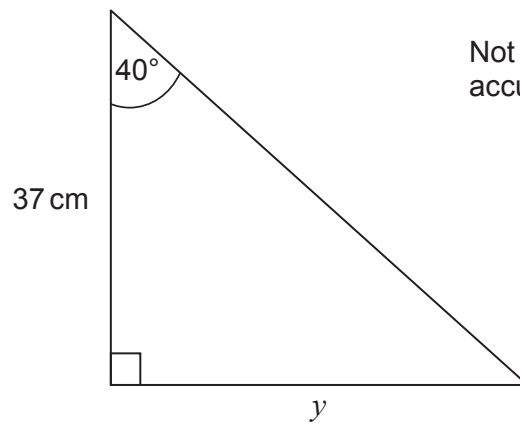


[2 marks]

Answer _____ degrees

- 11 (b) Work out length y .

Not drawn
accurately

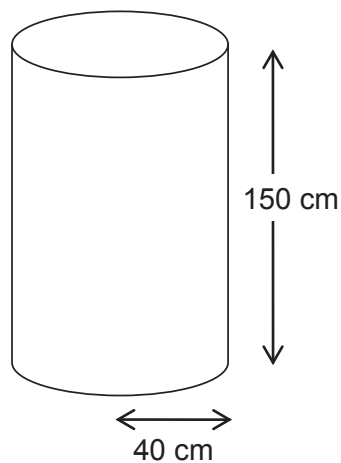


[2 marks]

Answer _____ cm

12

A water tank is a cylinder with radius 40 cm and depth 150 cm



Not drawn
accurately

It is filled at the rate of 0.2 litres per second.

1 litre = 1000 cm³

Does it take longer than 1 hour to fill the tank?

You **must** show your working.

[4 marks]

Answer _____

$$x(x + 4) \equiv x^2 + 4x$$

For how many values of x is $x(x + 4)$ equal to $x^2 + 4x$?

Circle your answer.

[1 mark]

all

Sophie sells birthday cards.

She adds 30% profit to the cost price.

She sells the cards for £2.34 each.

She wants to increase her profit to 40% of the cost price.

How much should she sell each card for?

[3 marks]

[illegible]

Answer £

15 $(6 \times 10^a) + (6 \times 10^b) + (6 \times 10^c) = 6006.6$

Write down a possible set of values of a , b and c .

[3 marks]

$a =$ _____ $b =$ _____ $c =$ _____

16 Work out the equation of the line that

is parallel to the line $y = 5x - 3$

passes through $(-2, -4)$

[3 marks]

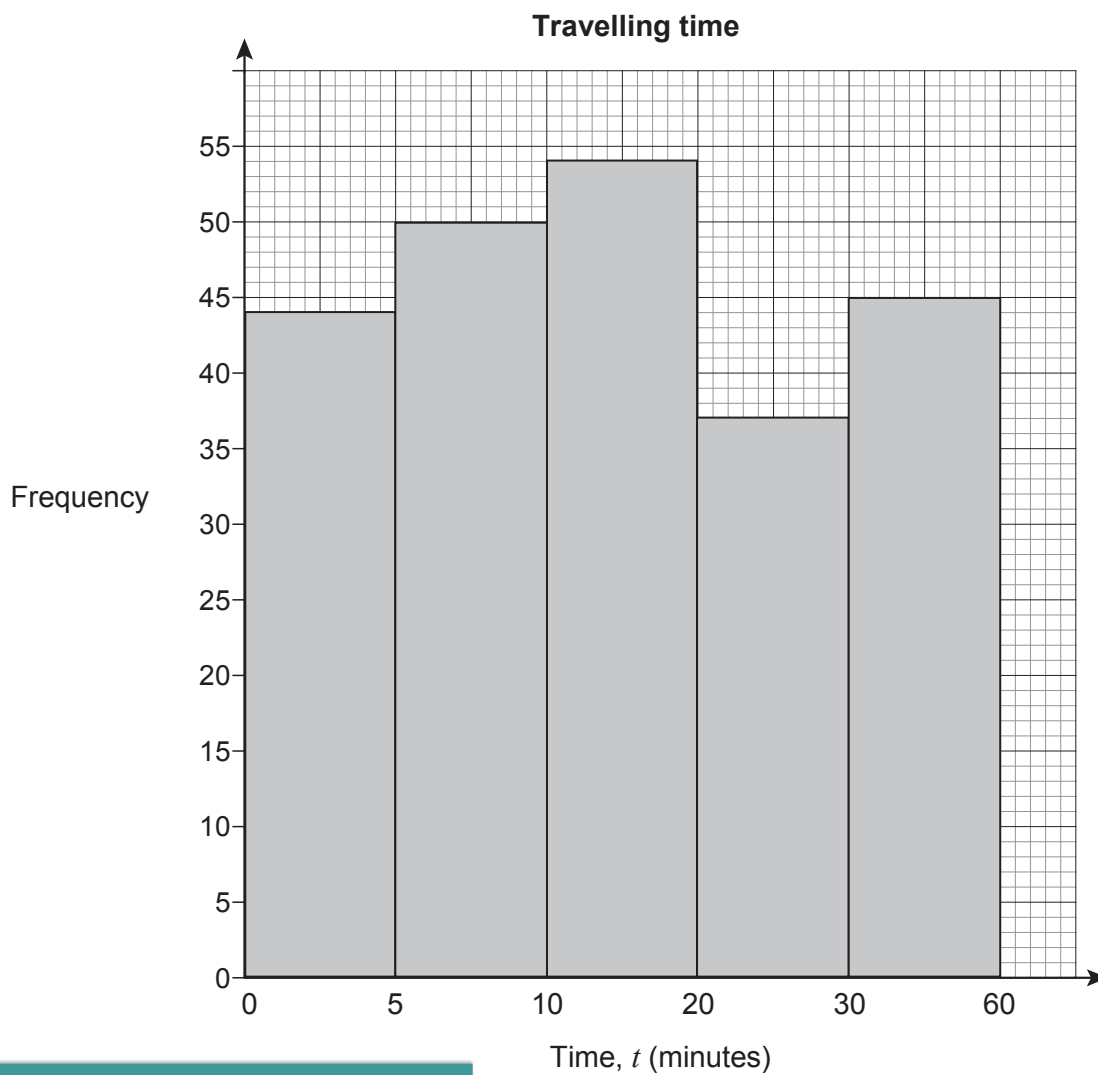
Answer _____

17 Joe asked 230 students how long it took them to travel to school.

The results are shown in the table.

Travelling time, t (minutes)	Number of students
$0 < t \leq 5$	44
$5 < t \leq 10$	50
$10 < t \leq 20$	54
$20 < t \leq 30$	37
$30 < t \leq 60$	45

This is Joe's attempt to draw a histogram to show the data.



i Q17 asks for critical evaluation of a statistical diagram - a topic that many Higher students will be able to have a really good attempt at.

Make **two** criticisms of his histogram.

[2 marks]

Criticism 1 _____

Criticism 2 _____

Turn over for the next question

18 The table shows the running times of some films.

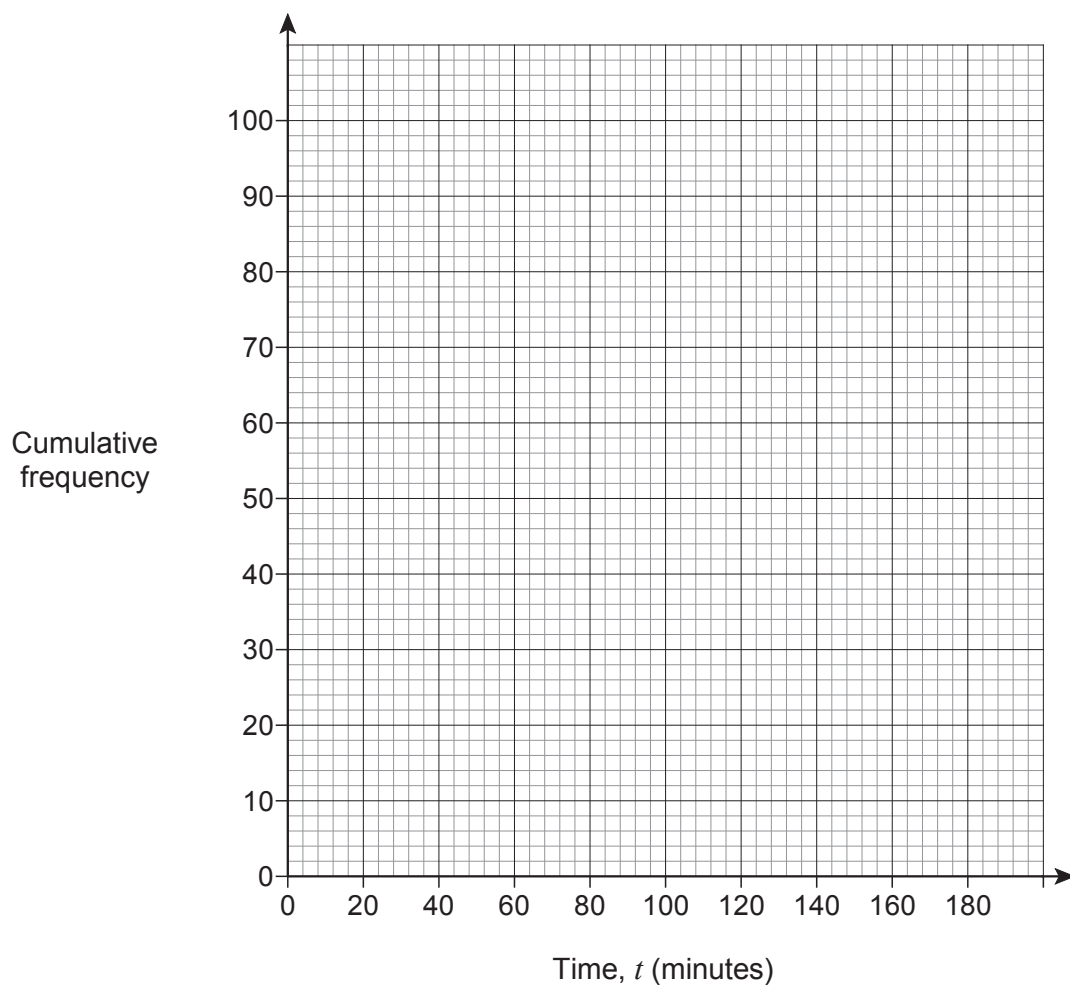
18 (a) Draw a cumulative frequency graph on the grid opposite to represent the data.

[3 marks]

Time, t (minutes)	Number of films	
$0 \leq t < 80$	0	
$80 \leq t < 100$	9	
$100 \leq t < 120$	35	
$120 \leq t < 140$	30	
$140 \leq t < 160$	18	
$160 \leq t < 180$	8	



Q18 is another example of a familiar question at this level that tests the AO2 skills of communicating and making inferences to draw conclusions in part (b).



- 18 (b)** Estimate the number of these films with a running time of less than $2\frac{1}{2}$ hours.

[1 mark]

Answer _____

Turn over for the next question

- 19** w is directly proportional to y
 w is inversely proportional to x^2

- 19 (a)** When $y = 4$, $w = 14$

Work out the value of w when $y = 9$

[2 marks]

Answer _____

- 19 (b)** When $x = 2$, $w = 5$

Work out the value of w when $x = 10$

[3 marks]

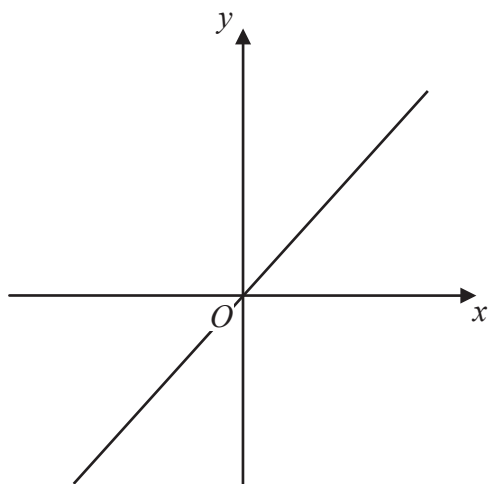
Answer _____

19 (c) Which graph shows the relationship between y and x ?

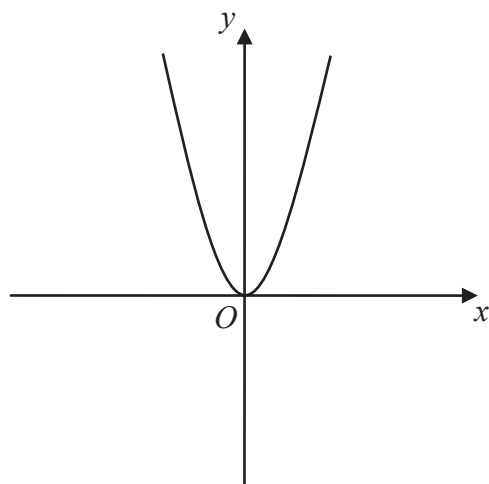
Circle the correct letter.

[1 mark]

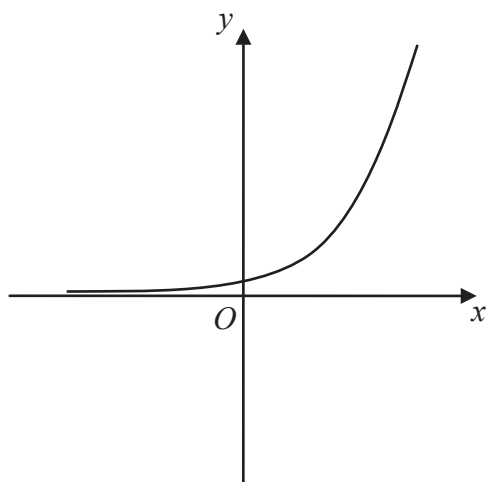
A



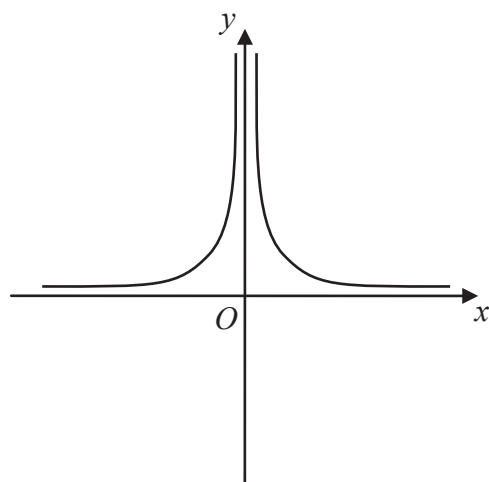
B



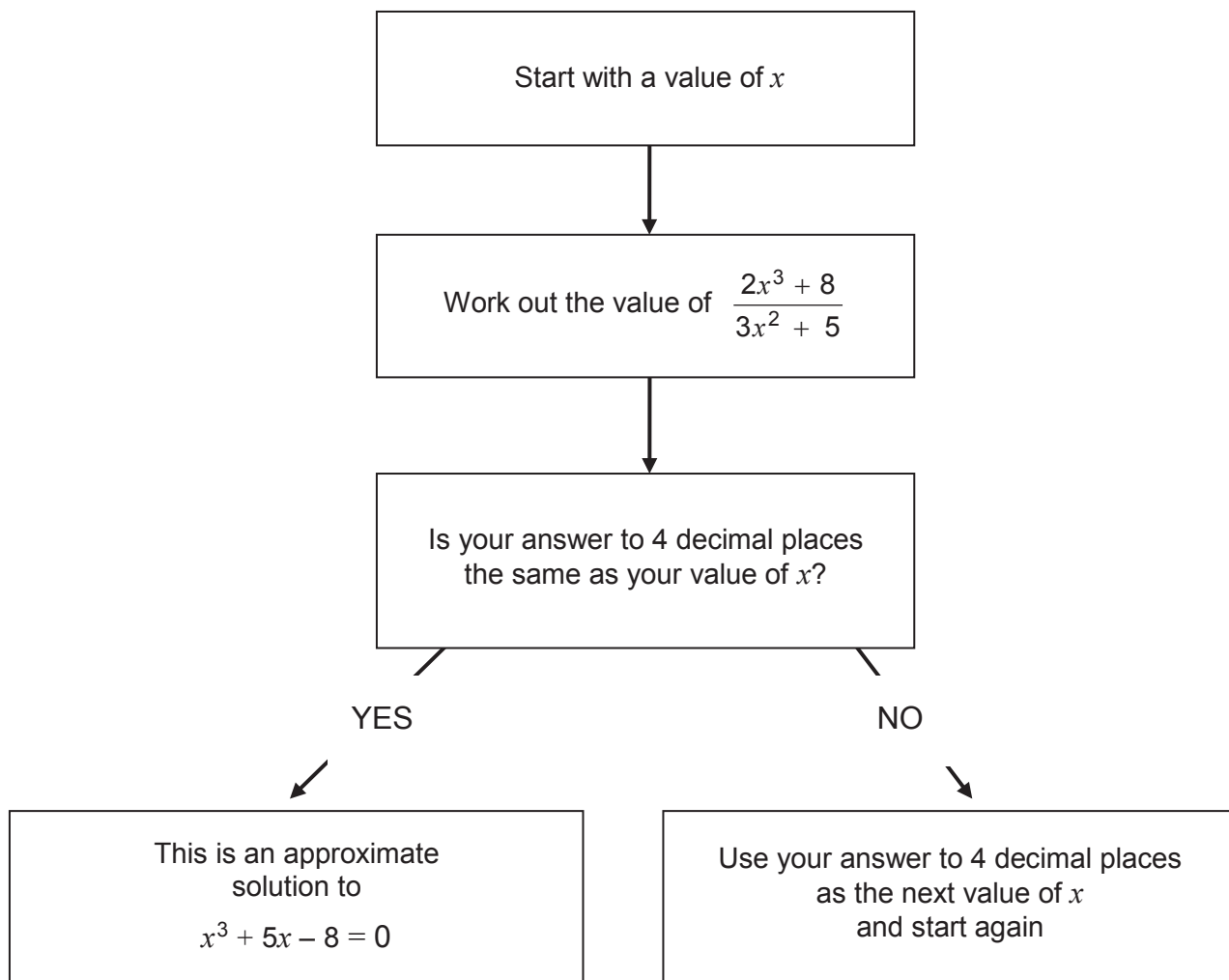
C



D



20 This iterative process can be used to find approximate solutions to $x^3 + 5x - 8 = 0$



i Q20 and Q22 both illustrate new topics in GCSE Mathematics and how they might be tested in our Higher papers. We will also on occasion be using suffix notation when assessing iterative processes. We expect students to be familiar with the symbol for the universal set and will use it to define the data set being displayed in a Venn diagram.

- 20 (a)** Use this iterative process to find a solution to 4 decimal places of $x^3 + 5x - 8 = 0$

Start with the value $x = 1$

[3 marks]

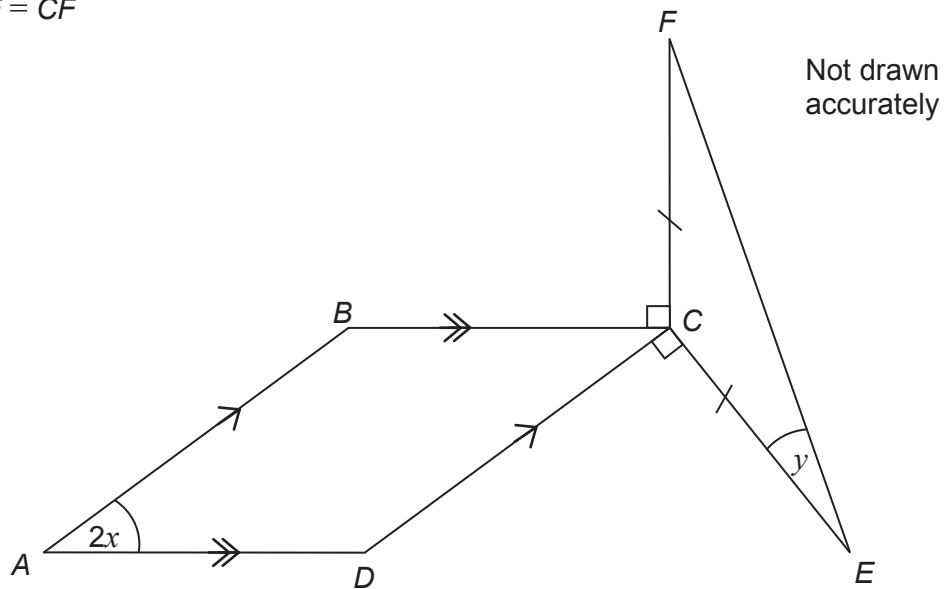
Answer _____

- 20 (b)** By substituting your answer to part (a) into $x^3 + 5x - 8$
comment on the accuracy of your solution to $x^3 + 5x - 8 = 0$

[2 marks]

21

$ABCD$ is a parallelogram.

$$CE = CF$$


Prove that $y = x$

[5 marks]

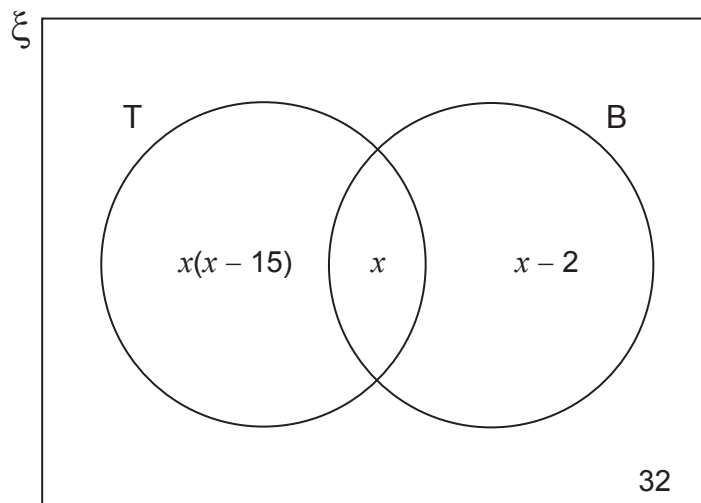
22

The Venn diagram shows information about a coin collection.

ξ = 120 coins in the collection

T = coins from the 20th century

B = British coins



A coin is chosen at random.

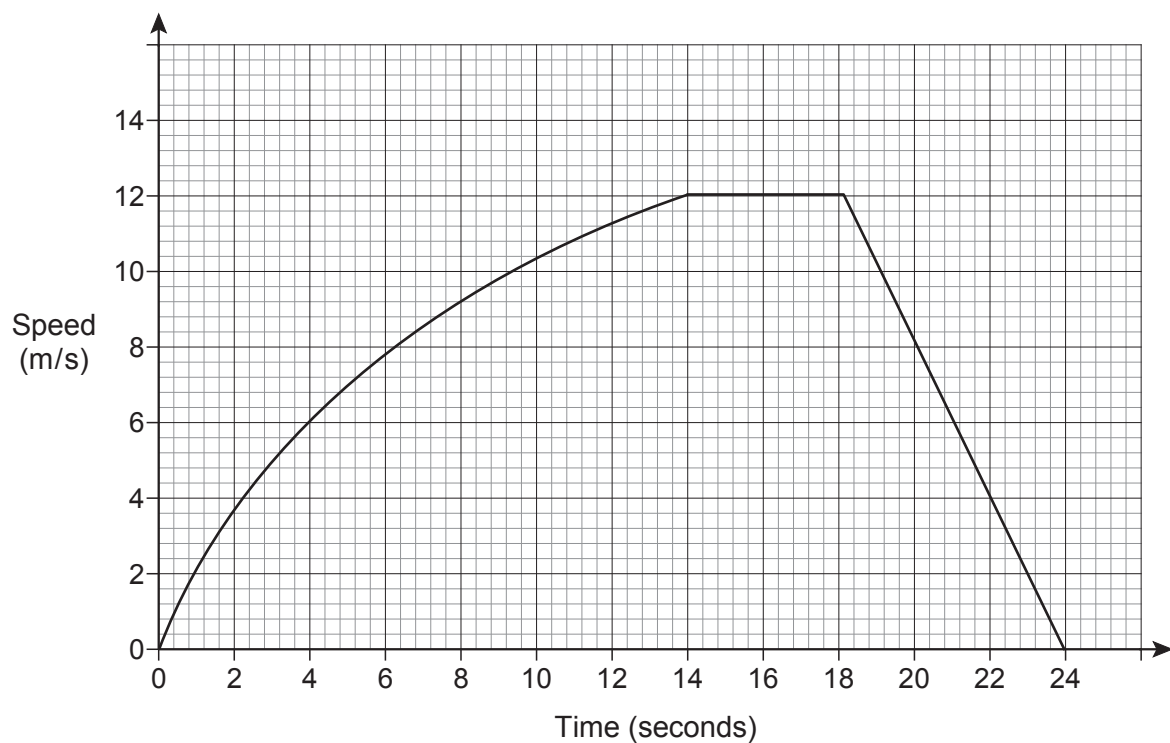
It is British.

Work out the probability that it is from the 20th century.

[5 marks]

Answer _____

- 23** The speed-time graph for a car's journey is shown.



- 23 (a)** Estimate the acceleration at 6 seconds.

You **must** show your working.

[3 marks]

Answer _____ m/s^2



Q23 tests topics new to GCSE in minimal context, with the final part testing the AO3 skill of evaluating results obtained, without the need to wrap it in complicated language or scenarios.

23 (b) Estimate the average speed of the car for the journey.

You **must** show your working.

[4 marks]

Answer _____ m/s

23 (c) Evaluate your answer to part (b).

Tick a box.

☐

underestimate

☐

exact

☐

overestimate

[1 mark]

Comment _____

24 Show that $\frac{2w+4}{w^2-25} \times \frac{w+5}{w^2+3w+2} \times (3w^2-16w+5)$

simplifies to $\frac{aw + b}{cw + d}$ where a, b, c and d are integers.

[5 marks]

END OF QUESTIONS



i Q24 is a test of algebraic confidence and competence, designed to challenge able students. Those who can factorise and cancel efficiently should be able to construct the chains of reasoning required to reach a solution. This is a challenge, but it's accessible, as the maths required is absolutely clear.

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED**

Paper 3

Higher Tier

This paper shows that not all of the initial 4 multiple choice questions need to be A01. Q3 is A02, assessing interpretation skills. The approach of all papers continues, with common questions making up many of the early questions. The final common question is Q12.

GCSE MATHEMATICS (8300/3H)

H

Paper 3 Higher tier

Specimen 2015

Morning

Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:

- a calculator
- mathematical instruments.



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.
- You must answer the questions in the space provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work that you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer booklet.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number

Candidate number

Surname

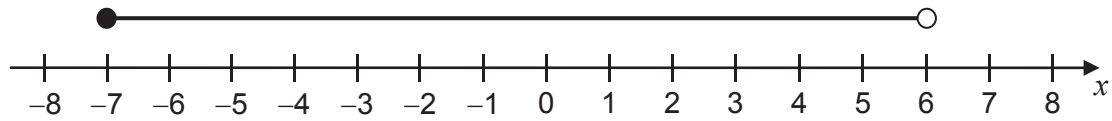
Forename(s)

Candidate signature

Answer **all** questions in the spaces provided.

- 1 Circle the inequality shown by the diagram.

[1 mark]



$-7 < x < 6$

$-7 \leq x < 6$

$-7 < x \leq 6$

$-7 \leq x \leq 6$

- 2 The probability that a biased coin lands on heads is $\frac{2}{3}$

The coin is spun twice.

Circle the probability of two heads.

[1 mark]

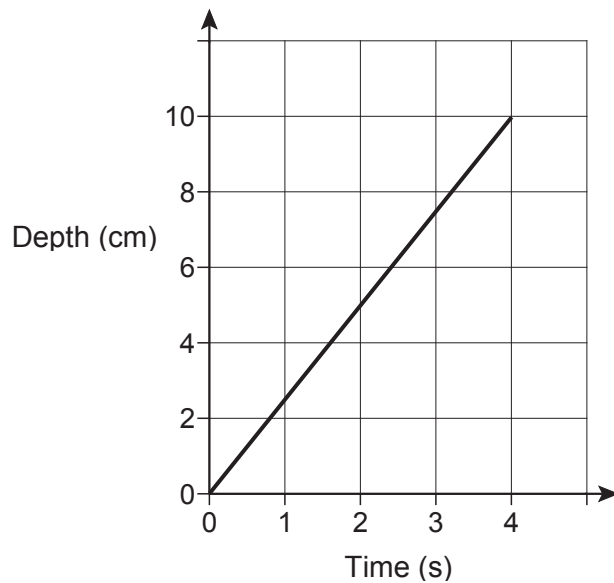
$\frac{2}{9}$

$\frac{4}{6}$

$\frac{4}{9}$

$\frac{4}{3}$

- 3** Water is poured into a glass for 4 seconds.
The graph shows the depth of the water in the glass.



What is the rate of change of the depth of the water?
Circle your answer.

[1 mark]

0.4 cm/s

1.25 cm/s

2.5 cm/s

10 cm/s

- 4** The ratio of $x : y$ is $2 : 3$

Circle the correct statement.

[1 mark]

x is $\frac{2}{3}$ of y

y is $\frac{2}{3}$ of x

x is $\frac{2}{5}$ of y

y is $\frac{3}{5}$ of x

5 Factorise fully $9a^2 - 6a$

[2 marks]

Answer _____

6 Work out the next term of this quadratic sequence.

[2 marks]

4 12 24 40 _____

Answer _____

- 7 Here is an ordinary dice.



- 7 (a) Ali is going to throw the dice six times.

He says,

“I will get one of each number.”

Give a reason why he could be wrong.

[1 mark]

- 7 (b) Lucy throws the dice 50 times.

Her results are shown.

Number thrown	1	2	3	4	5	6
Frequency	7	4	12	5	9	13

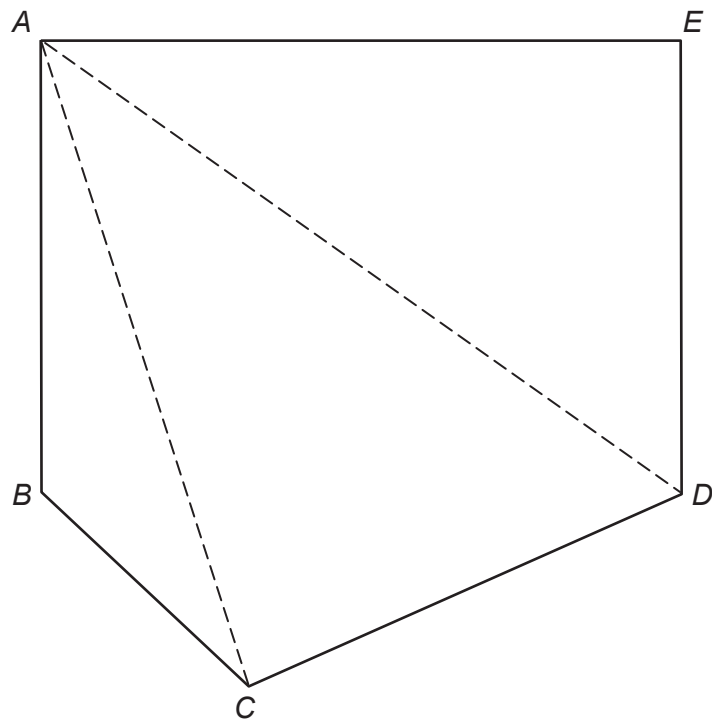
Work out the relative frequency of throwing an odd number.

[2 marks]

Answer _____

8

Polygon $ABCDE$ is divided into triangles as shown.



Not drawn
accurately

Use the triangles to work out the sum of the interior angles of polygon $ABCDE$.

You **must** show your working.

[2 marks]

Answer _____ degrees

9 In a school, 60% of the students are girls.

50% of the girls walk to school.

20% of the boys walk to school.

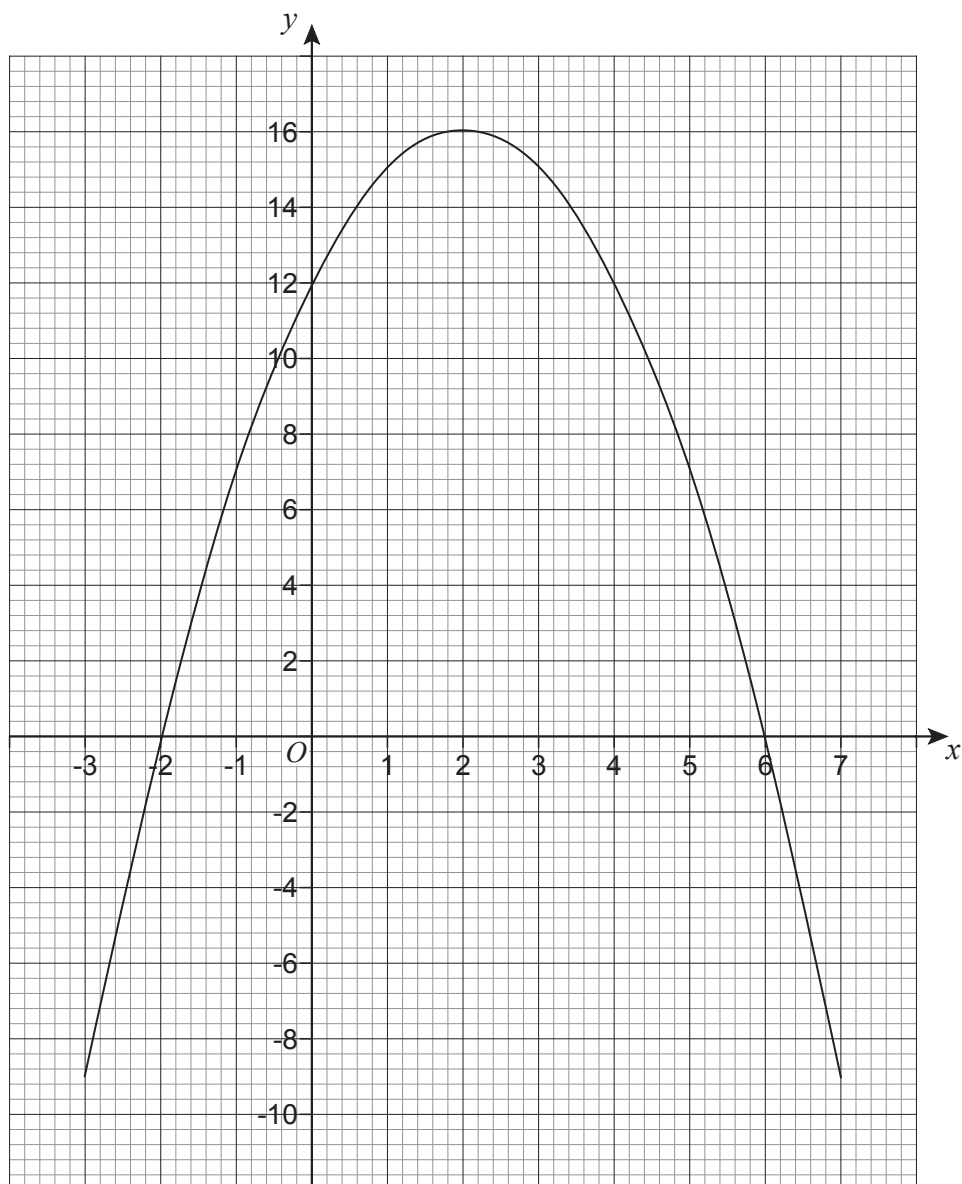
What percentage of the students walk to school?

[3 marks]

Answer _____ %

Turn over for the next question

- 10** The graph $y = a + bx - x^2$ is shown.



- 10 (a)** Circle the coordinates of the turning point of the curve.

[1 mark]

(-2, 0)

(0, 12)

(2, 16)

(6, 0)

- 10 (b)** Circle the value of a .

[1 mark]

-2

12

16

6

10 (c) Circle the two roots of $a + bx - x^2 = 0$

[1 mark]

–2 and 6

2 and –6

2 and 6

–2 and –6

11 Adam and six other men ran a race.

The times, in seconds, of the six other men are shown.

9.75

9.79

9.80

9.88

9.94

9.98

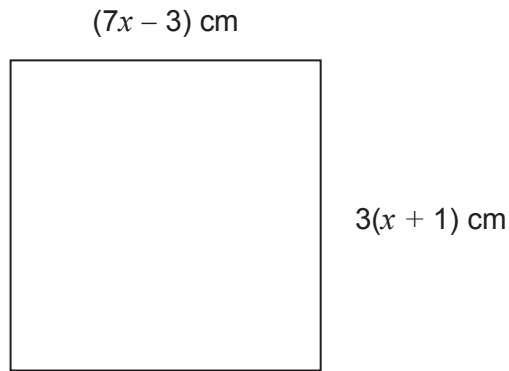
The mean time for **all** seven men was 9.83 seconds.

Did Adam win the race?

You **must** show your working.

[3 marks]

- 12** The diagram shows a square.



Work out the length of one side of the square.

[4 marks]

Answer _____ cm

- 13** A circle has equation $x^2 + y^2 = 4$

Circle the length of its radius.

[1 mark]

2

4

8

16

- 14** a , b and c are **different** prime numbers less than 20

$$a = \sqrt{4b + c}$$

Work out **two** possible sets of values of a , b and c .

[3 marks]



Q14 tests problem solving in a mathematical context where it is not obvious how to start. A method involving trial and improvement or 'reasoned listing' is likely to lead to success, but students will need to build confidence in starting novel problems like this. Our resource package will offer substantive support in approaching problems of this type.

Set 1 $a =$ _____ $b =$ _____ $c =$ _____

Set 2 $a =$ _____ $b =$ _____ $c =$ _____

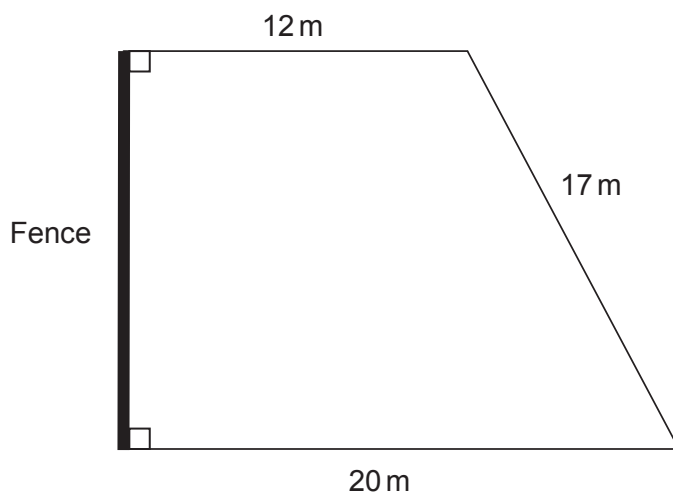
- 15** Simplify fully $(8x^3y^5)^2$

[2 marks]

Answer _____

16

The diagram shows a lawn with a fence along one edge.



Not drawn accurately

One can of weedkiller covers 90 square metres.

Each can costs £19.25

Work out the total cost of the cans of weedkiller needed to cover the lawn.

[5 marks]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Answer £

17 Expand and simplify $(2x + 5y)(3x - 8y)$

[3 marks]

Answer _____

18 The ratio of the number of boys to girls at a party is 3 : 4

Six boys leave the party.

The ratio of the number of boys to girls at the party is now 5 : 8

Work out the number of girls at the party.

[3 marks]



Q18 shows a problem solving question which is clearly about ratio, but requires either confident algebra or a sound listing strategy and good number sense to reach a correct solution. As with many problem solving questions, this question includes a single AO1 mark for an accurate final answer.

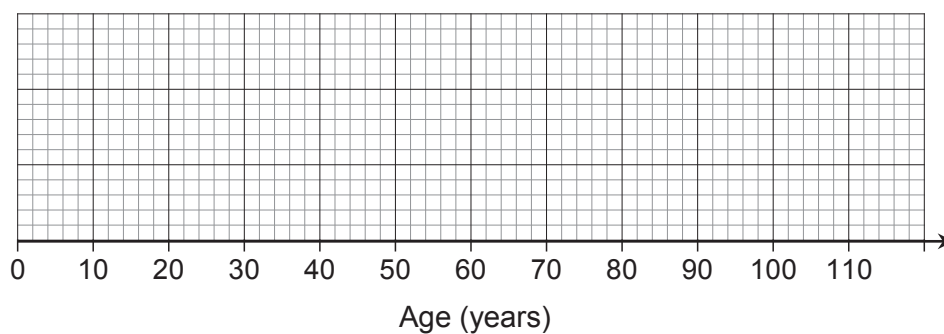
Answer _____

19 In the UK in 2000

25% of the population were under 24 years old
50% of the population were under 37 years old
the inter-quartile range of the ages was 32 years
the oldest person was 107 years old.

19 (a) Show the information on a box plot.

[3 marks]



19 (b) It is predicted that in 2050 the age distribution in the UK will have

lower quartile 26 years

median 44 years

upper quartile 66 years

Make **two** comments about the predicted change in the age distribution in the UK from 2000 to 2050

[2 marks]

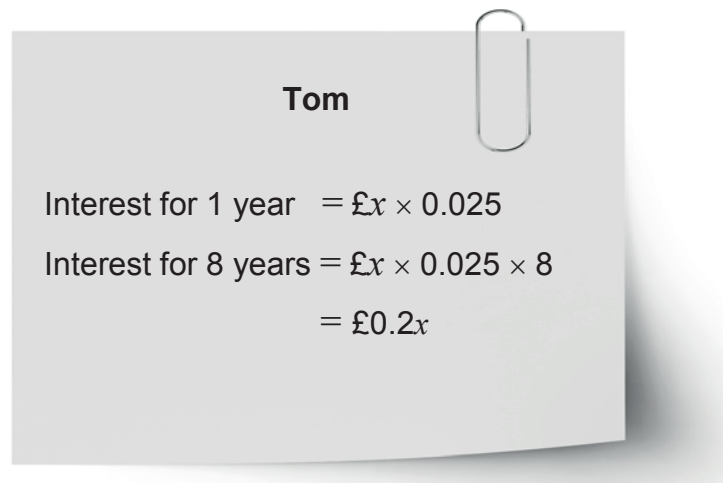
Comment 1 _____

Comment 2 _____

Turn over for the next question

- 20** £ x was invested for 8 years.
It earned **compound** interest at 2.5% per year.

- 20 (a)** Tom is working out the total interest earned.



State what is wrong with Tom's method.

[1 mark]

- 20 (b)** After 8 years the total value of the investment is £11 696.67

Work out the value of the original investment, £ x

[3 marks]

Answer £ _____

- 21 Mersenne primes are prime numbers that can be written in the form

$$2^n - 1 \quad \text{where } n \text{ is a whole number.}$$

For example, 3 can be written as $2^2 - 1$

- 21 (a) Prove that $2^9 - 1$ is **not** a Mersenne prime.

[2 marks]

- 21 (b) There are Mersenne primes when $n = 5$ and when $n = 7$

Ama says,

“The ratio of the indices is 5 : 7

This means the ratio of the Mersenne primes is 5 : 7”

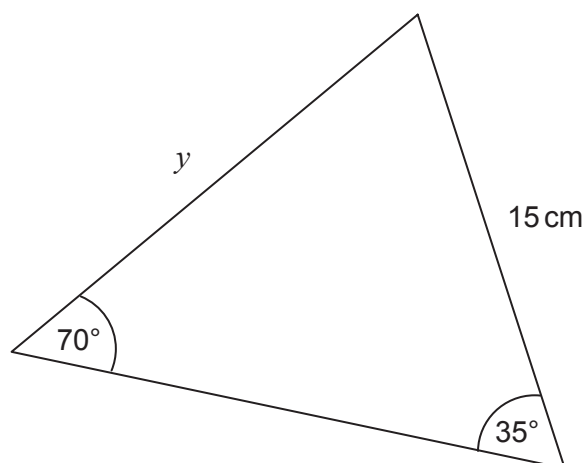
Show that Ama is wrong.

[1 mark]



Q21 tests whether students can work in unfamiliar mathematical situations. Mersenne primes will not be known by (m)any students, but they are fully explained at the start of the question. The proof needed in part (a) and the assessment of the validity of the argument in part (b) both depend on the students' engagement with the mathematical situation described. Introducing a new concept is always going to take a little bit of wording but we feel we have the skills to do this clearly and succinctly.

22




Not drawn
accurately

Work out the value of y .

[2 marks]

Answer _____ cm

 Q22 and Q23 are good examples of straightforward, AO1 assessment of bold content towards the end of a Higher tier paper. Good solid Higher tier students should find questions such as this accessible.

23

Write

$2x^2 - 20x + 65$

in the form

$a(x - b)^2 + c$

[3 marks]

Answer _____

Turn over for the next question

24

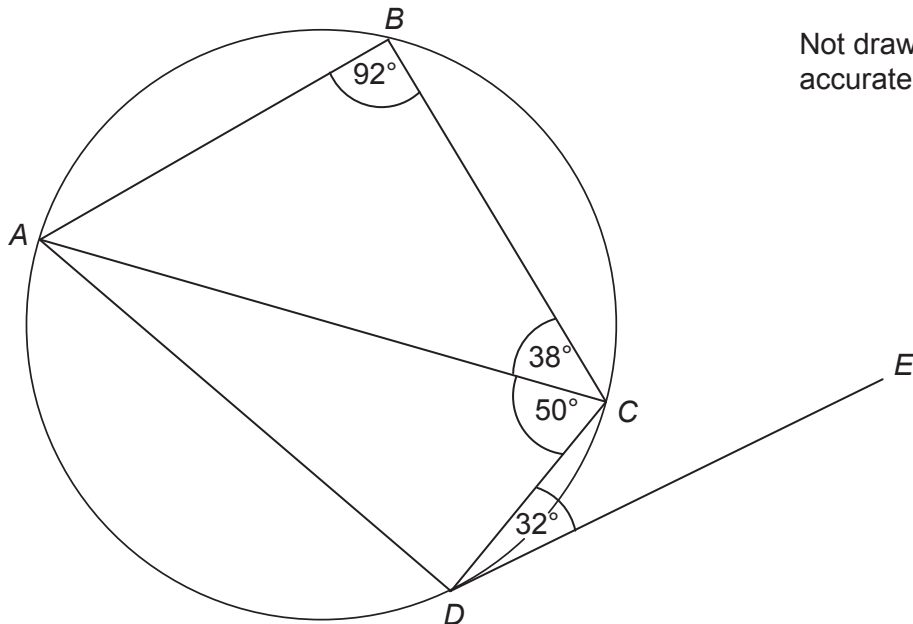
A, B, C and D are points on a circle.

$$\text{Angle } ABC = 92^\circ$$

$$\text{Angle } ACB = 38^\circ$$

$$\text{Angle } ACD = 50^\circ$$

$$\text{Angle } CDE = 32^\circ$$



Tick whether each statement is true or false.

Give a reason for each answer.

[4 marks]

Statement

True

False

AC is a diameter

☐
☐

Reason _____



In Q24, no credit is given for simply answering true or false. For each part we are expecting the use of and stating of theorems in a formal way. The parts are connected, but they can be tackled independently, thus having the benefit of giving a greater opportunity for students to follow different approaches, demonstrate their knowledge and score some marks.

Statement**True****False**Angle $ADC = 88^\circ$ ☐☐

Reason _____

Statement**True****False** $ABCD$ is a trapezium☐☐

Reason _____

Statement**True****False** DE is a tangent to the circle☐☐

Reason _____

- 25** A formula connecting speed (s), distance (d) and time (t) is

$$s = \frac{d}{t}$$

$d = 160$ to 2 significant figures

$t = 7.2$ to 2 significant figures

Work out the upper and lower bounds for s .

Give your answers to 3 significant figures.

[4 marks]

Upper bound _____

Lower bound _____

26 For all values of x , $f(x) = x^2 + 1$ $g(x) = x - 5$

26 (a) Show that $fg(x) = x^2 - 10x + 26$

[2 marks]

26 (b) Solve $fg(x) = gf(x)$

[4 marks]

$x =$ _____



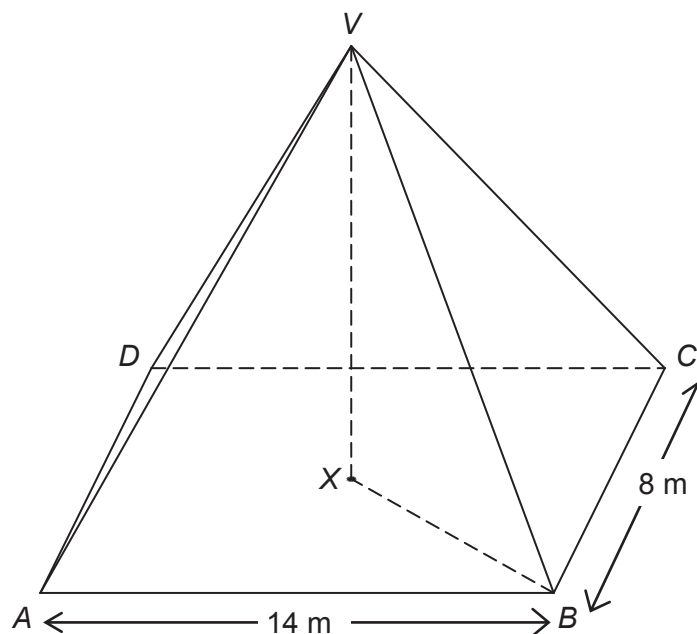
Q26 assesses a challenging topic new to GCSE. We think it is appropriate at the end of the paper to ask students to:

- show their reasoning in obtaining and simplifying a composite function
- develop an unfamiliar mathematical situation by generating and solving an equation.

27 Volume of a pyramid = $\frac{1}{3} \times \text{area of base} \times \text{perpendicular height}$

$VABCD$ is a rectangular-based pyramid with volume 336 m^3

X is the centre of the base, directly below V .



Work out the angle between VB and the base.

[6 marks]



Q27 is an example of a formula being given in the question. In the new specifications, students are expected to recall and use many more formulae than in the past. Whenever a student can be given a formula, we will include it in the question rather than having a formula sheet at the start of each question paper. This is a major benefit of NOT having a formula sheet. By this point in the paper, many students will have either forgotten about a formula sheet, or the specific formulae included on it. The provision of the required formula in the question should help students be able to tackle this multi-mark, problem solving question at the very end of the paper.

Answer _____ degrees

END OF QUESTIONS

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