Surname	Centre Number	Candidate Number
Other Names		0

WJEC CBAC

GCSE LINKED PAIR PILOT

4362/02

APPLICATIONS OF MATHEMATICS

UNIT 2: Financial, Business and Other Applications
HIGHER TIER

A.M. THURSDAY, 19 June 2014

2 hours

4362
020001

ADDITIONAL MATERIALS

A calculator will be required for this paper.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

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.

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.

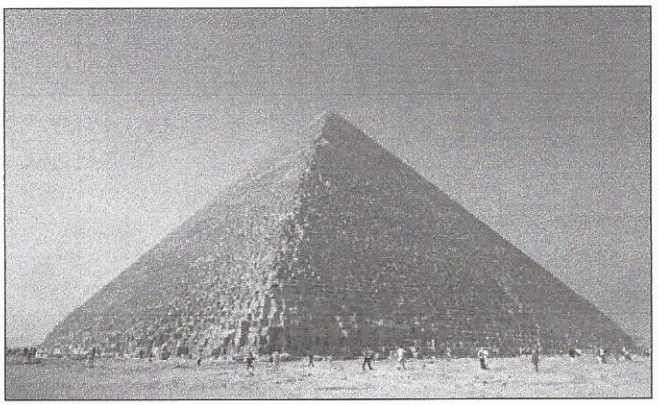
The number of marks is given in brackets at the end of each question or part-question.

You are reminded that assessment will take into account the quality of written communication (including mathematical communication) used in your answer to question **2***(b)*.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**4**	
2.	**11**	
3.	**7**	
4.	**9**	
5.	**8**	
6.	**9**	
7.	**12**	
8.	**4**	
9.	**4**	
10.	**3**	
11.	**11**	
12.	**7**	
13.	**11**	
Total	**100**	

Examiner only

1.



At the time when the pyramids were built, the Egyptians used different measures from those we use today.

It is believed that

1 pyramid inch = 1·0010846752 inches
1 pyramid cubit = 25 pyramid inches.

We also know that

1 inch = 2·54 cm.

Complete the following table. [4]

Measure	Equivalent to
1 pyramid cubit	25.027 inches, correct to 3 decimal places
1 pyramid inch	2.543 cm, correct to 4 significant figures

1 pyramid Cubit = 25×1.0010846752
$= 25.027\,11688$ inches

1 pyramid inch = $\frac{2.54}{1.0010846752} = 2.53724\ldots$
$= 2.543$ cm

Examiner only

2. *(a)* Frankie has a number of chocolate bars that are wrapped in colourful packaging.

Frankie asked herself the question shown above.
A section of the spreadsheet that Frankie created is shown below.

	A	B	C	D	E
1	Name of chocolate bar	Chocolate bar weight (g)	Packaging weight (g)	Total weight (g)	Chocolate bar weight as a percentage of the total weight
2	Chokkie Dream	345	165		67·65
3	Air Bubbly	235	140	375	
4	Dark Bite	200	120	320	62·50

Frankie has written some of the formulae to complete the spreadsheet, but some are missing.
Write down the formulae that are needed to complete the following cells.

(i) **D2** [1]

D2 = B2 + C2

(ii) **E3** [2]

E3 = 100 x B3 / D3

as percentage ← fraction

Examiner only

(b) *You will be assessed on the quality of your written communication in this part of the question.*

The table below shows the carbohydrate content of *Crackly Bars*.

Crackly Bars		
	per 100 g	per bar
Carbohydrate	64·5 g	15·48 g

100g × 3.6 ✗ (How many 100 goes into 360g)

Crackly Bars are sold in 360 g packs.
Calculate how many bars there are in a pack.
You must show all your working. [5]

Total Carbohydrates in 360g Pack = $64.5 \times \left(\frac{360}{100}\right)$ = 232.2 g

How many bars in 232.2g = $\frac{232.2}{15.48}$ = 15

∴ 15 bars per pack

(c) Snack size *Crackly Bars* are made using the same recipe.
Snack size *Crackly Bars* are sold in 85 g packs.

Complete the table for 85 g packs of snack size *Crackly Bars*.
Give your answer **correct to an appropriate degree of accuracy**. [3]

✗ Same number of d.p as others

Crackly Bars		
	per 100 g	per 85 g pack
Carbohydrate	✗ 64·5 g	54.8 g

Bar 100g → Carb 64.5g ÷100 ÷100

∴ Per 85g

⇒ 1g → $\frac{64.5}{100}$ g

$\frac{85 \times 64.5}{100} = 54.8$

× 85 will give 85g Value

2.d.p

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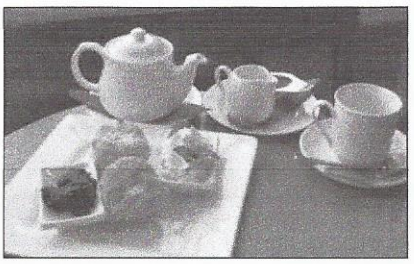
3.

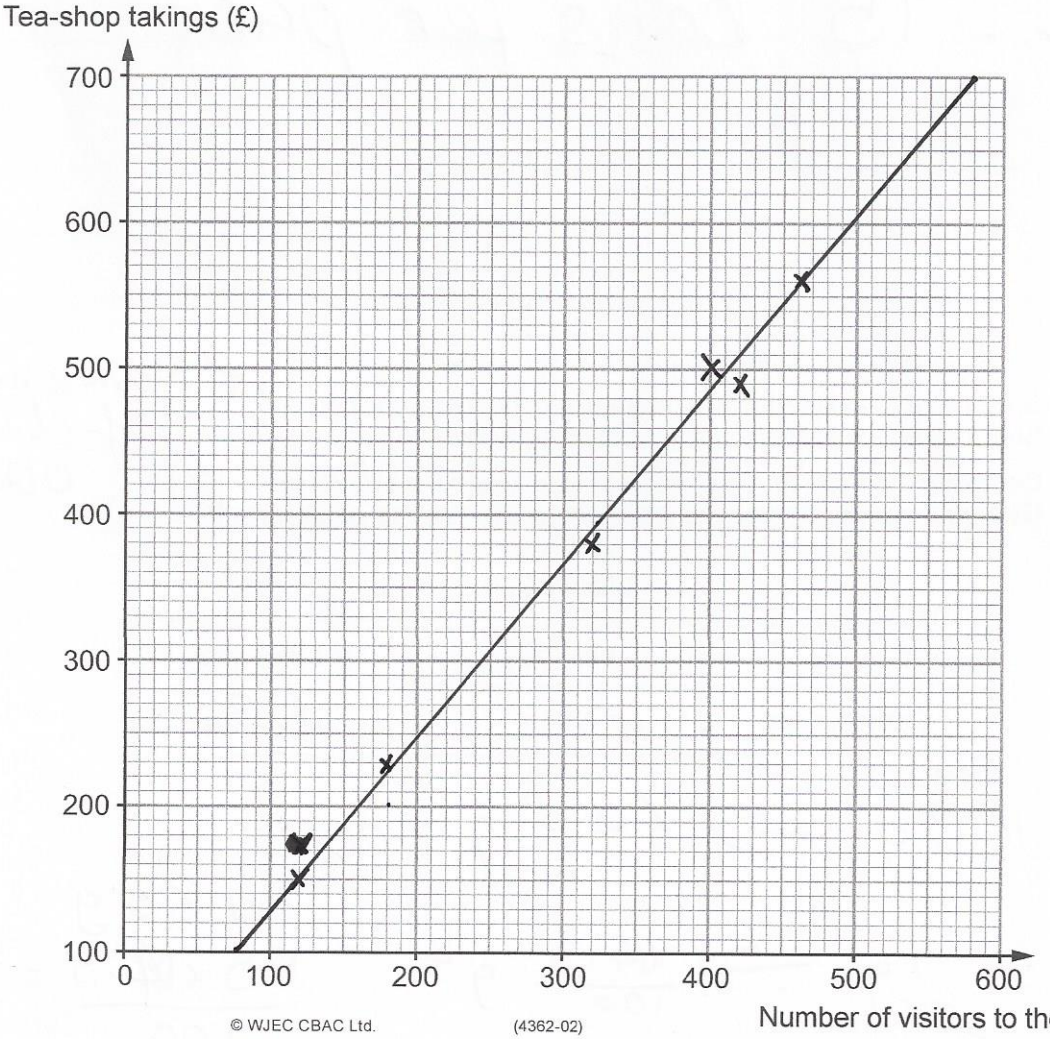


The manager of a tea-shop at a castle kept some records every day for 7 days.
The manager recorded:

- The number of visitors to the castle.
- The total money taken at the tea-shop.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Number of visitors to the castle	120	180	400	320	460	550	420
Tea-shop takings (£)	150	230	500	380	560	660	490

(a) On the graph paper provided, draw a scatter diagram of these results. [2]



Examiner only

(b) Draw, by eye, a line of best fit on your scatter diagram opposite. [1]

(c) Describe the correlation between the number of visitors to the castle and the tea-shop takings. [1]

Positive

(d) The manager of the tea-shop states,

'My records tell me that each visitor to the castle spends more than £1 each at the tea-shop.'

(i) Explain why the manager might have come to this conclusion. [2]

the number of visitors is always less than the tea shop taking.

(ii) The statement is not necessarily true.
Explain why this statement may not be true. [1]

Some visitors may not even visit the tea shop. And many visitors will spend more than £1.

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Examiner only

4.

(a) Selwyn used a stem-and-leaf diagram to record the prices of two makes of suitcases on display in a luggage shop.
Selwyn's stem-and-leaf diagram is shown below.

Subidas		Dinkey
7 1	8	1 5
6	7	2 5
8 7	6	1 6 7
6 3	5	4 4 4
6 2 2 1	4	5

Key: Subidas 3 | 5 means £53
Dinkey 5 | 4 means £54

(i) What is the price and make of the most expensive suitcase? [1]

Price: £ 87

Make: Subidas

(ii) Complete the following table. [4]

85-45 87-41

	Median in £	Range in £	Mode in £
Subidas	56	46	42
Dinkey	66	40	54

Subidas: 87, 81, 76, 68, 67, 56, 53, 46, 42, 42, 41

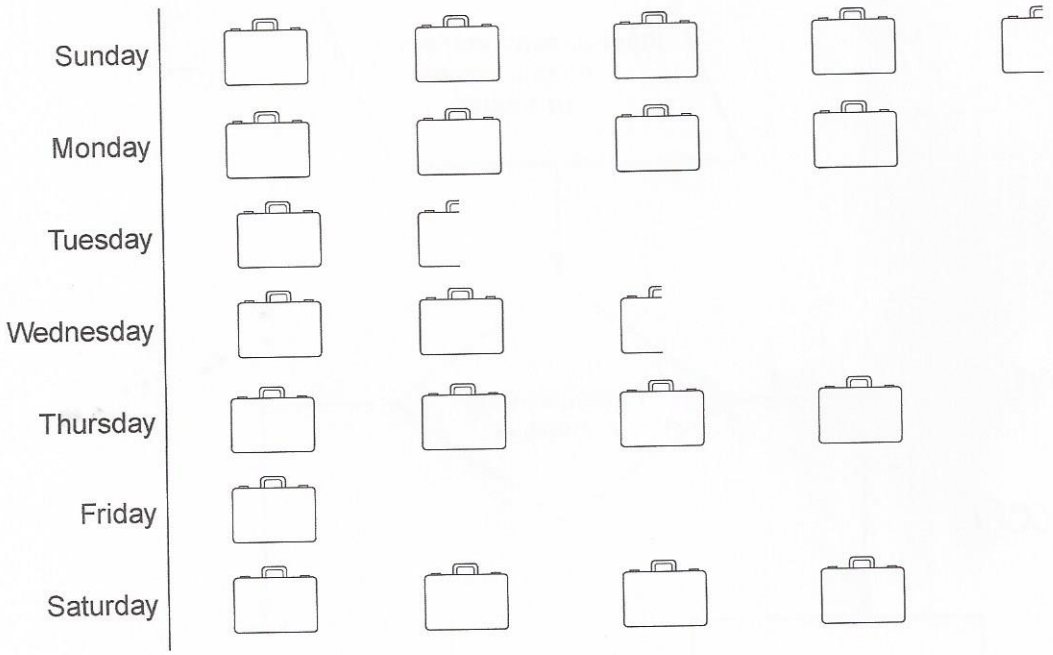
Dinkey: 85, 81, 85, 72, 67, 66, 61, 54, 54, 54, 45

(iii) On average, which make of suitcase is the more expensive?
You must give a reason for your answer. [1]

Dinkey, higher median and mode than Subidas

Examiner only

(b) The luggage shop owner has illustrated, in a pictogram, the number of suitcases sold in a week.



Key:  is 20 suitcases

(i) Selwyn looks at the pictogram and says,

'The number of suitcases sold on Sunday was 40% higher than the number of suitcases sold on Wednesday.'

Is Selwyn correct?
You must show all your working to justify your answer. [2]

Sunday = 20 + 20 + 20 + 20 + 10 = 90

Wednesday = 20 + 20 + 10 = 50

1·8 => 180%. 0·8 => 80%.

$\frac{90}{50}$ = 1·8 more times ∴ 80% higher sales

=> incorrect

(ii) Looking at the pictogram again, Selwyn says,

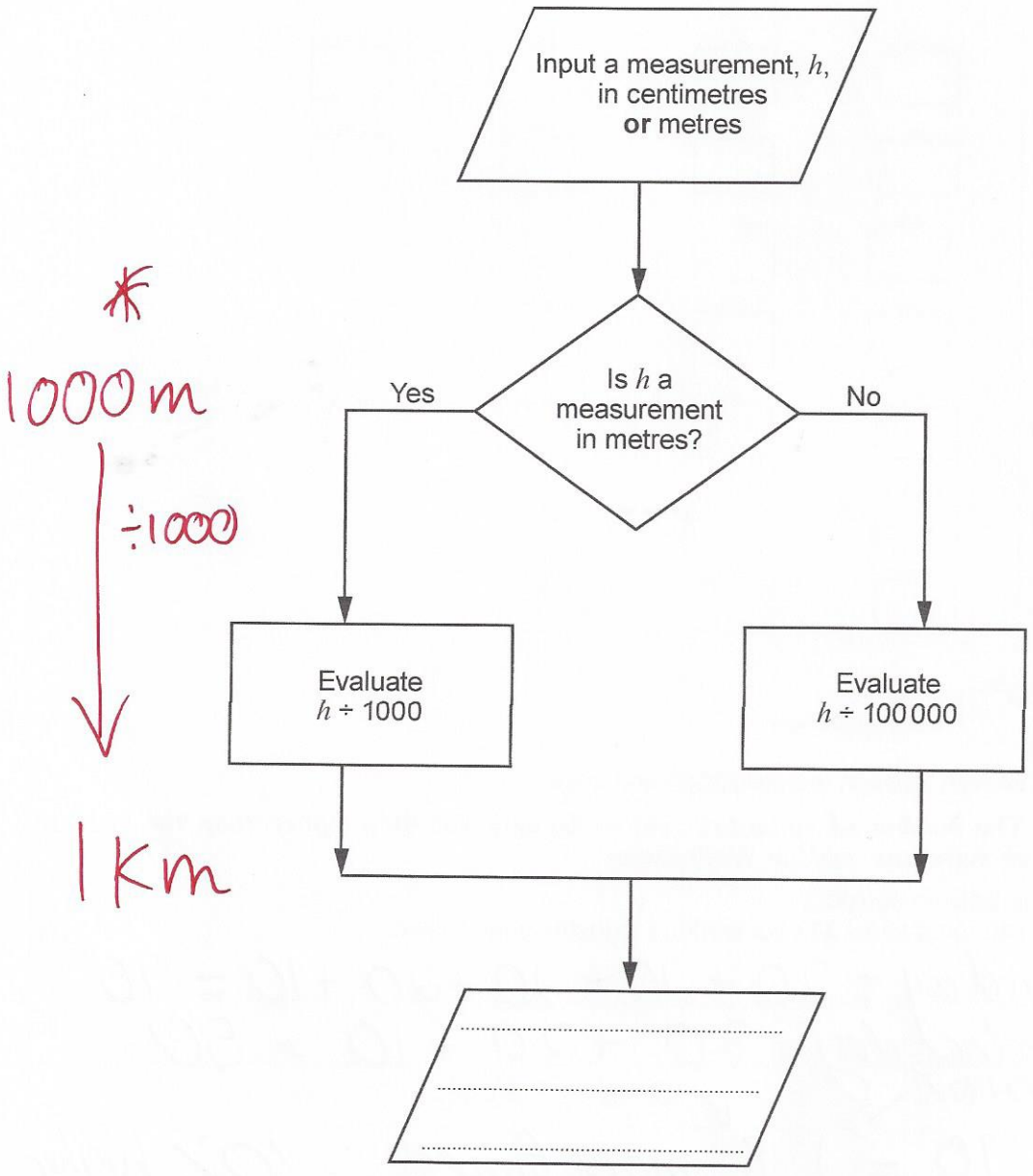
'More money was spent on buying suitcases in this shop on Sunday than on any other day.'

Is Selwyn correct?
You must give a reason for your answer. [1]

Pictogram only displays number of cases sold, not the price of an individual case

Examiner only

5. *(a)* The following is a section of a flowchart.



*
1000 m
÷1000
1 km

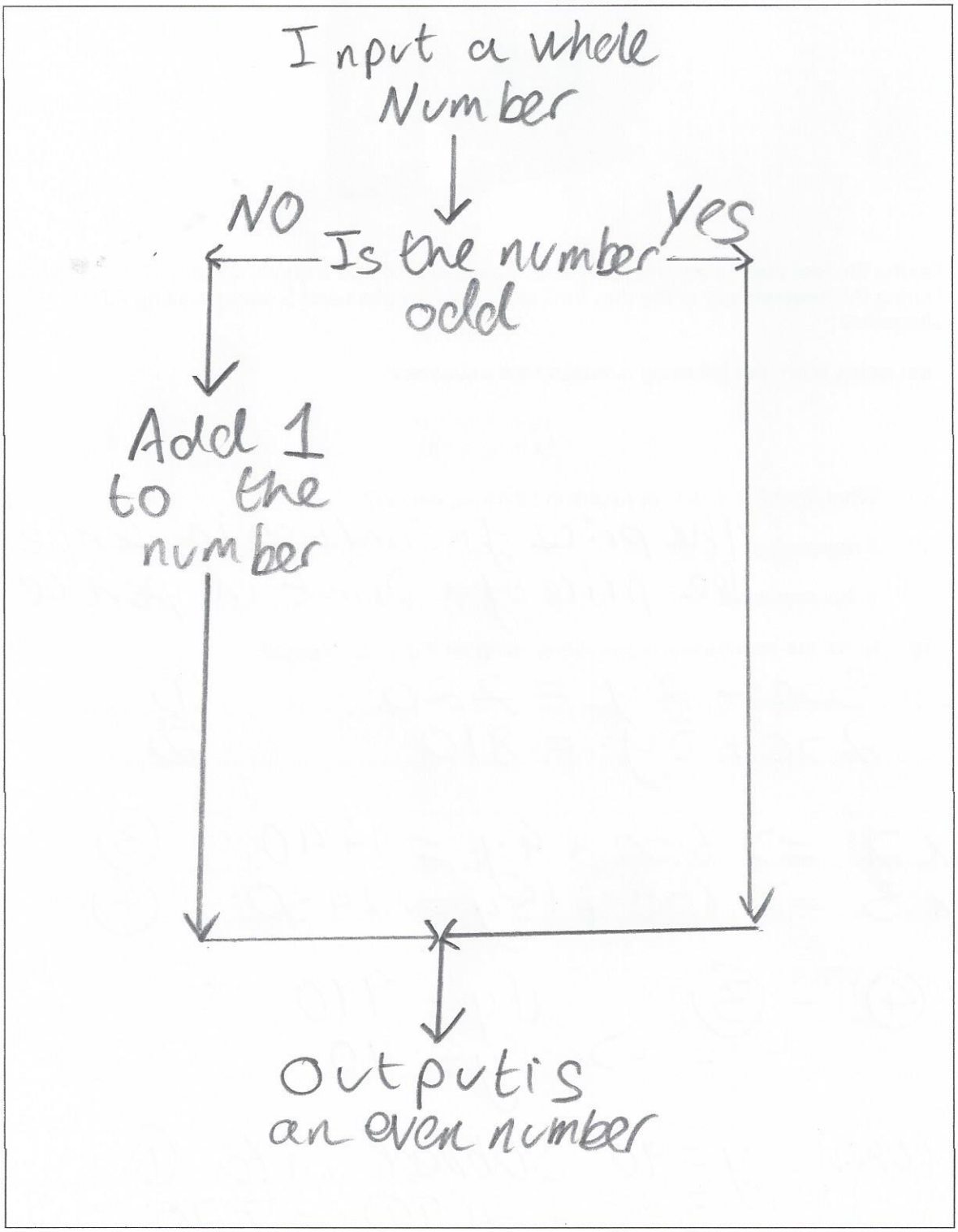
What would this section of the flowchart be used for?
Give an example of what might be written in the output box. [2]

Output is measure in kilometres *

Examiner only

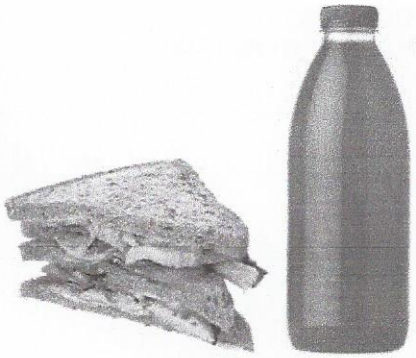
(b) In the box below construct a section of a flowchart that would:

- Allow input of whole numbers
- Add 1 to any odd number
- Not change even numbers
- Allow the output of only even numbers. [6]



Examiner only

6. Levi owns a snack bar.
All the sandwiches are the same price and all the drinks are the same price.



During the first hour of the day, Levi sells 3 sandwiches and 2 drinks costing £7.20 altogether.
During the second hour of the day, Levi sells 2 sandwiches and 5 drinks costing £8.10 altogether.

Levi writes down the following simultaneous equations:

$$3x + 2y = 720$$
$$2x + 5y = 810.$$

(a) What do the x and y represent in Levi's equations? [2]

x represents The price of a Sandwich in pence

y represents The price of a Drink in pence

(b) Solve the simultaneous equations using an algebraic method. [4]

$3x + 2y = 720$ (1)

$2x + 5y = 810$ (2)

(1) x 2 $\Rightarrow 6x + 4y = 1440$ (3)

(2) x 3 $\Rightarrow 6x + 15y = 2430$ (4)

(4) − (3) $11y = 990$

$\Rightarrow y = 90$

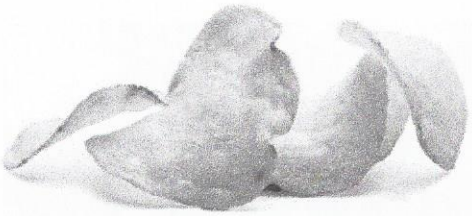
When $y = 90$ subbed into (1)

$3x + 2(90) = 720$

$\Rightarrow x = 180$

Examiner only

(c)



Levi also sells bags of crisps.
He sells a bag of crisps for £1.68.
He makes a profit of 12% on the cost price of a bag of crisps.

He buys the bags of crisps in boxes.
Each box contains 10 bags of crisps.

Calculate the cost price of a **box** of crisps. [3]

$1.68 = 112\%$ ← Same thing

$\Rightarrow x \times 1.12 = 1.68$

$x = \frac{1.68}{1.12} = £1.50$

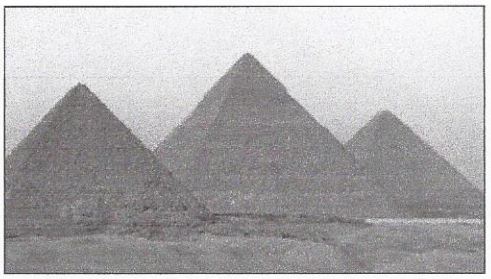
Price of Bag →

$\therefore$ Price of Bag = £1.50

$\Rightarrow$ Price of Box $= 1.50 \times 10 = £15$

Examiner only

7. Thutmose lives in Egypt and has an interest in pyramids.



(a) The Egyptians built right pyramids.
Thutmose visits a pyramid that has a square base measuring 230 metres by 230 metres.
The vertical height of this pyramid is 146 metres.
Thutmose makes his way up from the ground to the top of the pyramid along one of the sloping edges.

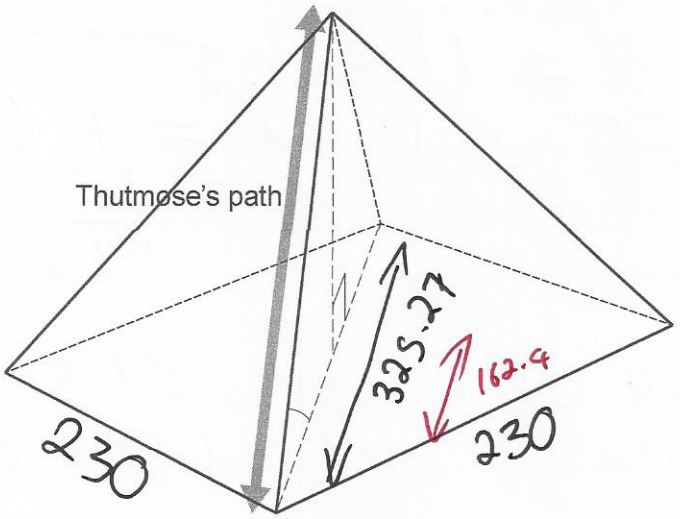


Diagram not drawn to scale

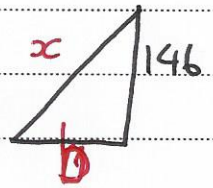
(i) Calculate the length of Thutmose's path along the edge of the pyramid, as shown in the diagram above. [5]

Diagonal length $\Rightarrow H^2 = 230^2 + 230^2$

$\Rightarrow H = \sqrt{105800}$

$\Rightarrow H = 325.27$

$\Rightarrow b = \frac{325.27}{2} = 162.64$



As we want right angled triangle

$x^2 = b^2 + 146^2$

$x^2 = (162.64)^2 + 146^2$

$\Rightarrow x = \sqrt{47767.77} = 218.6$ m

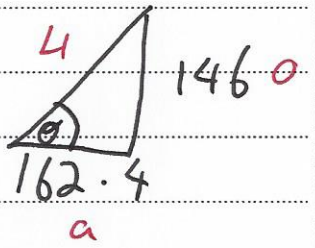
Examiner only

(ii) Calculate the angle of elevation of Thutmose's path with the horizontal ground, as shown in the diagram opposite. [3]

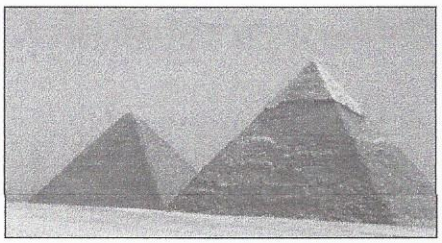
SOH CAH TOA

$\tan\theta = \frac{o}{a} = \frac{146}{162.4}$

$\therefore \theta = 41.96°$



(b) Thutmose noticed that two different pyramids have 2 triangular faces that are **similar** when viewed from a distance.



He used a photograph to sketch the 2 similar triangles, as shown below.

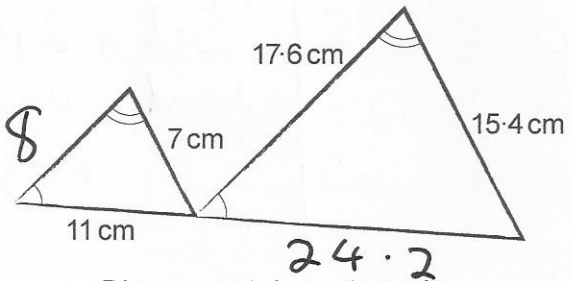


Diagram not drawn to scale

Scale factor

Calculate the missing lengths on the smaller and on the larger triangle. [4]

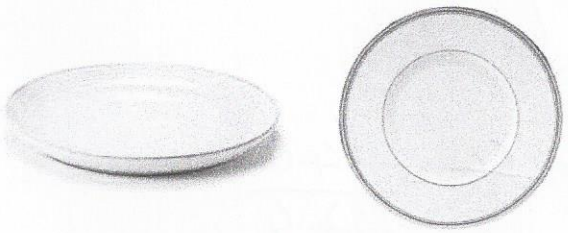
$S.f = \frac{15.4}{7} = 2.2$

$\Rightarrow 11 \times 2.2 = 24.2$ cm

$\frac{17.6}{2.2} = 8$ cm

Examiner only

8. A restaurant needs some new pieces of crockery.
The crockery the restaurant needs are dishes and plates.



The dishes and plates are available to buy in packs.
There are 3 dishes or 2 plates in each pack.
The restaurant cannot afford to buy more than 25 packs altogether.
The restaurant wants to buy at least 60 new pieces of crockery.

The information given can be represented by the inequalities,

$$d + p \leqslant 25$$
$$3d + 2p \geqslant 60$$

where,

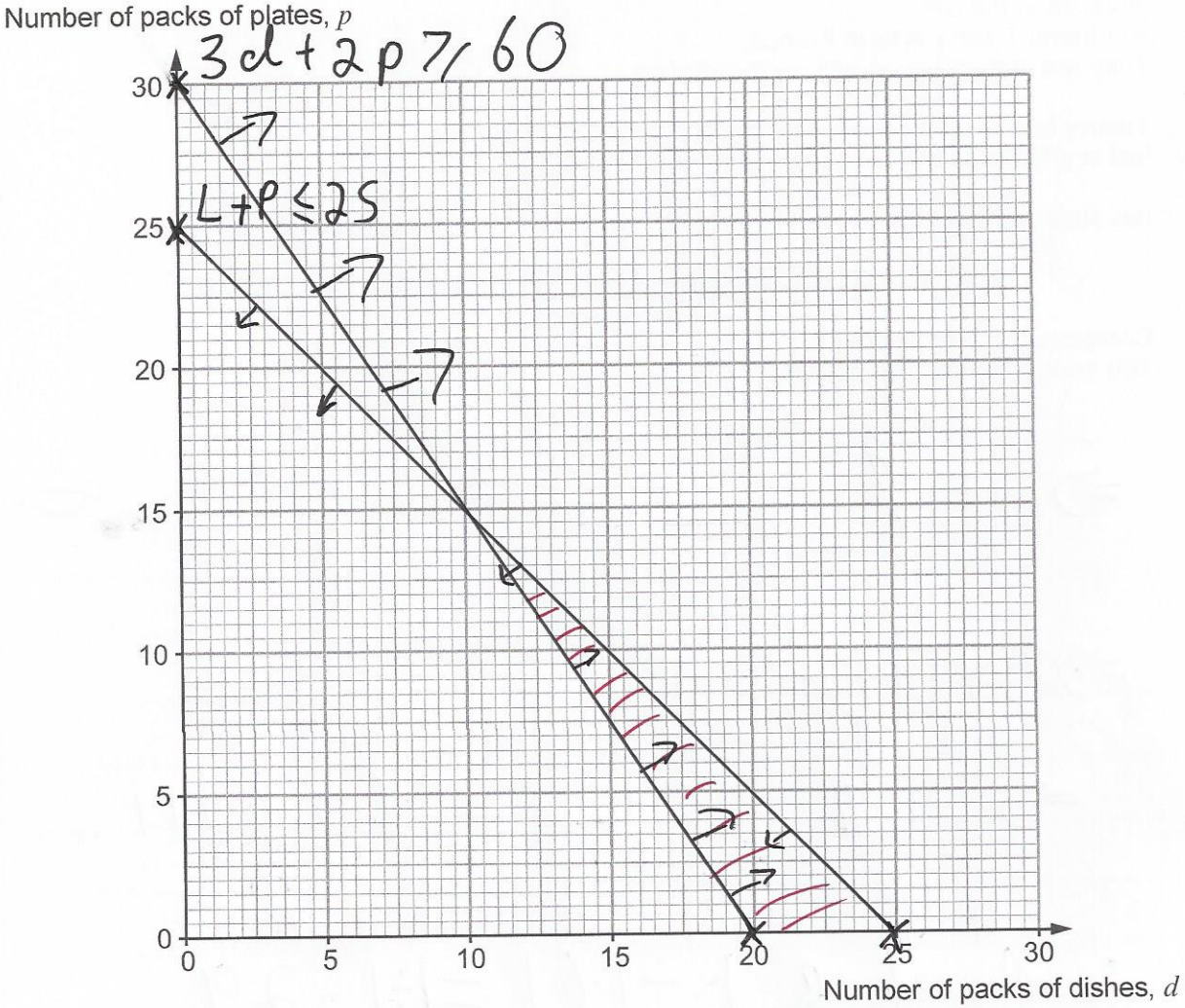
- d represents the number of packs of new dishes bought, and
- p represents the number of packs of new plates bought.

(a) Use the graph paper opposite to find the region that is satisfied by the inequalities. [3]

$d + p = 25$ when $d=0$ $p=25$, $p=0$ $d=25$

$3d + 2p = 60$ when $d=0$ $p=30$, $p=0$ $d=20$

Examiner only



(b) The restaurant decides to order some dishes **and** some plates.
Complete the order form below by selecting a suitable number of packs of dishes and packs of plates for the restaurant to buy. [1]

Crockery	Number of packs to buy
Dishes	20
Plates	4

(Any point in shaded area)

Examiner only

9. Issi lives in the UK.
Her friend Thierry lives in France.
They are both going on holiday to America.

Thierry is offered an exchange rate of 1 euro to 1.29 dollars.
Issi is offered an exchange rate of £1 to 1.61 dollars.

Issi states

'Using these exchange rates, £1 is worth ..... euros.'

Complete Issi's sentence.
You must show all your working. [4]

1€ = 1.29 $

⇒ 1 $ = $\frac{1}{1.29}$ = 0.77519... €

~~⇒ 1.61 $~~

∴ 1 $: 0.77519... €

⇒ 1 $ = $\frac{1}{1.61}$ = £0.6211...

1 $ Pound Euro

∴ Therefore 1 ÷ 1.61 = 1 ÷ 1.29

⇒ £0.6211 = €0.7751...

⇒ £ $\frac{0.6211}{0.6211}$ = € $\frac{0.7751...}{0.6211}$

⇒ £1 = €1.248...

∴ £1 = €1.25

[Hard to explain, basically work out what 1 $ is in each currency and make them equal as 1 $ = 1 $ then rearrange to get £1 ...]

Examiner only

10. An engineering company makes metal parts for engines.
The diagram below shows the design for a split-disc.
The split-disc is drawn as two concentric circles, each with centre *O*.
Both *OAB* and *ODC* are straight lines.

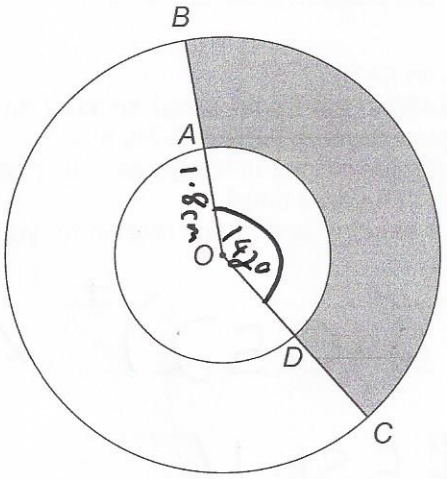


Diagram not drawn to scale

It is known that $A\hat{O}D = 142°$ and $OA = AB = 1{\cdot}8$ cm.
The company needs to know the area of the shaded surface *BCDA*.
Calculate this area. [3]

Area of Seeter $= \frac{\theta}{360} \times \pi r^2$

Area of Small Secter $= \frac{142}{360} \times \pi \times (1{\cdot}8)^2 = 4{\cdot}015 cm^2$

Area of Large Secter $= \frac{142}{360} \times \pi \times (3{\cdot}6)^2 = 16{\cdot}06 cm^2$

$2 \times 1{\cdot}8$

$\therefore$ Area of Shaded $= 16{\cdot}06 - 4{\cdot}015$
$= 12{\cdot}05 cm^2$

Examiner only

11. *(a)*

Account	**AER** Annual Equivalent Rate
Eagle Saver	5·2%

Cledwyn has been given £450.
He decides to invest £450 in the *Eagle Saver* account for 4 years.
The *Eagle Saver* account pays an AER of 5·2% p.a.
Will Cledwyn have sufficient money in his *Eagle Saver* account to be able to buy a television costing £550 in 4 years time?
You must show all your working and give a reason for your answer. [4]

$(1 + 0.052)^4 \times 450$

$= £551.16$

$\therefore$ Yes as $£551.16 > £550$

Examiner only

(b) Cledwyn is also interested in opening a savings account.
Cledwyn has some details of a *Kite Saver* account.

Account	Nominal interest rate	**AER** Annual Equivalent Rate, correct to 2 decimal places
Kite Saver	6·8% p.a. paid quarterly	6.98 %

(i) Write 6·8% as a decimal. [1]

$\frac{6.8}{100} = 0.068$

(ii) Would you expect the AER for the *Kite Saver* account to be greater than, equal to, or less than 6·8%?
Tick (✓) one of the boxes below.
Without doing any calculations, give an explanation for your answer. [1]

Greater than 6·8% ✓ Equal to 6·8% ☐ Less than 6·8% ☐

Interest is accumulated throughout the year (3 months)

(iii) In the table above, complete the AER column, correct to 2 decimal places, for the *Kite Saver* account using the following information.
AER, as a decimal, is calculated using the formula $\left(1+\frac{i}{n}\right)^n - 1$,
where
i is the nominal interest rate per annum **as a decimal** and
n is the number of compounding periods per annum. [4]

$AER \left(1+\frac{0.068}{4}\right)^4 - 1$

$= 6.98\%$.

$n = 4$

$\frac{12}{3} = 4$

(iv) Explain why banks use AER. [1]

Fair comparison of interest rates can be made.

Examiner only

12. *(a)* A substance **loses** $\frac{1}{4}$ of its mass every second.

Its initial mass is 2500 grams.

(i) Use the graph paper below to draw a graph showing the decreasing mass during the first 4 seconds. [3]

T = 0 M = 2500 ← 2500 × $\frac{3}{4}$

T = 1 M = 1875

T = 2 M = 1406·3

T = 3 M = 1055

T = 4 M = 791

(ii) After how many seconds will the mass be 1500 grams? [1]

1·8 seconds

Examiner only

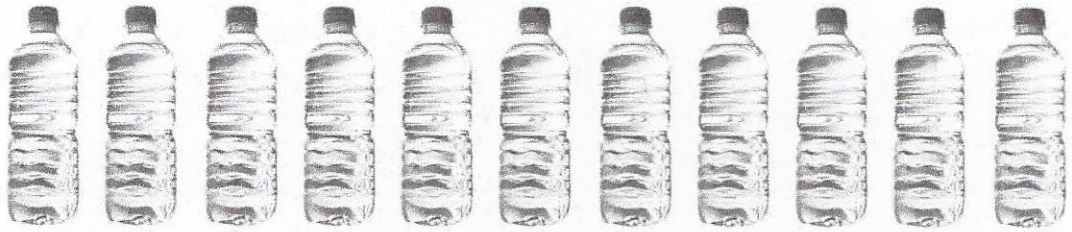
(b) A substance has an initial mass m grams.
It loses a quarter of its mass every second.
Write down a formula for finding the final mass, f grams, of the substance after 5 seconds. [3]

Mass At T $= m \times \left(\frac{3}{4}\right)^5$

$\therefore f = m \times \left(\frac{3}{4}\right)^5$

Examiner only

13. *(a)* The company *Aqua24/7* fills plastic water bottles.



The company fills 3000 one-litre water bottles per hour.
The process is continuous for 12 hours each day.

(i) Calculate the rate of filling water bottles per minute.
State the unit of your answer. [2]

$\frac{3000}{60} = 50$ Litres per minute

(ii) Calculate the number of water bottles filled during one working day.
You must give your answer in standard form. [2]

$50 \times 12 \times 60 = 3.6 \times 10^4$

(b) Aluminium water bottles can be reused more safely than plastic water bottles.
Aqua24/7 decides to make aluminium water bottles.
The design of the aluminium water bottle is based on two parts, attaching a hemisphere onto a cylinder.

Diagram not drawn to scale

The inside diameter of the aluminium water bottle is 8 cm.
It holds 1 litre of water when filled to the top, including filling the hemispherical part.

Examiner only

(i) For the aluminium water bottle, calculate
- the inside height of the cylindrical part, and
- the overall inside height.

[6]

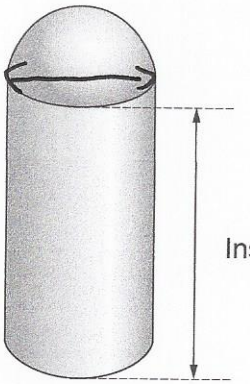


Diagram not drawn to scale

$D = 8\,cm \Rightarrow r = 4\,cm$

$Volume = 1\,Litre = 1000\,cm^3$

$Volume\ of\ cylinder = \pi r^2 h$

$Volume\ of\ hemisphere = \frac{1}{2} \times \frac{4}{3} \pi r^3$

$\therefore 1000 = \pi \times (4)^2 \times h + \frac{2}{3} \pi \times (4)^3$

$\Rightarrow 1000 = 16\pi h + 42.7\pi$

$\Rightarrow h = 17.23$

$Overall\ height = h + r = 17.23 + 4 =$

Inside height of the cylindrical part: 17.23

Overall inside height: 21.2

(ii) In practice, do you think a bottle made with these dimensions will actually hold 1 litre of water?
You must give a reason for your answer.

[1]

Air gap in top of bottle may lead to < 1 Litre of water.

END OF PAPER