Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3310U40-1

A20-3310U40-1

THURSDAY, 5 NOVEMBER 2020 – 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 **2**, 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.	**5**	
2.	**7**	
3.	**7**	
4.	**10**	
5.	**3**	
6.	**6**	
7.	**7**	
8.	**4**	
9.	**11**	
10.	**4**	
11.	**6**	
12.	**6**	
13.	**4**	
Total	**80**	

3310U401
01

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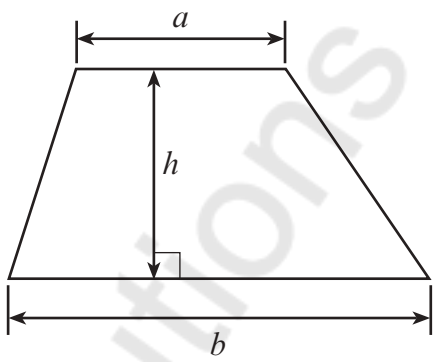
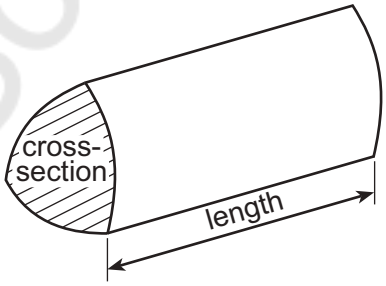
Formula List – Intermediate Tier

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



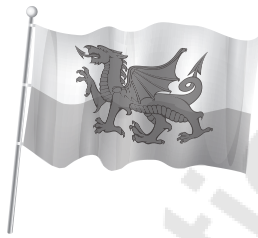
Volume of prism = area of cross-section × length



Examiner only

1. Maldwyn sells flags, scarves and hats outside a stadium.
At the end of a football match, Maldwyn sells his remaining flags, scarves and hats at sale prices.

(a)

Scarf	Flag
	
Was £4.97 Now **$\frac{3}{7}$ off** in the sale	£8.50 each Buy 2 and get **26% off** the total price

(i) Calculate the sale price of a scarf. [2]

⇒ Taking $\frac{3}{7}$ off in the sale ⇒ $\frac{3}{7} \times 4.97$
⇒ £2.13
Sale Price ⇒ £4.97 − £2.13 = £2.84

4.97 − 2.13 = 2.84

(ii) Calculate the cost of buying **two** flags in the sale. [2]

for 2 flags = 2 × £8.50 = £17
26% off the total price ⇒ 26% × £17
⇒ $\frac{26}{100} \times 17 = \frac{442}{100}$ = £4.42
⇒ Cost of buying two flags ⇒ £17 − £4.42 ⇒ 12.58

(b) Before the sale, a hat cost £3.99.
In the sale, the hat costs £2.66.
By what fraction has the cost of the hat been **reduced**?
Circle your answer. [1]

$\frac{1}{4}$ $\frac{1}{3}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{1}{2}$

⇒ from £3.99 to £2.66 ⇒ 3.99 − 2.66 = £1.33
⇒ $\frac{1.33}{3.99} = \frac{133}{399} = \frac{1}{3}$

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03

Examiner only

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

Huw buys peanuts to feed the birds.

He finds the following prices for buying peanuts.

Bird Feast	Cheep Feed	Kind to Birds
£16.20 for 12·55 kg	£32 for 25 kg	£15.60 for 12 kg

Which of the above options is the best value for money?
You must show all your working. [5 + 2 OCW]

* Bird Feast ⇒ £16.20 / 12.55 = 1.29

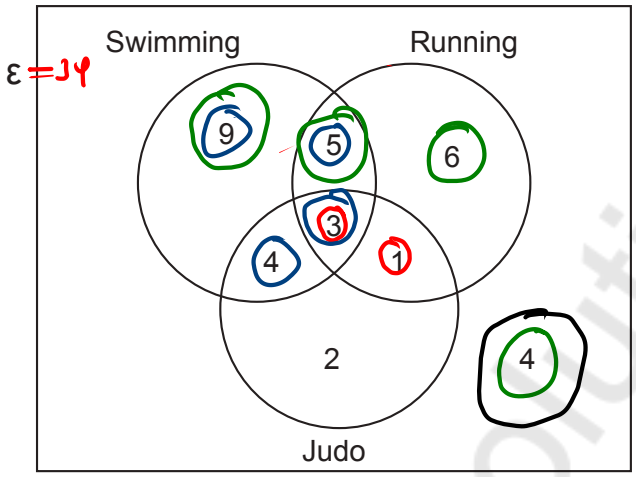
* Cheep Feed ⇒ £32 / 25 = 1.28

* Kind to Birds = £15.60 / 12 = 1.3

⇒ Cheep Feed

Examiner only

3. There are 34 pupils in class 10A.
Dewi carried out a survey to find out how many of these pupils take part in swimming, running and judo.
He displayed his results in a Venn diagram, as shown below.



(a) How many of the pupils in class 10A take part in both judo and running?
Circle your answer. [1]

1 8 4 3 21

$3 + 1 \Rightarrow 4$

(b) How many of the pupils in class 10A take part in swimming?
Circle your answer. [1]

9 4 14 3 21

$\Rightarrow 9 + 5 + 4 + 3 = 21$

(c) How many of the pupils in class 10A **do not** take part in judo?
Circle your answer. [1]

9 10 20 24 15

$\Rightarrow 9 + 5 + 6 + 4 = 24$

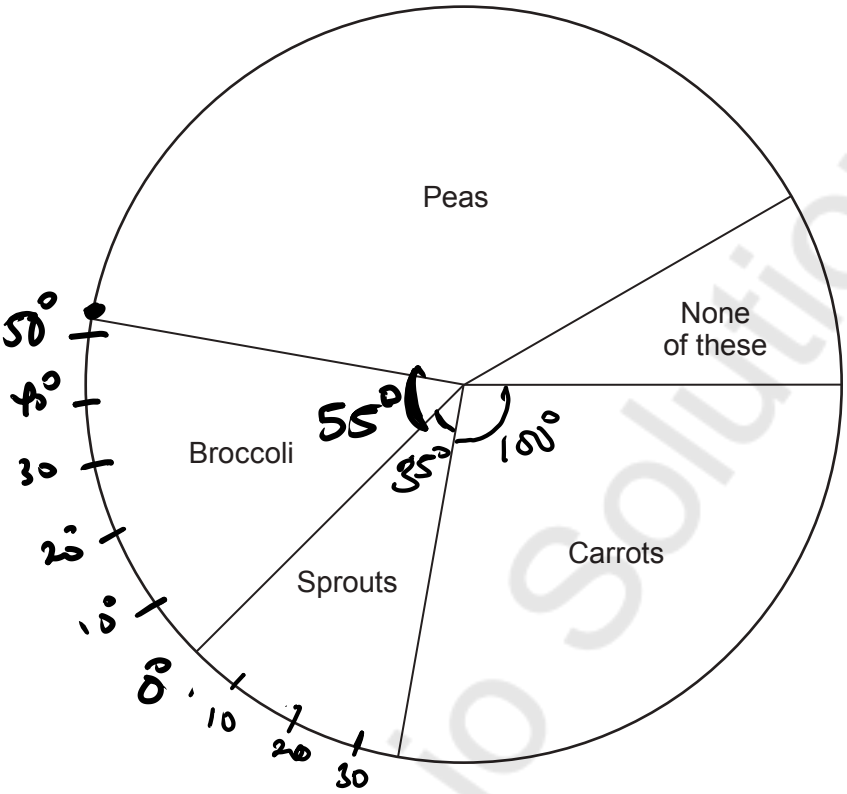
(d) Calculate the percentage of the pupils in class 10A who **do not** take part in swimming, running or judo.
Give your answer correct to 1 decimal place. [4]

$\Rightarrow \frac{4}{34} \times 100\% \Rightarrow \frac{400}{34}\% = 11.76\%$

$\simeq 11.8\%$

Examiner only

4. *(a)* 1080 people were asked to choose their favourite vegetable.
The pie chart shows the results.



(i) How many people chose broccoli as their favourite vegetable?
You must show all your working. [3]

$\frac{55}{360} \times 1080 = 165$

$= 165$ People

Examiner only

(ii) How many more people chose carrots than chose sprouts as their favourite vegetable?
You must show all your working. [3]

Angle Sector for Carrots = 100°

$\Rightarrow \frac{100^\circ}{360} \times 1080 = 300$ People

Angle Sector for Sprouts = 35°

$\Rightarrow \frac{35^\circ}{360} \times 1080 = 105$ People

$\Rightarrow \frac{100^\circ - 35^\circ}{360^\circ} \times 1080$

$\Rightarrow$ 195 people

$\Rightarrow 300 - 105$

$\Rightarrow 195$

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07

(b) 420 people selected peas as their favourite vegetable.
They were asked which they preferred: fresh peas, frozen peas or tinned peas.

Of these 420 people, $\frac{3}{14}$ said they preferred fresh peas.

Twice as many people preferred frozen peas to tinned peas.

How many of these people preferred frozen peas? [4]

$\Rightarrow 2 \times \frac{1}{3} \Rightarrow \frac{2}{3}$ *

$\Rightarrow 1 - \frac{3}{14} = \frac{14-3}{14} = \frac{11}{14}$

$\Rightarrow \frac{2}{3} \times \frac{11}{14}$

$\Rightarrow \frac{22}{42} \Rightarrow$

$\frac{22}{42} \times \frac{10}{420} = 22 \times 10$

$= 220$ People

Examiner only

5. Each week in Ysgol Derwen, the headteacher calculates the mean attendance for each class. This is the mean number of half-days per week that students have attended school from Monday to Friday.

There are 5 classes in Year 11.
The headteacher has partially completed a table recording Week 1 attendance for each class in Year 11, as shown below.

Class	Number of pupils	Total number of half-days attended in Week 1	Mean attendance for the 10 half-days in Week 1
11A	28	238	8·5
11B	25	7.4 × 25 = 185	7·4
11C	32	9.5 × 32 = 304	9·5
11D	30	270	9·0
11E	25	6.6 × 25 = 165	6·6
Total	140		

Complete the table.

Hence calculate the overall mean attendance for all of Year 11 in Week 1 at Ysgol Derwen.
You must show all your working. [3]

$$238 + 185 + 304 + 270 + 165$$

$$= \frac{1162}{140}$$

$$= 8.3$$

Overall mean attendance for all of Year 11 is 8.3 half days

Examiner only

6. Last year, Simone's total income before tax was €30 000.

The tax bands, taxable income and tax rates last year were as follows:

Band	Taxable income	Tax rate
Personal Allowance	Up to €4000	0%
Basic rate	€4000 to €10 000	15%
Higher rate	over €10 000	22%

(a) Show that Simone should have paid €900 tax at the basic rate.
You must show all your working. [2]

From Basic rate at 15% Tax Rate

From €4000 to €10 000 ⇒ 10,000 − 4000 = €6,000

15% of €6 000 ⇒ $\frac{15}{100} \times 6000 = 15 \times 60$

= €900

(b) Calculate Simone's **total** tax bill last year.
You must show all your working. [4]

At higher rate ⇒ 22%

Recall that Simon Income tax was €30,000

Such that;

Taxable Income at Higher Rate ≥ €10,000

At last year ⇒ 20,000

22% × 20,000

$\frac{22}{100} \times 20,000 = 22 \times 200 = €4,400$

⇒ €4,400 + €900

Total Tax Due ⇒ €5,300

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Examiner only

7. In May 2018, the population of Wales was approximately 3 150 000.
Of this population, approximately 286 500 people were aged 75 or over.

In May 2018, a survey in Wales found the following:
- 85% of the population of Wales used the internet,
- 99% of people aged 16 to 24 used the internet,
- 40% of people aged 75 or over used the internet.

(a) In May 2018, how many people in Wales **did not** use the internet? [2]

Total Population = 3150 000

100% − 85% = 15% of the population of Wales did not use Internet

⇒ 15% of 3150000 = $\frac{15}{100}$ × 3150000 = 15 × 3150

= 472, 500 People

(b) Of all the internet users in Wales in May 2018, what percentage were aged 75 or over?
Give your answer correct to 2 significant figures.
You must show all your working. [5]

40% of 286500

$\frac{40}{100}$ × 286500

= 40 × 2865

= 114, 600

Population of those who used the Internet

⇒ 85% × 3150 000

⇒ $\frac{85}{100}$ × 3,150,000 = 2677500

⇒ $\frac{114,600}{2677500}$ × 100%

⇒ 4.3%

Examiner only

8. In Cuba, urban gardens are used for food production.

1 acre ≈ 0·00405 km^2

35 000 acres of urban gardens in Cuba produced 3·4 million tonnes of food in 2002.

Calculate the number of tonnes of food produced per km^2 in urban gardens in Cuba in 2002.
You must show all your working. [4]

Given 3.4 million tonnes ;
35000 acres

$\Rightarrow \frac{\text{tonnes}}{\text{Acres}} \Rightarrow \frac{3.4 \text{ million}}{3500}$

$\Rightarrow \frac{3\,400\,000}{3500}$

$\Rightarrow 97.1$

Given 1 acre = 0.00405 km^2

$\Rightarrow 97.1 \div 0.00405$

$\Rightarrow 23975$ tonnes

≈ 24000 tones

Examiner only

9. Formula One cars are some of the fastest racing cars in the world.

The cars' top speeds are up to 375 km/h and their engines are limited to 15 000 rotations per minute.

The Monaco Grand Prix is the shortest Formula One race with 78 laps of the track and a total distance of 260·5 km.

Fernando Alonso won the Monaco Grand Prix in 2007.
He completed the race with an average speed of 155·552 km/h.

(a) Complete the following statement.

'Top speeds of Formula One cars are up to ..... mph.' [2]

1 km/hr → $\frac{5}{8}$ mph

375 km/hr → x

$x = 375 \times \frac{5}{8} = \frac{1875}{8} = 234.375$

(b) Calculate Alonso's average lap time for the 2007 Monaco Grand Prix.
Give your answer in minutes.
You must show all your working. [4]

Given Total distance = 260.5 km

Average speed = 155.552 km/h

No. of Laps = 78

$\Rightarrow$ Time = $\frac{\text{Distance}}{\text{Speed}} = \frac{260.5}{155.552} \approx 1.674$ hours

Convert Time to minutes $\Rightarrow$ 1.674 × 60 mins

= 100.44

Average Lap time = $\frac{100.44}{78} = 1.288$ minutes ~ 1.29

(c) Which number from the list below would correctly complete the following statement?
Circle your answer. [1]

'Formula One engines are limited to ..... rotations **per second**.'

900 000 **(250)** 300 4·17 54 million

15,000 rotation per minute

Convert to rotations per second

$\frac{15000}{60} = 250$ rotation per second

Examiner only

(d) Typical exchange rates in 2018 were as follows.

- £1 = 1.38 US dollars
- £1 = 1.14 euros

In 2018, the average annual cost of running a Formula One race team was 250 million US dollars.

Complete the following statement.

'In 2018, the average **monthly** cost of running a Formula One race team was ..... million euros.'

You must show all your working. [4]

Given £1 = 1.38 US Dollars

£1 = 1.14 Euros

Annual Cost = £250 Million US Dollars

$$\frac{250 \times 1.14}{1.38 \times 12}$$

$$= \frac{285}{16.56}$$

= 17.21 Million Euros

Examiner only

10. Ruth measures the lengths of 5 square pictures.
The measurements she records are as follows.

21 cm 22 cm 23 cm 24 cm 26 cm

Each of these measurements is **correct to the nearest cm**.

She plans to display all 5 pictures in a line, edge to edge, on a shelf of a bookcase.
The length of the shelf is 120 cm, **correct to the nearest 5 cm**.

Show that the shelf could be 1 cm too short to display all 5 of these pictures.
You must show all your working. [4]

Considering the Maximum Possible actual Lengths =>

21 cm => Up to 21.5 cm
22 cm => Up to 22.5 cm
23 cm => Up to 23.5 cm
24 cm => Up to 24.5 cm
26 cm => Up to 26.5 cm

Maximum Total Picture:
21.5 + 22.5 + 23.5 + 24.5 + 26.5
= 118.5 cm

=> Correct to the nearest 5 cm
=> ± 2.5 cm

Max Shelf Length = 120 cm
= 120 − 2.5
= 117.5 cm

Compare => M_P = 118.5 cm is greater than M_S = 117.5 cm

118.5 cm > 117.5 cm = 118.5 cm − 117.5 cm

The shelf would be 1 cm too short

Examiner only

11. *(a)* In March 2014, there were an estimated 6 550 000 000 two pence coins in circulation.

Calculate the value of these 2p coins in **pounds** (£).
Give your answer in standard form.
You must show all your working. [3]

$6\,550\,000\,000 \times 0.02 = 131\,000\,000.$

$= 1.31 \times 10^8$

$= 1.31 \times 10^8$

$1\text{£} \rightarrow 100\text{p}$

$x \rightarrow 2\text{p}$

$\frac{100x}{100} = \frac{2}{100}$

$x = 0.02$

(b) The 2p coin is made from a mixture of metals.
It has a diameter of 25·9 mm and a thickness of 2·03 mm.

The 2p coin can be considered to be a cylinder.
Calculate the volume of metal in a 2p coin. [3]

$V = \pi r^2 h \qquad r = \frac{\text{diameter}}{2}$

$= \pi \times \left(\frac{25.9}{2}\right)^2 \times 2.03$

$= \pi \times 167.7025 \times 2.03$

$= \pi \times 340.436$

$= 340.4\pi$

Examiner only

12. The Leaning Tower of Pisa stands on horizontal ground.
The vertical height of the tower on the higher side is 56·7 m.
The top of the tower is displaced 3·9 m horizontally.

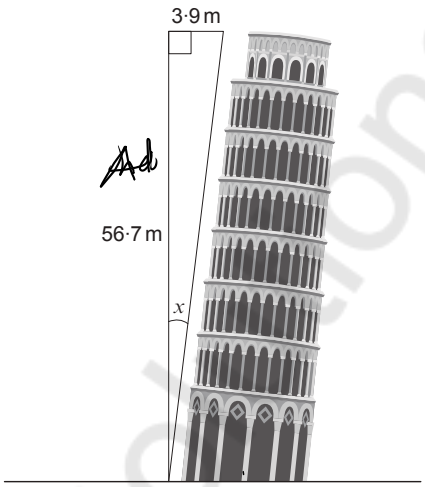


Diagram not drawn to scale

(a) Calculate the angle, x, at which the tower leans.
Give your answer correct to 2 decimal places.
You must show all your working. [4]

Using $\tan x = \frac{\text{Opp}}{\text{Adj}} = \frac{3.9}{56.7}$

$\tan x = 0.06878$

$x = \tan^{-1}(0.06878)$

$x = 3.93^{\circ}$

Examiner only

(b) Ceri plans to make a poster that is mathematically similar to the Leaning Tower of Pisa.

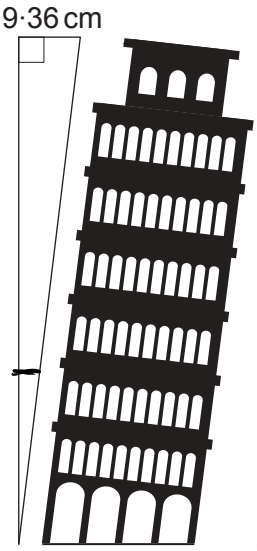


Diagram not drawn to scale

Calculate the height of the poster Ceri plans to make. [2]

Height of poster $= \frac{OPP}{\tan(3.93)}$

$= \frac{9.36}{\tan(3.93)}$

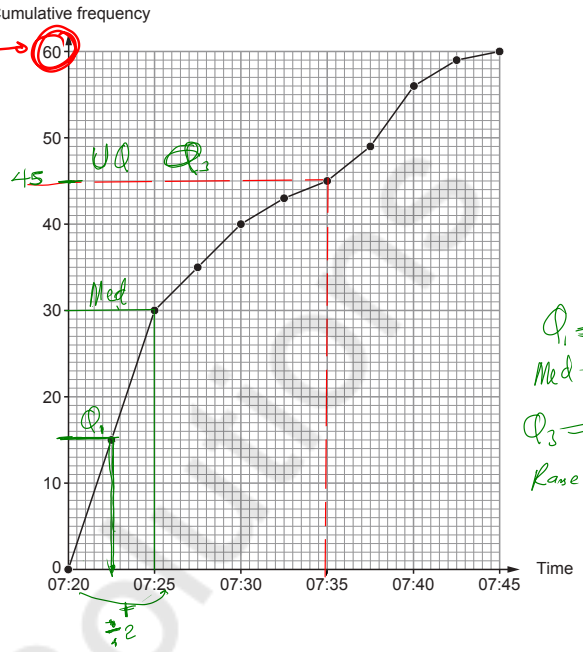
$= 137.3$

$= 137\text{ cm}$

Examiner only

13. On Wednesday, there were no cars in a car park when it opened at 7:00 a.m. From 7:00 a.m., the number of cars entering the car park was recorded.

The cumulative frequency diagram has been drawn from the results.



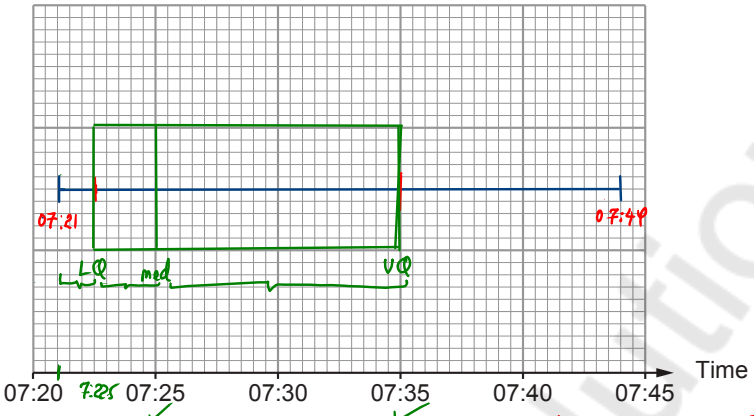
(a) How many cars had entered the car park by 7:35 a.m.? [1]

.....

Examiner only

(b) The first car entered the car park at 7:21 a.m.
The last car entered the car park at 7:44 a.m.

Draw a box-and-whisker plot using this information and the data from the cumulative frequency diagram. [3]



Median $= \frac{\Sigma f}{2} = \frac{60}{2} = 30^{th}$

Q_3 = Upper Quartile $= \frac{3\Sigma f}{4} \Rightarrow \frac{3(60)}{4} = \frac{180}{4} = (45)^{th}$

$Q_1 \Rightarrow$ Lower Quartile $= \frac{1\times\Sigma f}{4} = \frac{1\times 60}{4} = \frac{60}{4} = (15)^{th}$

UQ $\rightarrow Q_3 =$ 07:35, $Q_1 =$ 7:22.5 $\rightarrow$ LQ

Med $=$ 07:25

END OF PAPER

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

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