Surname	StemUp Model Solution	Centre Number	Candidate Number
First name(s)			0

GCSE

3310U40-1

S24-3310U40-1

MONDAY, 3 JUNE 2024 – MORNING

MATHEMATICS – NUMERACY
UNIT 2: CALCULATOR-ALLOWED
INTERMEDIATE TIER

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

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.

If you run out of space, use the additional page at the back of the booklet. Question numbers must be given for all work written on the additional page.

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.

In question **3**, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

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

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01

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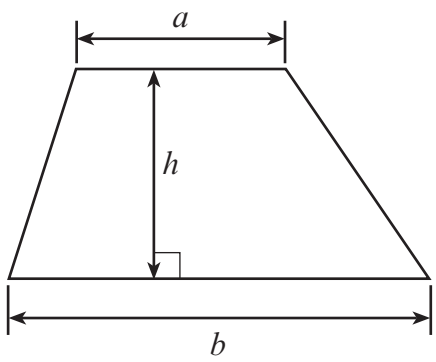
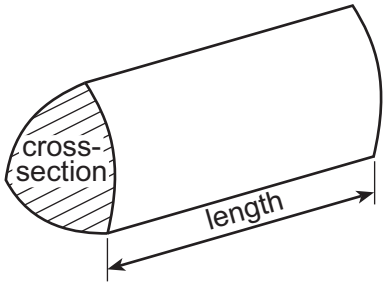
Formula List – Intermediate Tier

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



Volume of prism = area of cross-section × length



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1. Shiona is saving to pay for a holiday.
She has 13 weeks to save £510 to pay for her holiday.

Shiona already has savings of £95.
In the first week, she knows she can save £70.

She plans to save equal amounts of money in each of the remaining weeks.

How much does Shiona need to save in each of the remaining weeks so that she can pay for her holiday?
You must show all your working. [4]

Amount still needed after savings and the first week:

£510 − £95 − £70 = £345

Number of remaining weeks = 13 − 1 = 12 weeks

Amount to save each week = £345 ÷ 12

= £28.75

Check: 95 + 70 + 12 × 28.75 = 95 + 70 + 345 = £510

Shiona needs to save £28.75 in each of the remaining 12 weeks.

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2. Idris flies from Cardiff to Faro, in Portugal.

(a) The actual flying time is 133 minutes.
The plane flies at an average speed of 8 miles per minute.

(i) Calculate the flying distance between Cardiff and Faro.
Give your answer in miles. [2]

Distance = speed × time = 8 × 133

= 1064 miles

(ii) Calculate the plane's average speed in **miles per hour**. [2]

Speed = 8 miles per minute × 60 minutes

= 480 miles per hour

(b) Idris takes a cabin bag on board his flight.
His bag measures 55 cm by 40 cm by 23 cm.
The label on his cabin bag says,

Bag capacity is greater than 48 litres.

Is this label correct?

Yes ☑ No ☐

You must show all your working and give a reason for your answer. [3]

Capacity of bag = 55 × 40 × 23 = 50 600 cm^3

1 litre = 1000 cm^3, so 50 600 cm^3 = 50 600 ÷ 1000 = 50.6 litres

(48 litres = 48 000 cm^3)

Yes, the label is correct because 50.6 litres is greater than

48 litres.

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(c) Idris looks out of the aeroplane window.
He notices a village below.
Idris takes a photograph of the village to try to work out where he is.
From the photograph, he draws a sketch including some parallel streets.

His sketch is shown below.

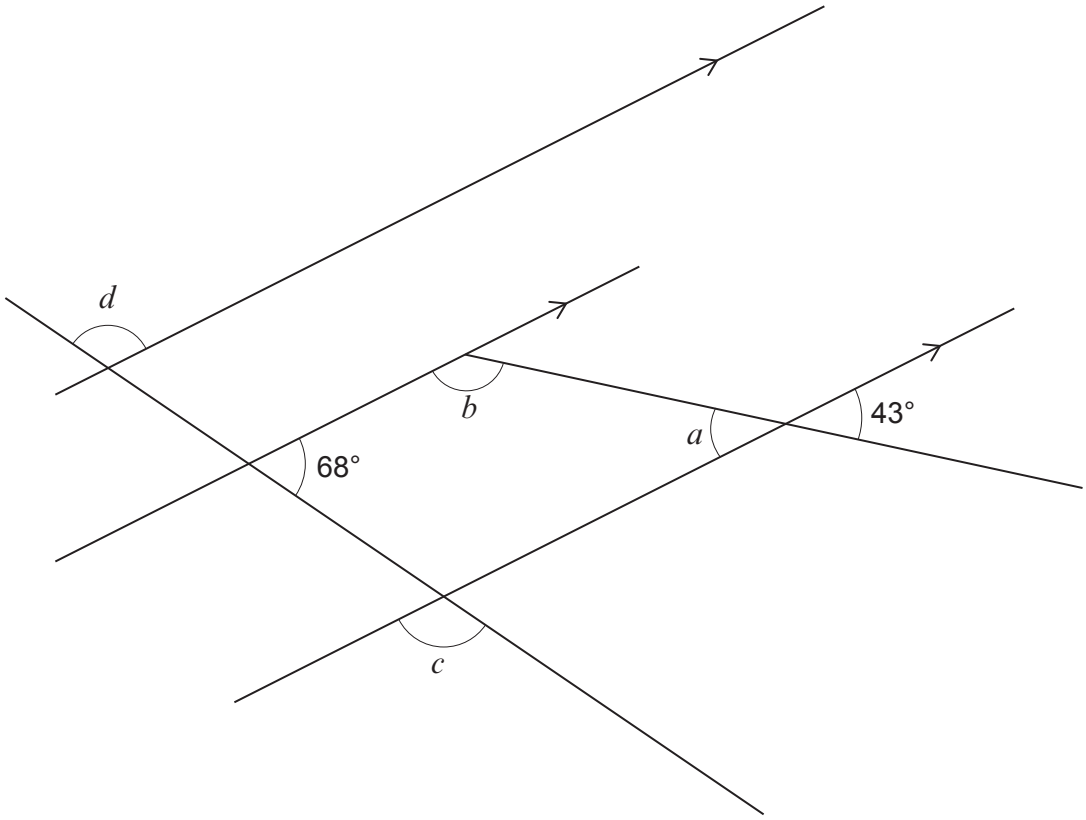

Diagram not drawn to scale

Find the size of each of the angles a, b, c and d. [4]

a = 43° (vertically opposite), b = 180 − 43 = 137° (co-interior angles)

c = 360 − (68 + 43 + 137) = 112° (angles in a quadrilateral), d = c (corresp.)

a = 43 ° b = 137 ° c = 112 ° d = 112 °

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3. *In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.*

Gracie decides to buy a new ZX31 camera.
On the internet, she sees advertisements for the camera she wants.

Camera Fox	*US Camera Geek*	*Sure Camera*
ZX31 camera £62.95 + £3.90 delivery	ZX31 camera $81.20 with FREE international delivery	ZX31 camera special offer. Usual price £75 NOW 14% discount AND free delivery

Gracie knows that the exchange rate is £1 = $1.25.

She wants to buy the ZX31 camera that is the best value for money.

Which of the advertisements offers the best option for Gracie?
You must show all your working. [5 + 2 OCW]

Camera Fox: £62.95 + £3.90 delivery = £66.85

US Camera Geek: $81.20 ÷ 1.25 = £64.96 (free delivery)

Sure Camera: 14% discount = 0.14 × £75 = £10.50

Price = £75 − £10.50 = £64.50 (free delivery)

Comparing the costs in pounds:

Camera Fox £66.85, US Camera Geek £64.96, Sure Camera £64.50

Sure Camera is the cheapest, so Sure Camera offers the best option for Gracie. She pays £64.50.

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4. During the 30 days in the month of September, Andras used 138 m^3 of gas.
The cost of this gas was 12p per kWh.

> The formula used to calculate the number of kWh for the gas used is as follows:
>
> Number of kWh = number of m^3 of gas × 39·5 × 1·02264 ÷ 3·6

The standing charge was 32p per day.
VAT at 5% was payable on the sum of the cost of the gas used and the standing charge.

Calculate Andras's gas bill for September.
You must show all your working. [7]

Number of kWh = 138 × 39.5 × 1.02264 ÷ 3.6

= 1548.4474... kWh

Cost of gas = 1548.4474... × £0.12 = £185.8136...

= £185.81

Standing charge = 30 days × £0.32 = £9.60

Cost of gas + standing charge = £185.81 + £9.60 = £195.41

VAT at 5%: total = 1.05 × £195.41

= £205.1805

Andras's gas bill for September is £205.18.

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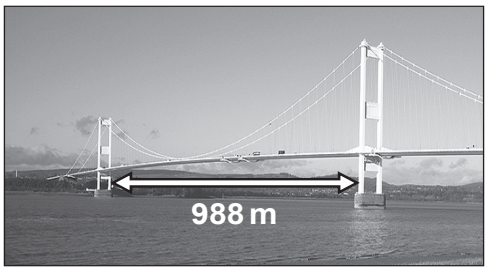
5. The Severn Bridge was built in 1966 to allow vehicles to travel between England and Wales.

The bridge has a width of 23 m and a total length of 1600 m.
The section of the bridge between the two towers is 988 m long.

The tarmac road surface is 0·035 m thick.

The cables from the towers to support the road are made from 18 000 miles of wire.



(a) What fraction of the total length of the bridge is the section between the two towers? Give your fraction in its simplest form. [2]

Fraction = $\frac{988}{1600} = \frac{494}{800} = \frac{247}{400}$ (÷ 2, then ÷ 2 again)

(b) Calculate the length of the wire used to make the cables in **kilometres**. [2]

1 mile = 1.6 km (5 miles = 8 km)

Length of wire = 18 000 × 1.6

= 28 800 km

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(c) The cost of tarmac is £250 per m^3.

Calculate the cost of the volume of tarmac needed to resurface the total length of the Severn Bridge. [3]

Volume of tarmac = length × width × thickness

= 1600 × 23 × 0.035 = 1288 m^3

Cost = 1288 × £250

= £322 000

(d) Some of the tolls charged for a car to enter Wales are given in the table below.

Year	2004	2009	2014	2019
Toll for a car	£4.60	£5.40	£6.40	FREE

In which of the following 5-year periods was there the greatest percentage increase in the toll?

2004 to 2009 2009 to 2014 2014 to 2019

State the percentage increase for this 5-year period.
You must show all your working. [4]

2004 to 2009: increase = 5.40 − 4.60 = £0.80

% increase = 0.80 ÷ 4.60 × 100 = 17.391...% = 17.4%

2009 to 2014: increase = 6.40 − 5.40 = £1.00

% increase = 1.00 ÷ 5.40 × 100 = 18.518...% = 18.5%

2014 to 2019: the toll became free, so this was a decrease.

18.5% > 17.4%, so the greatest increase was 2009 to 2014.

The greatest percentage increase in the toll was in the period 2009 to 2014.

The percentage increase was 18.5%

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6. (a) A survey was carried out to find the total time people took to read the book 'Wales is a Celtic Country'.
The results are shown in the frequency polygon below.

(i) Which is the modal group?
Circle your answer. [1]

18 to 24 hours 21 hours 12 to 18 hours 34 hours 30 to 36 hours

(ii) How many people took part in the survey?
Circle your answer. [1]

34 30 33 97 108

.....

.....

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(iii) How many of the people in the survey took 24 hours or more to read this book? Circle your answer. [1]

13 34 47 24 84

(iv) Did any of the people in the survey take less than 6 hours to read this book?

Yes ☐ No ☑ Can't tell ☐

You must give a reason for your answer. [1]

No. The first point of the frequency polygon (at 3 hours) has a frequency of 0, so nobody was in the 0 to 6 hours group.

(b) Four books are placed in a stack.

The thickness of each of the books is as follows:

22 mm 25 mm 29 mm 31 mm

The thickness of each book is measured **correct to the nearest mm**.

Show that the total height of the stack of these four books cannot be more than 109 mm. [3]

Each thickness could be up to 0.5 mm more than measured.

Upper bounds: 22.5 mm, 25.5 mm, 29.5 mm, 31.5 mm

Greatest height = 22.5 + 25.5 + 29.5 + 31.5

= 109 mm

So the total height cannot be more than 109 mm.

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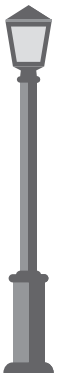
7. (a)

Remember:

1 kilowatt (kW) = 1000 watts (W)



There are 8 street lights in Ffordd Alwyn.
Each light is fitted with an 80 watt light bulb.

Each of the 8 street lights is usually on from 6 p.m. to 6 a.m.

It costs 32.4p per hour for each **kilowatt** of electricity used.

How much would be saved **per week** if the 8 street lights were only on from 7 p.m. to 5 a.m.?
Give your answer in pounds, correct to the nearest penny.
You must show all your working. [5]

Hours saved each night: 6 p.m. to 6 a.m. = 12 hours,

7 p.m. to 5 a.m. = 10 hours, 12 − 10 = 2 hours

Hours saved per week = 2 × 7 = 14 hours

Power of 8 lights = 8 × 80 = 640 W = 640 ÷ 1000 = 0.64 kW

Electricity saved = 0.64 kW × 14 hours = 8.96 kWh

Saving = 8.96 × 32.4p = 290.304p

= £2.90304...

The saving per week is £2.90.

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(b) A lamp post is vertical and stands on horizontal ground.
The angle of elevation of the top of the lamp post is 68° when measured from a point 3·3 m from the centre of the base of the lamp post.

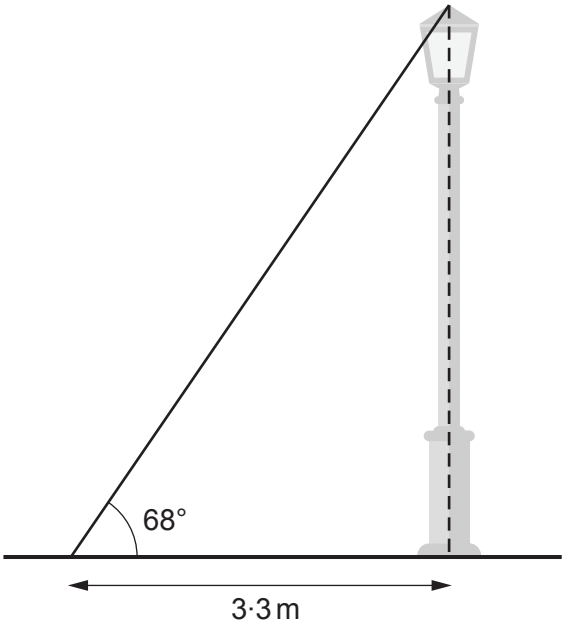

Diagram not drawn to scale

Calculate the height of the lamp post. [3]

tan 68° = height ÷ 3.3

Height = 3.3 × tan 68°

= 8.1677... m

Height of the lamp post = 8.17 m

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8. (a) 50 people living by the sea were asked how often they went for a walk along the sea wall each week.

The results were as follows:

Number of walks each week	Frequency
0 to 2	8
3 to 5	12
6 to 8	20
9 to 13	4
14 to 18	6

Calculate an estimate of the mean number of walks per person each week. [4]

Midpoints: 1, 4, 7, 11, 16

Total = 1×8 + 4×12 + 7×20 + 11×4 + 16×6

= 8 + 48 + 140 + 44 + 96 = 336

Mean = 336 ÷ 50

= 6.72 walks per person each week

(b) High tide in the morning is, on average, 35 minutes later each day.
The morning high tide on 3rd March was at 08:03.
At what time was the morning high tide on 1st March? [1]

2 days earlier: 2 × 35 = 70 minutes = 1 hour 10 minutes earlier

08:03 – 1 hour 10 minutes

High tide on 1st March was at 06:53

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(c) A new concrete sea-defence wall is to be built.
The sea-defence wall will have a uniform cross-section.
A sketch of the new wall is shown below.

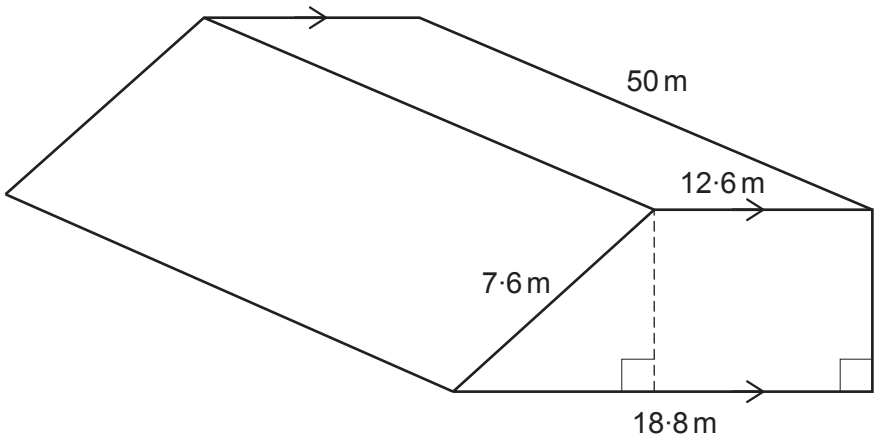

Diagram not drawn to scale

Calculate the volume of concrete needed to make this new sea-defence wall.
You must show all your working. [7]

Horizontal part of the sloping side = 18.8 − 12.6 = 6.2 m

Pythagoras: height^2 = 7.6^2 − 6.2^2 = 57.76 − 38.44 = 19.32

Height = √19.32 = 4.3954... m

Cross-section is a trapezium:

Area = ½ × (12.6 + 18.8) × 4.3954...

= ½ × 31.4 × 4.3954... = 69.0086... m^2

Volume = area of cross-section × length

= 69.0086... × 50

= 3450.43... m^3

Volume of concrete needed = 3450 m^3

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9. (a) A volcano is an opening in the Earth's crust, through which molten lava, hot ash and gases escape into the air.

(i) An estimated 500 000 000 people live near active volcanoes.
What is 500 000 000 written in standard form? [1]

5×10^8

(ii) The teragram is a unit of mass.
1 teragram = 10^9 kg

Last year, a volcano released a total of 140 teragrams of carbon dioxide in 300 days.

Calculate the average number of kilograms of carbon dioxide that were released by this volcano **per hour**.
Give your answer correct to 3 significant figures.
You must show all your working. [5]

140 teragrams = 140×10^9 kg = 1.4×10^{11} kg

Number of hours = 300 days × 24 = 7200 hours

Mass per hour = $1.4 \times 10^{11} \div 7200$

= 19 444 444.44... kg

= 19 400 000 kg per hour (to 3 s.f.)

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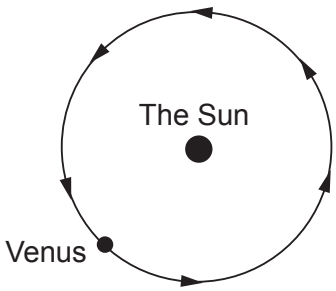
(b) (i) The planet Venus orbits the Sun.
Its orbit can be considered to be circular.

The distance between Venus and the Sun is $1{\cdot}08 \times 10^8$ km.

Venus orbits the Sun once every 224·7 days.



Calculate the distance Venus travels in 1 day.
Give your answer in standard form. [4]

Orbit (circumference) = $2 \times \pi \times r = 2 \times \pi \times 1.08 \times 10^8$

= 678 584 013.4... km

Distance in 1 day = 678 584 013.4... ÷ 224.7

= 3 019 955.56... km

= 3.02×10^6 km

(ii) The surface area of Venus is 460 234 320 km^2.
The surface of Venus is wrinkled-volcanic, smooth-volcanic or **non**-volcanic.
The areas of these three different types of surface are in the ratio 7 : 1 : 2.

Wrinkled-volcanic : Smooth-volcanic : Non-volcanic = 7 : 1 : 2

Calculate the total surface area of Venus that **is** volcanic.
You must show all your working. [3]

Total parts = 7 + 1 + 2 = 10

One part = 460 234 320 ÷ 10 = 46 023 432 km^2

Volcanic = wrinkled + smooth = 7 + 1 = 8 parts

Volcanic area = 8 × 46 023 432

= 368 187 456 km^2

END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.	Examiner only

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