

Surname <i>StemUp Model Solution</i>	Centre Number	Candidate Number
First name(s)		0



GCSE

3310U40-1



S23-3310U40-1

WEDNESDAY, 7 JUNE 2023 – 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 the 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(a), 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.	3	
2.	12	
3.	15	
4.	8	
5.	7	
6.	7	
7.	4	
8.	13	
9.	7	
10.	4	
Total	80	

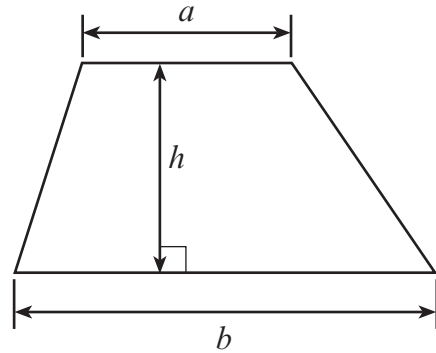
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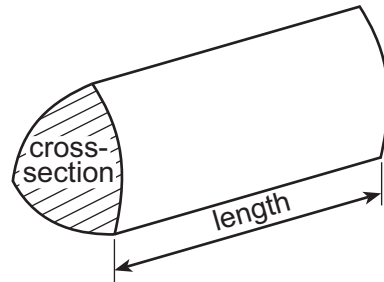
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Formula List – Intermediate Tier

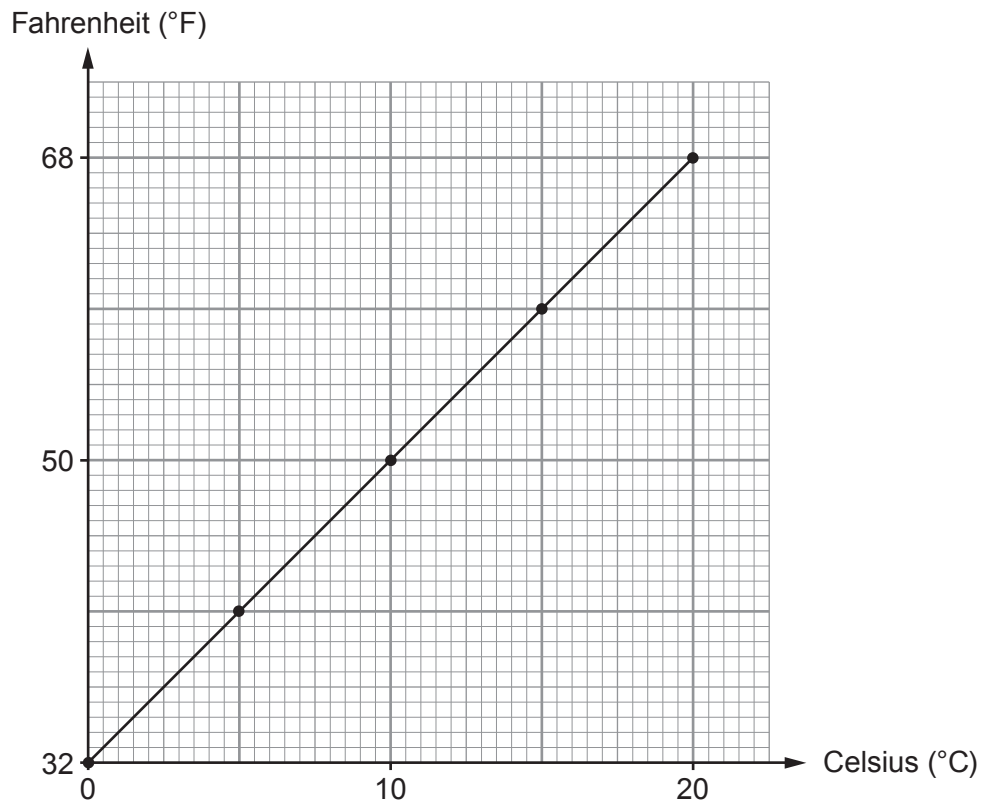
Area of trapezium $= \frac{1}{2}(a + b)h$



Volume of prism $= \text{area of cross-section} \times \text{length}$



1. Owain has drawn a conversion graph to help him with his homework.



- (a) Circle the correct answer to complete the following statement.
15°C in Fahrenheit is

[1]

-5°F

59°F

58°F

55°F

66°F

- (b) Bethan says,

40°C in Fahrenheit is 136°F, as it is twice what it is at 20°C.

Bethan is **incorrect**.

Express 40°C in Fahrenheit.

[2]

From the graph, every 10°C adds 68 - 50 = 18°F

40°C = 68°F (at 20°C) + 18°F + 18°F

= 104°F (check: 1.8 × 40 + 32 = 104)

40°C is 104 °F



2. In 2018, the costs of making phone calls from the UK to some overseas countries were as shown in the tables below.

International rate (pence per minute)		
Band	To landlines	To mobiles
A	30	60
B	60	90
C	120	150

Band	Countries
A	Canada, Hong Kong, Japan
B	Albania, China, Pakistan
C	Argentina, Kenya, Tonga, Zambia

- (a) (i) Calculate the cost of making a $2\frac{1}{4}$ hour phone call to a mobile in China.
Give your answer in pounds. [3]

$$2\frac{1}{4} \text{ hours} = 2.25 \times 60 = 135 \text{ minutes}$$

$$\text{Cost} = 135 \times 90\text{p} = 12\,150\text{p} = \text{£}121.50$$

£ 121.50

- (ii) A one hour phone call cost £72.

Was this call made to a landline or a mobile?

Was this call made to a country in Band A, Band B or Band C?

You **must** show all your working. [3]

Tick (✓) the **two** correct boxes.

Landline



Mobile



Band A



Band B



Band C



$$\text{Cost per minute} = \text{£}72 \div 60 = \text{£}1.20 = 120\text{p per minute}$$

120p per minute is the rate to landlines in Band C,

so the call was to a landline in a Band C country.



- (b) The table below gives the exchange rates in September 2018.

£1 exchange rate			
Japan 143.42 yen	Pakistan 159.21 rupees	Argentina 47.85 peso	Tonga 2.96 pa'anga

- (i) A phone call to Argentina cost £6.

How much did this phone call cost in pesos?

[2]

$$\text{Cost in pesos} = 6 \times 47.85 = 287.1 \text{ pesos}$$

287.1 pesos

- (ii) A phone call to a landline in Japan cost 2151.30 yen.

Calculate:

- the cost of this phone call, in pounds,
- how long the phone call lasted, in minutes.

[4]

$$\text{Cost in pounds} = 2151.30 \div 143.42 = \text{£}15$$

$$\text{Japan is Band A, landline rate} = 30\text{p per minute}$$

$$\text{Length of call} = 1500\text{p} \div 30\text{p} = 50 \text{ minutes}$$

Cost £ 15

Phone call lasted 50 minutes



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

The Draig Afon youth choir went on tour.
48 people travelled and stayed in hotels.

The organiser booked:

- Gwesty Arwel for 3 nights
- Hotel Glan y Môr for 5 nights.

The table gives the prices per night for the two hotels.

Gwesty Arwel		Hotel Glan y Môr	
Single room	£84	Single room	£58
Twin room (total cost for two people)	£102	Twin room	£34 per person
Group bookings get a discount of 14%			

The Draig Afon youth choir qualified for the group booking offer.

12 of these people required single rooms.
The other 36 people were booked into twin rooms.

Calculate the total cost of the 8-night stay for the choir.
You must show all your working.

[8 + 2 OCW]

Gwesty Arwel (3 nights):

Single rooms: $12 \times £84 = £1008$ per night

Twin rooms: $36 \div 2 = 18$ rooms, $18 \times £102 = £1836$ per night

Cost per night = $£1008 + £1836 = £2844$

Cost for 3 nights = $3 \times £2844 = £8532$

With 14% discount: $£8532 \times 0.86 = £7337.52$

Hotel Glan y Môr (5 nights):

Single rooms: $12 \times £58 = £696$ per night

Twin rooms: $36 \times £34 = £1224$ per night

Cost per night = $£696 + £1224 = £1920$



Cost for 5 nights = $5 \times £1920 = £9600$

Total cost of 8-night stay = $£7337.52 + £9600$

= $£16\ 937.52$

The total cost of the 8-night stay for the choir is $£16\ 937.52$.

- (b) The Draig Afon youth choir hired a coach.
At the start of the tour, the coach's display showed it had travelled 32 474 km.
At the end of the tour, the coach's display showed 33 860 km.

The fuel for the coach cost £1.86 per litre.

On average, the coach used 1 litre of fuel for every 4 km travelled.

Calculate the total cost of the fuel used for the choir's tour.

[5]

Distance travelled = $33\ 860 - 32\ 474 = 1386$ km

Fuel used = $1386 \div 4 = 346.5$ litres

Cost of fuel = $346.5 \times £1.86 = £644.49$

The total cost of the fuel for the tour is $£644.49$.



4. (a) Llandudno Pier is 700 m long.
What is the length of Llandudno Pier in feet?
You must use the following conversions.

[3]

12 inches = 1 foot

1 inch $\approx$ 2.5 cm

$$700 \text{ m} = 700 \times 100 = 70\,000 \text{ cm}$$

$$70\,000 \text{ cm} \div 2.5 = 28\,000 \text{ inches}$$

$$28\,000 \text{ inches} \div 12 = 2333.33... \text{ feet}$$

$$\text{Length of Llandudno Pier} \approx 2333 \text{ feet}$$

- (b) Southend Pier is the longest pleasure pier in the world.
It is 1.34 miles long.

Gareth walks at a steady pace along Southend Pier.

He walks 84 metres every minute.

He starts walking along the length of the pier at 2 p.m.

At what time does Gareth reach the end of the pier?

Give your time correct to the nearest minute.

You must show all your working.

[5]

$$5 \text{ miles} \approx 8 \text{ km, so } 1.34 \text{ miles} = 1.34 \times 8 \div 5 = 2.144 \text{ km}$$

$$2.144 \text{ km} = 2.144 \times 1000 = 2144 \text{ m}$$

$$\text{Time taken} = 2144 \div 84 = 25.523... \text{ minutes}$$

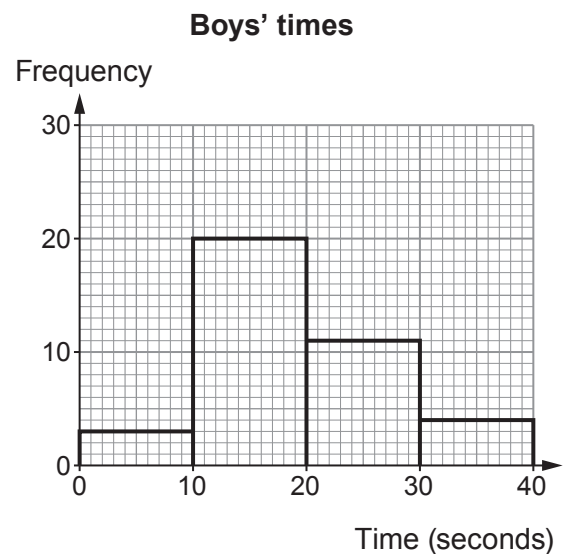
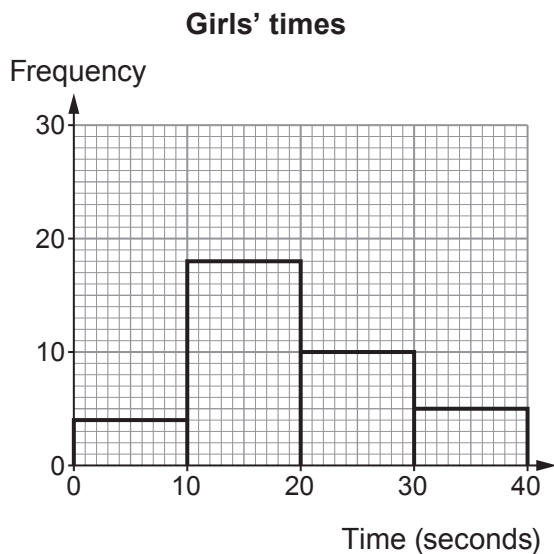
$$= 26 \text{ minutes (to the nearest minute)}$$

$$2 \text{ p.m.} + 26 \text{ minutes} = 2:26 \text{ p.m.}$$

Gareth reaches the end of the pier at 2:26 p.m., correct to the nearest minute.



5. The times it took a group of girls and a group of boys to complete the same puzzle are shown in the frequency diagrams below.



- (a) Anand says,

There are more boys than girls in these groups.

By showing all your working, decide if Anand's statement is correct or not.

[3]

Correct



Incorrect



$$\text{Number of girls} = 4 + 18 + 10 + 5 = 37$$

$$\text{Number of boys} = 3 + 20 + 11 + 4 = 38$$

$$38 > 37, \text{ so there are more boys. Anand is correct.}$$

- (b) What is the difference between the percentage of girls completing the puzzle in less than 10 seconds and the percentage of boys completing the puzzle in less than 10 seconds?

Give your answer correct to one decimal place.

[4]

$$\text{Girls under 10 s: } 4 \div 37 \times 100 = 10.810...\%$$

$$\text{Boys under 10 s: } 3 \div 38 \times 100 = 7.894...\%$$

$$\text{Difference} = 10.810... - 7.894... = 2.916...\%$$

$$= 2.9\% \text{ (to 1 d.p.)}$$

Difference is 2.9 %, correct to one decimal place



6. The table gives the heights of the 27 musicians in the Camwen Youth Orchestra.

Height, h cm	Frequency
$150 \leq h < 158$	3
$158 \leq h < 166$	10
$166 \leq h < 174$	9
$174 \leq h < 182$	4
$182 \leq h < 190$	0
$190 \leq h < 198$	1

- (a) (i) In which group does the median height of a musician lie?
You must give a reason for your answer.

[2]

Group: $166 \leq h < 174$

Reason: The median is the $(27 + 1) \div 2 = 14$ th height.

$3 + 10 = 13$ and $13 + 9 = 22$, so the 14th height is in this group.

- (ii) Is it certain that there is at least one musician in the orchestra who is less than 154 cm tall?
Give a reason for your answer.

[1]

Yes

☐

No

☒

We only know 3 musicians are between 150 cm and 158 cm,

not their actual heights. They could all be taller than 154 cm.

- (b) Calculate an estimate of the mean height of a musician in the Camwen Youth Orchestra.

[4]

Midpoints: 154, 162, 170, 178, 186, 194

$$\Sigma fx = 154 \times 3 + 162 \times 10 + 170 \times 9 + 178 \times 4 + 186 \times 0 + 194 \times 1$$

$$= 462 + 1620 + 1530 + 712 + 0 + 194 = 4518$$

$$\text{Mean} = 4518 \div 27 = 167.333\dots$$

Estimate of the mean height ≈ 167.3 cm



7. Layla has been set a target by her fitness trainer.
Every day, Layla has to increase the number of steps she does.

Today, Layla did 1800 steps.

Layla's target for the number of steps per day:
Increase by 2% every day for the next 28 days

Calculate the number of steps Layla's trainer is expecting her to do on the last of these 28 days.

[4]

Multiplier for a 2% increase = 1.02

Steps on the 28th day = 1800×1.02^{28}

= 3133.843...

The trainer expects Layla to do about 3134 steps on the last day.



8. Paper comes in standard sizes.

Paper size		A0	A1	A2	A3	A4
Dimensions:	Length (cm)	118.9	84.1	59.4	42.0	29.7
	Width (cm)	84.1	59.4	42.0	29.7	21.0

- (a) Which paper size has an area of approximately 500 000 mm²?
Circle your answer.

[1]

A0

A1

A2

A3

A4

$$A1: 84.1 \times 59.4 = 4995.54 \text{ cm}^2 = 499\,554 \text{ mm}^2 \approx 500\,000 \text{ mm}^2$$

- (b) The mass of paper is measured in grams.
The quality of paper is given by its mass per square metre of paper.

The quality of a sheet of A2 paper used for printing is stated as 120 g/m².
Complete the following statement.

[4]

'This sheet of A2 paper has a mass of 29.9376..... g.'

$$\text{Area of A2} = 59.4 \text{ cm} \times 42.0 \text{ cm} = 2494.8 \text{ cm}^2$$

$$= 2494.8 \div 10\,000 = 0.24948 \text{ m}^2$$

$$\text{Mass} = 0.24948 \times 120 = 29.9376 \text{ g}$$

$$\approx 29.94 \text{ g}$$



- (c) Sheets of A4 and A5 paper are mathematically similar.

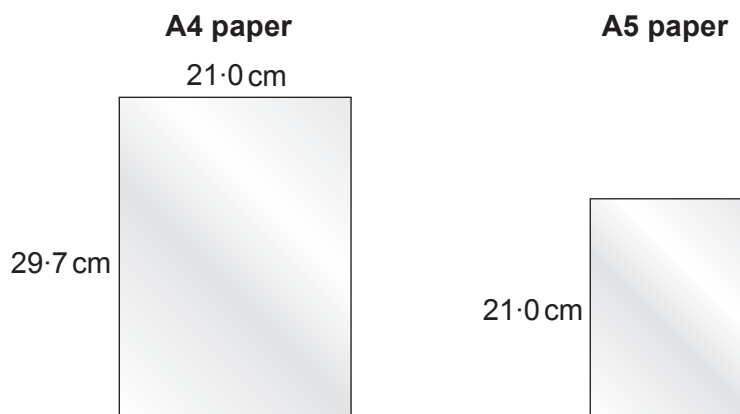


Diagram not drawn to scale

Calculate the length of the **diagonal** of a sheet of A5 paper.
You must show all your working.

[5]

$$\text{Diagonal of A4}^2 = 21.0^2 + 29.7^2$$

$$= 441 + 882.09 = 1323.09$$

$$\text{Diagonal of A4} = \sqrt{1323.09} = 36.374... \text{ cm}$$

$$\text{Scale factor A4 to A5} = 21.0 \div 29.7 = 0.7070...$$

$$\text{Diagonal of A5} = 36.374... \times 21.0 \div 29.7$$

$$= 25.719... \text{ cm}$$

$$\text{Diagonal of A5} \approx 25.7 \text{ cm}$$

- (d) The measurements for the A1 sheet of paper in the table are correct to the nearest mm.
Calculate the greatest possible perimeter of an A1 sheet of paper.

[3]

$$\text{Upper bounds: length} = 84.15 \text{ cm, width} = 59.45 \text{ cm}$$

$$\text{Greatest perimeter} = 2 \times (84.15 + 59.45)$$

$$= 2 \times 143.6 = 287.2 \text{ cm}$$



9. The cost of sending a package depends on its volume.

Volume (cm ³)	Cost
0 to 1000	£12.55
greater than 1000, up to 2000	£13.60
greater than 2000, up to 4000	£14.85
greater than 4000, up to 10 000	£16.25
Parcels with volume greater than 10 000 cm ³ are not accepted	

A rectangular 'HANDLE WITH CARE' label is stuck on a package.
 The label measures 17.5 cm by 11.1 cm.
 The package is a cuboid with height 19 cm and width 6.7 cm.
 Each vertex of the label touches an edge of the front face of the package.

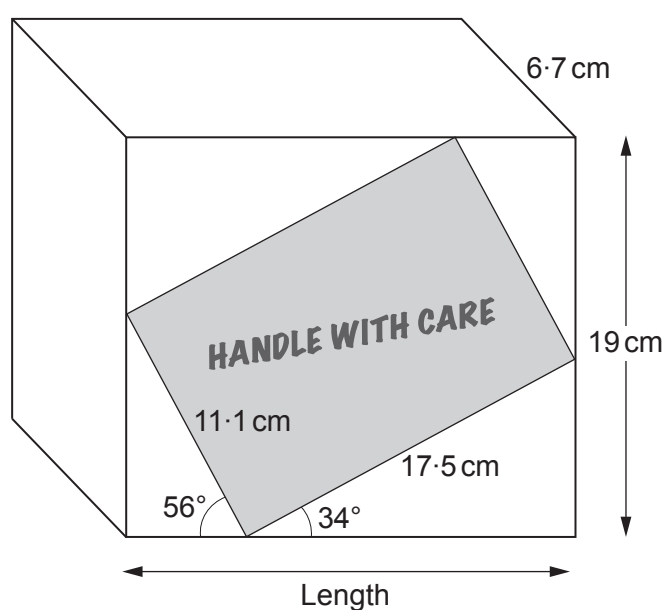


Diagram not drawn to scale

Calculate the volume of the package and hence find the cost of sending this package.
 You must show all your working.

[7]

Length = horizontal part of 17.5 cm side + horizontal part of 11.1 cm side

$$x = 17.5 \times \cos 34^\circ = 14.508... \text{ cm}$$

$$y = 11.1 \times \cos 56^\circ = 6.207... \text{ cm}$$

$$\text{Length} = 14.508... + 6.207... = 20.715... \text{ cm}$$

$$\text{Volume} = 19 \times 6.7 \times 20.715...$$



$$= 2637.04... \text{ cm}^3$$

2637 cm³ is greater than 2000 cm³ and up to 4000 cm³,

so the cost of sending this package is £14.85.

The volume of the package is *2637 cm³*

The cost of sending this package is *£14.85*

10. Delta Metals makes aluminium chimneys in the shape of open cylinders.

Each chimney has a height of 2.5 m.

The external diameter of each chimney is 0.18 m.

Calculate the external curved surface area of one of these chimneys.

Give your answer correct to 3 significant figures.

[4]

$$\text{Curved surface area} = \pi \times \text{diameter} \times \text{height}$$

$$= \pi \times 0.18 \times 2.5$$

$$= 1.41371... \text{ m}^2$$

$$= 1.41 \text{ m}^2 \text{ (to 3 significant figures)}$$

END OF PAPER



[illegible]