GCSE

MATHEMATICS - NUMERACY
UNIT 2: CALCULATOR - ALLOWED
HIGHER TIER

2nd SPECIMEN PAPER SUMMER 2017

1 HOUR 45 MINUTES

ADDITIONAL MATERIALS
A calculator will be required for this paper.
A ruler, protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES
Write your name, centre number and candidate number in the spaces at the top of this page.

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

Take π as 3·14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

The assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing in question **2(a).**

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**2**	
2.	**10**	
3.	**3**	
4.	**7**	
5.	**8**	
6.	**6**	
7.	**5**	
8.	**4**	
9.	**5**	
10.	**8**	
11.	**5**	
12.	**7**	
13.	**5**	
14	**5**	
TOTAL	**80**	

Formula list – Higher tier

Area of a trapezium $= \frac{1}{2}(a+b)h$
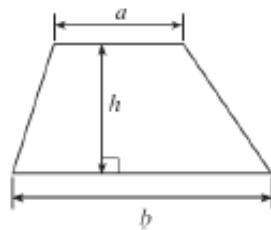
Volume of a prism = area of cross section × length
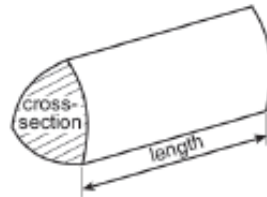
Volume of a sphere $= \frac{4}{3}\pi r^3$

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

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

Curved surface area of a cone $= \pi r l$

In any triangle ABC,

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

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

Area of triangle $= \dfrac{1}{2}ab\sin C$
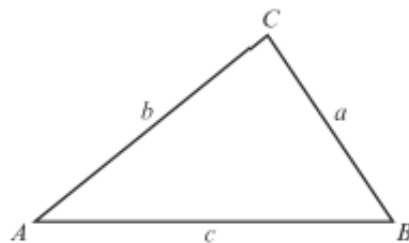
The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1 + \dfrac{i}{n}\right)^n - 1,$ where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

1.

A ribbon is tied around **all** the faces of a box, as shown in the picture.
The ribbon is placed across **each** face of the box and meets all the edges of the box at right angles.
A bow is tied on top of the box. The bow is made using 18 cm of ribbon.
The box has length l cm, width w cm and height h cm.

Write down an expression for the total length of ribbon needed to decorate this box.

[2]

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2. Lech went on holiday from his home in Wales to Poland.
Before going, he went into his local money exchange shop to buy some Polish zloty.

Lech only had £250 to spend on buying zloty.
He wanted to buy as many zloty as possible.
Unfortunately, the money exchange shop only had 50 zloty notes.
The exchange rate to buy zloty was £1 = 4.37 zloty.

(a)   *You will be assessed on the quality of your organisation, communication and accuracy in writing in this part of the question.*

How much did Lech pay for the zloty?

[5 + OCW 2]

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(b)   While in Poland, Lech spent 340.40 zloty.
On returning to Wales from his holiday, Lech changed his zloty back to pounds.
Unfortunately, the money exchange shop would only buy back a whole number of zloty.
The exchange rate used for changing zloty back to pounds was £1 = 4.43 zloty.
Calculate how much Lech received back from the money exchange shop.
Give your answer correct to the nearest penny.

[3]

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3.   Sabrina sees the following advertisement.

> ### Money Today
>
> *Borrow today – why wait until payday?*
>
> *Costs 1% per day compound interest*

Sabrina knows that she will be paid in 2 weeks' time.
She decides to borrow £400 for a period of 2 weeks.

How much will Sabrina have to pay back after 2 weeks?
Show all your working.

[3]

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4. *(a)* The North Hoyle Offshore Wind Farm is located approximately 7·5 km off the coast of North Wales.

When this wind farm opened, it was working at 35% of its full capacity, and it produced enough annual electricity for 50 000 homes.
For how many homes would the wind farm have been able to produce electricity each year if it had worked at full capacity?

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(b) There are many offshore wind farms off the coast of Wales, Scotland and England.

The full power of the individual wind turbines is different in the various wind farms.

The table shows information for 4 wind farms.

Wind farm	Full power of each turbine in Mega Watts (MW)	Number of wind turbines
North Hoyle	2·0	30
Lynn and Inner Dowsing	3·5	54
Rhyl Flats	3·6	25
Robin Rigg	3·0	60

If each of these 4 wind farms worked at 45% of full power, what would be the mean power of a single wind turbine?
Give your answer correct to 2 decimal places.
You must show all your working.

[5]

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5. In Aberfar, a group of local people took part in a challenge to learn how to tie a Celtic knot.

The frequency diagram shows the times taken by the local people to tie a Celtic knot for the first time.
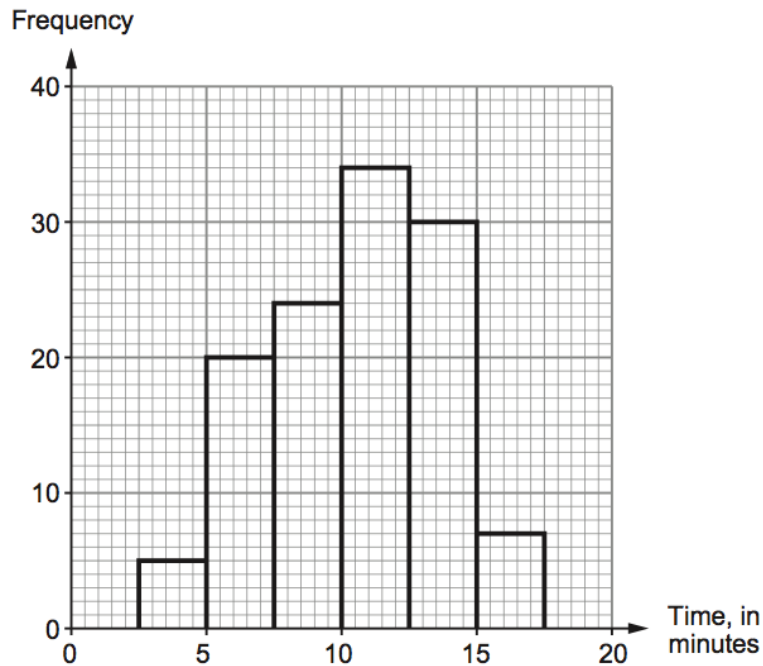
(a) Complete the cumulative frequency table for the times taken by the local people to tie a Celtic knot for the first time.

[2]

Time, t in minutes	$t \leq 2{\cdot}5$	$t \leq 5$	$t \leq 7{\cdot}5$	$t \leq 10$	$t \leq 12{\cdot}5$	$t \leq 15$	$t \leq 17{\cdot}5$
Cumulative frequency							

(b) The graph paper opposite shows a cumulative frequency diagram of the times taken by 140 visitors to Wales to tie a Celtic knot for the first time.

On the same graph, draw a cumulative frequency diagram for the times taken by the local people to tie a Celtic knot for the first time.

[2]

Cumulative frequency

140

120

100 — Visitors

80

60

40

20

0

0   5   10   15   20

Time (minutes)
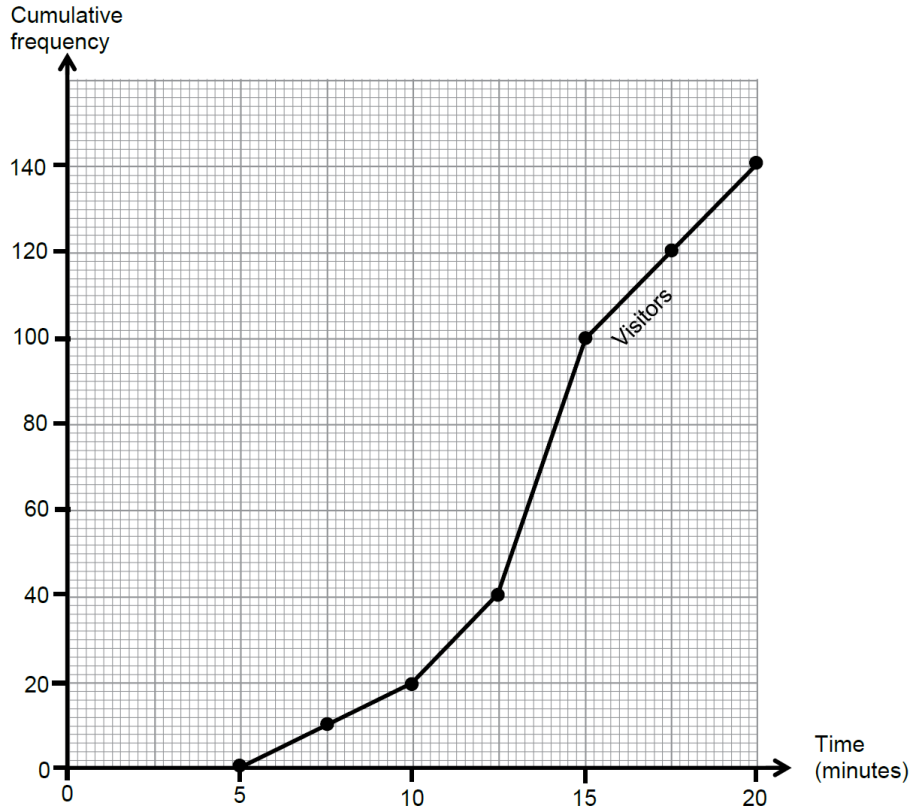
(c) The visitors had been set a target that 100 of the group would finish within $17\frac{1}{2}$ minutes. By how many minutes did they miss or beat their target?

[2]

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Did they miss the target or beat the target?   …………………..

By how many minutes?   …………………

(d) Circle either TRUE or FALSE for each of the following statements.   [2]

The tenth percentile reading for the local people is between 5 minutes and 7 minutes.	TRUE	FALSE
40% of the visitors took less than $12\frac{1}{2}$ minutes.	TRUE	FALSE
The estimated median time taken by the visitors is 13·75 minutes.	TRUE	FALSE
The difference between the estimated median times of the two groups of people is about 3 minutes.	TRUE	FALSE
If there had been only 120 visitors, they would certainly all have finished within 18 minutes.	TRUE	FALSE

6. Luis has a large dog which lives in a kennel.
In order to design a similar kennel for a smaller dog, Luis wants to calculate the angle of elevation of the roof of his dog's kennel.
He has noticed that the front of his dog's kennel is symmetrical.

He has measured a number of lengths and recorded them on a diagram of the kennel, as shown below.
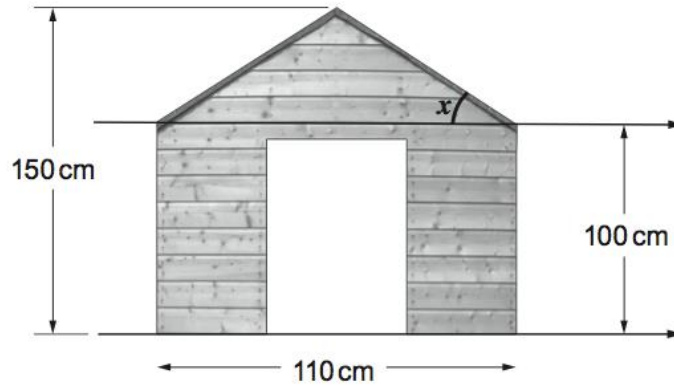
Diagram not drawn to scale

Luis has marked the angle of elevation with an x on the diagram.

(a) Calculate the size of angle x to an appropriate degree of accuracy.

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(b) Explain why, in practice, this angle may not be as accurate as you have calculated.

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7. The length of the flag shown is twice its width.

Diagram not drawn to scale

The diagonal of the flag measures 2·5 metres.
Calculate the width of the flag.

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Width of the flag is ………………..

8. On holiday, Ffion sees a necklace priced at 168 euros in a shop.

The shopkeeper tells her there is an error in the marked price. The rate of value added tax (VAT) included in the price has been calculated as 15%, but it should be 20%.

As Ffion is disappointed, the shopkeeper offers her an additional reduction of 12% after the VAT is corrected.

If she accepts the shopkeeper's offer, how much does Ffion eventually pay for the necklace?

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9. An engineer needs to check the density of steel produced by the factory where he works.

He collects a sample of 1000 ball bearings, each with a radius of 0·8 cm.

The total mass of the ball bearings is 16·935 kg.

Calculate the density of the steel.

Give your answer in kg / m^3.

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10. Ceri is a jewellery designer and is making a brooch.

The brooch is in the shape of a sector of a circle of radius 2·8 cm, as shown in the diagram.

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Diagram not drawn to scale

(a) Ceri is planning to cover the brooch in gold leaf.

Ceri buys gold leaf in square sheets of side length 80 mm. The cost of one sheet of gold leaf is £48.00.

Assuming that no gold leaf is wasted, find the cost of the gold leaf that is required to cover the brooch.

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(b) (i) The cost of the metal Ceri uses for the base of her first brooch should be £2.28.

She decides to produce a larger brooch in a similar shape, but with a base of the same thickness. The radius of the sector of the circle she uses this time is 4·2 cm.

The cost of the metal needed for the base of the second brooch should be

£3.19   £3.42   £4.47   £5.13   £9.58

[1]

(ii) Ceri finds that when she makes the base of a brooch, she wastes $\frac{1}{4}$ of the metal that she buys.
Including the waste, the actual cost of the metal for the base of the smaller brooch is

£0.57   £1.71   £2.85   £3.04   £9.12

[1]

11. Dragon Nation Bank is advertising a savings account.

Account	Nominal interest rate	AER **Annual Equivalent Rate, correct to 2 decimal places**
Dragon Saver	7·6% p.a., paid quarterly	.... %

(a) Complete the AER entry in the table.

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(b) Explain why AER is used by the bank.

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12. A cylinder is made of bendable plastic.
Part of a child's toy is made by bending the cylinder to form a ring.
The two circular ends of the cylinder are joined to form the ring.

Diagram not drawn to scale

The inner radius of the ring is 9 cm.
The outer radius of the ring is 10 cm.

Diagram not drawn to scale

Calculate an approximate value for the volume of the ring.
State and justify what assumptions you have made in your calculations and the impact they have had on your results.

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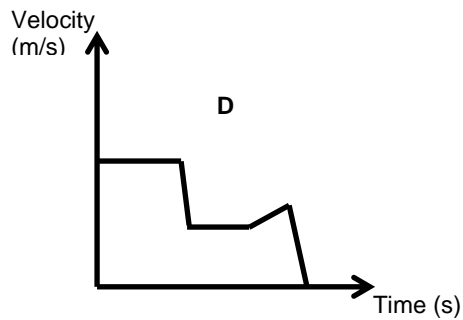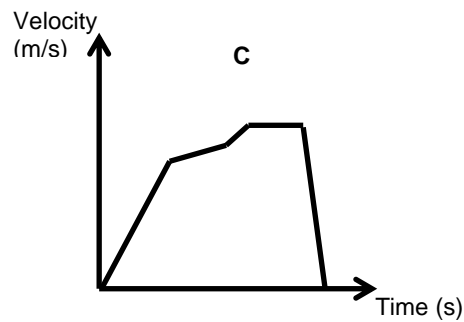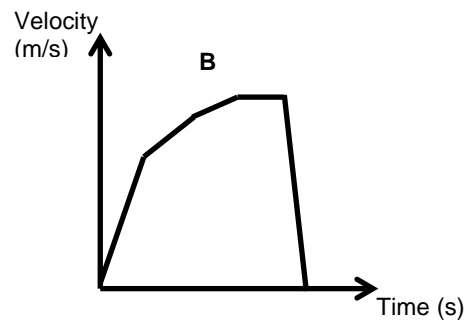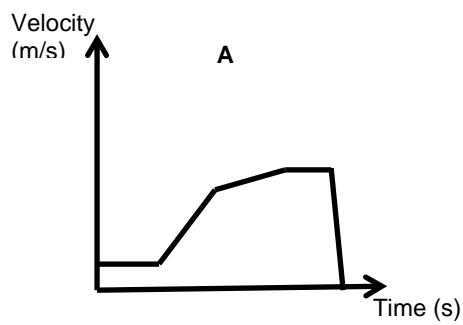...

13. Dewi was a cyclist.
He travelled along a straight flat road to the bottom a hill and cycled up the hill.
The gradient of the hill was constant at first, then decreased near the top, where
Dewi stopped for a rest.

Dewi maintained the same level of effort throughout his journey.

(a) Which of the following **velocity-time** graphs represents Dewi's journey?

[1]
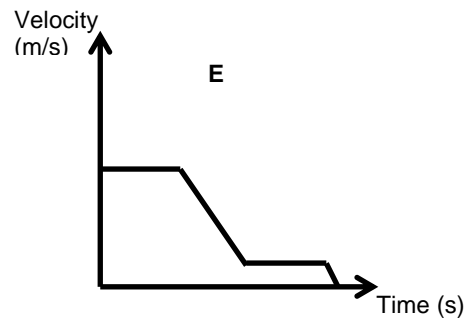
The graph which represents Dewi's journey is graph ....

(b) Later in the day, Dewi's greatest velocity was 22 metres per second, measured to the nearest metre per second.
In that location, the speed limit on the road was 80 kilometres per hour.

Is it possible that Dewi exceeded the speed limit?
You must show all your working.

[4]

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14. A solid concrete base for a garden statue is to be made in the shape of a *frustum* of a pyramid. The *frustum* is formed by removing a small pyramid from a large pyramid, as shown in the diagram.

Calculate the volume of concrete required to make the base for the garden statue. Give your answer in **litres**.
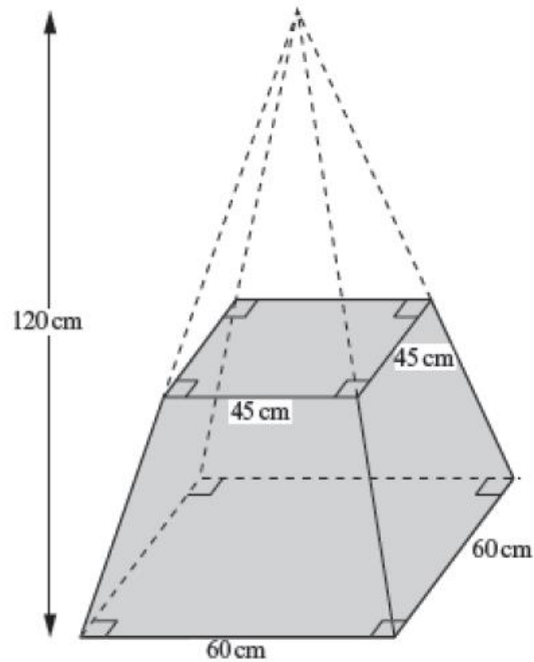
[6]

Diagram not drawn to scale

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END OF PAPER