Surname	Centre Number	Candidate Number
Other Names		0

GCSE LINKED PAIR PILOT

4362/02

APPLICATIONS OF MATHEMATICS

UNIT 2: Financial, Business and Other Applications
HIGHER TIER

A.M. THURSDAY, 20 June 2013

2 hours

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 **5***(a)*.

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1	5	
2	3	
3	4	
4	5	
5	11	
6	4	
7	4	
8	15	
9	2	
10	7	
11	6	
12	11	
13	2	
14	7	
15	4	
16	10	
TOTAL MARK		

4362 020001

Examiner only

1. A furniture shop keeps a simple spreadsheet to show cost price, selling price and profit for sofas sold.

A section of this spreadsheet, with some entries missing, is shown below.

	A	B	C	D	E	F	G
1	Sofa	Cost price	Selling price	Profit per sofa	Number of sofas sold	Total profit	
2	Brown leather	£780	£999	219 999 - 780	5	1095 219 × 5	
3	Cream cloth	£660	£1108.80	448·80 1108·80 - 660	8	3590·4 1108·80 × 8	
4	Red velour	£500	£1000	£500	10	5000 500 × 10	
5							

(a) Write down a formula that could be used in the spreadsheet, to calculate the entries for the following cells.

D3

D3 = C3 - B3

F3

F3 = E3 x D3

[3]

(b) (i) Complete this section of the spreadsheet by calculating the values of the missing entries in columns **D** and **F**.

[1]

(ii) Write down a formula, for cell **G5**, that could be used to calculate the total profit for the sales of **all** the sofas shown in this spreadsheet.

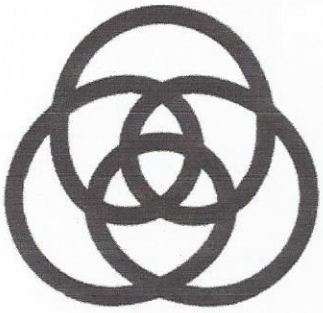
G5 = F2 + F3 + F4

[1]

Turn over.

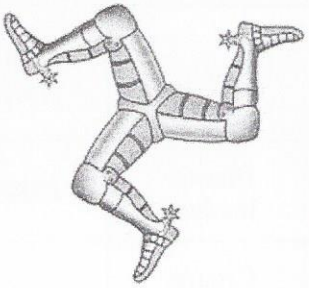
Examiner only

2. A plate manufacturer wishes to design a pattern to be printed on a new circular dinner plate. They consider three possible designs as shown below.



Rings

Petals



Legs

The new design must satisfy the following criteria.

Given that

n = the number of lines of symmetry

r = the order of rotational symmetry

then $n > 2$ and $r - n = 0$

Complete the following table.

Design	n	r	Satisfies the criteria? Yes or No
Rings	3	3	Yes (3-3=0)
Petals	4	4	Yes (4-4=0)
Legs	0	3	NO

.....

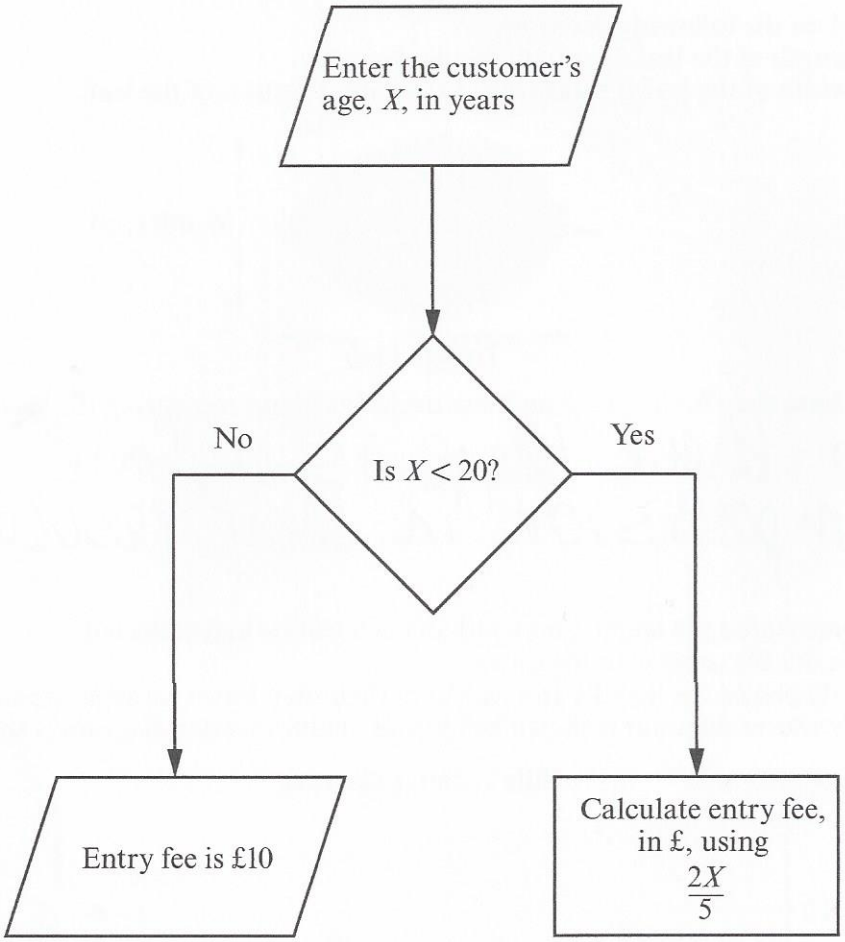
.....

.....

[3]

Examiner only

3. The following section of a flowchart is used to find the entry fee for an Aqua Park.



Use this section of the flowchart to find the Aqua Park entry fee for each of the following customers.

Howard, aged 20

$x = 20 \quad \geq 20 \quad \therefore$ £10

Betty, aged 10

$x = 10 \quad < 20 \quad \therefore \frac{2 \times 10}{5} =$ £4

Charlie, aged 6

$x = 6 \quad < 20 \quad \therefore \frac{2 \times 6}{5} =$ £2·40

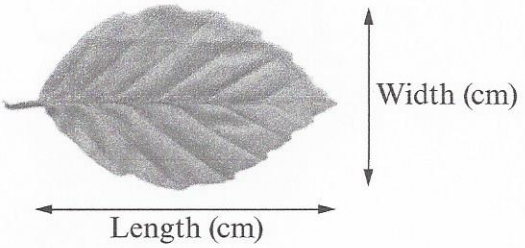
[4]

Examiner only

4. Billy and Shaun both completed a survey.
They collected leaves from a number of trees and decided to measure them.

They agreed on the following decisions.

- The length of the leaf does not include the stem.
- The width of the leaf is measured at the widest section of the leaf.



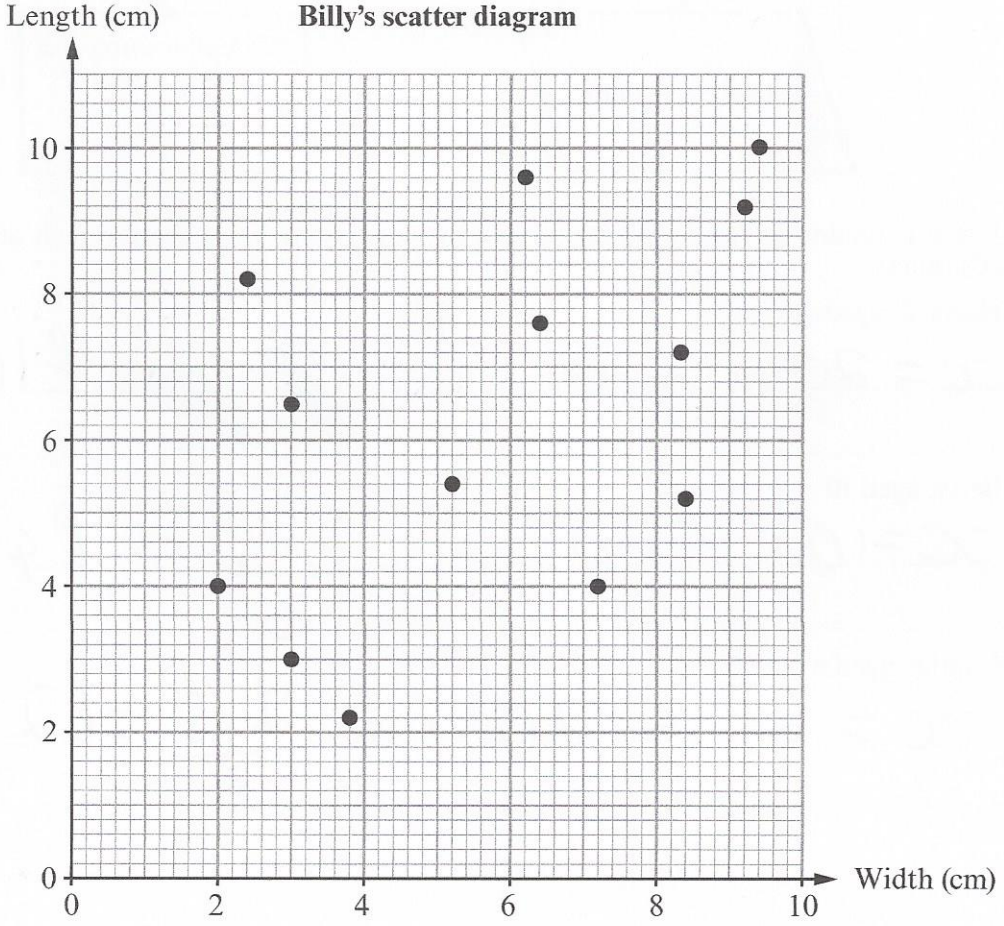
(a) Why have they both agreed on these decisions about measuring the leaves?

So that there is a fair comparision in their results

[1]

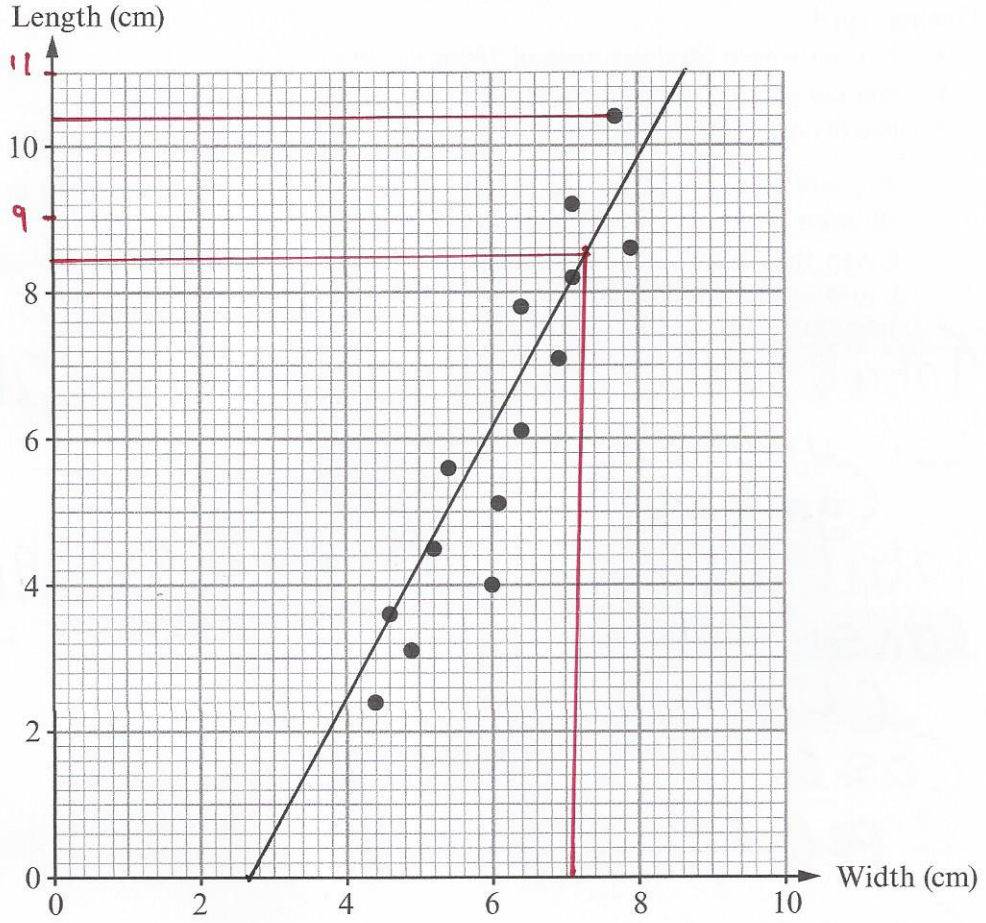
(b) Billy measured the length and width of each leaf he had collected.
Shaun did the same with his leaves.
They displayed the lengths and widths of their own leaves on separate scatter diagrams.
Billy's scatter diagram is shown below and Shaun's scatter diagram is shown opposite.

Billy's scatter diagram



Examiner only

Shaun's scatter diagram



(i) Who found the longest leaf? Shaun

Write down the length of this leaf. 10·4 cm [1]

(ii) One of the two boys collected leaves from a variety of trees.
Who was this, Billy or Shaun? Give a reason for your answer.

Billy, because no correlation (pattern) in his results.

[1]

(iii) Draw, by eye, a line of best fit on Shaun's scatter diagram. [1]

(iv) Shaun realises he has one more leaf that he has not included on his scatter diagram.
The leaf is damaged in such a way that Shaun cannot measure its width.
The leaf is of length 8·5 cm.
Write down a reasonable estimate for the width of this leaf.

Width 6·6 cm

[1]

Examiner only

5. Laura has her own car.

During April

- Laura drove a total distance of 560 miles in her car.
- Her car's fuel consumption was 37·8 mpg (miles per gallon).
- Petrol cost £1.48 per litre.

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

Given that 1 gallon is approximately 4·55 litres, calculate the cost of the petrol that Laura used during April.

You must show all your working.

Total fuel consumption (gallons) $= \frac{560}{37.8} = 14.81$ Gallons

Total fuel consumption (Litres) $= 14.81 \times 4.55 = 67.41$ Litres

Total cost $= 67.41 \times 1.48 = £99.76$ [7]

Examiner only

(b) (i) Laura spent 10 hours 45 minutes driving during April.
Calculate the average speed of Laura's car for the distance driven during April.
Give your answer in miles per hour.

$V = \frac{D}{T} = \frac{560}{10.75} = 52$ mph

0.75 of an hour is 45 mins

[3]

(ii) Select which of the following best describes the roads on which Laura travelled during April.

You must give a reason for your answer.

A: Mainly small narrow country lanes
B: Mainly inner city roads with lots of traffic lights ✗
C: Mainly motorways and dual carriageways ✓
D: Mainly steep mountain routes with many sharp bends
E: Mainly roads with speed limits of 30 mph ✗

Reason:

C, because average speed allows a higher speed such as 60/70 mph that is the limit on Motorways.

[1]

4362 020009

Examiner only

6. *Kingham Inc* is a company that makes cardboard boxes.
One of their boxes, in the shape of a triangular prism, is shown below.

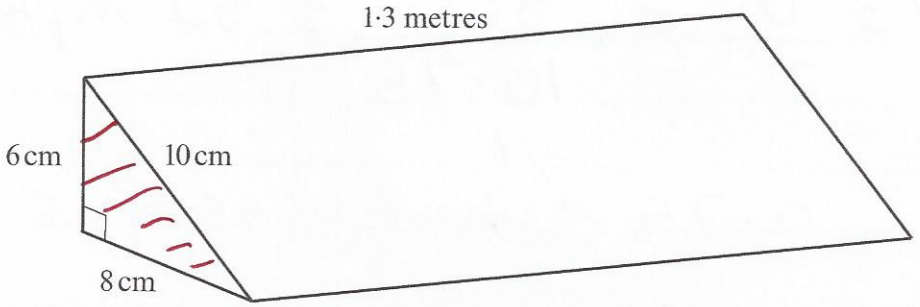


Diagram not drawn to scale

A customer asks if the box has a volume of 3 litres.

(a) Calculate the volume of the box in cm^3.

Area of Triangle

Volume $= \frac{1}{2}(b \times h) \times L$

$= \frac{1}{2}(6 \times 8) \times 130$

$= 3120\ cm^3$

[3]

(b) Is the volume of the box greater or less than 3 litres?
State by how much it is greater or less than 3 litres, giving your answer in cm^3.

Yes, is $120\ cm^3$ greater.

($1000\ cm^3 = 1$ Litre)

[1]

Examiner only

7. *Abbiford Computers* sells computer systems.
Their customers are Internet businesses and town centre shops.
All customers are given access to a helpline when they are setting up a new computer system.
Abbiford Computers carried out a survey to find the number of times each customer called the helpline.
The stem-and-leaf diagram shows the results of the survey.

Internet businesses		Town centre shops
1	4	
	3	
3	2	2 3 5 7
5 3	1	1 4 4 6 8
7 4 3 3 2 2 2	0	7 9

Key: Internet businesses 3 | 2 means 23 calls
Town centre shops 1 | 8 means 18 calls

(a) Complete the following table.

41 - 2

	Median	Range	Mode
Internet businesses	4	39	2
Town centre shops	16	20	14

27 - 7

Internet: 41, 23, 15, 13, 7, 4, 3, 3, 2, 2, 2
town: 27, 25, 23, 22, 18, 16, 14, 14, 11, 9, 7

[3]

(b) The director of *Abbiford Computers* states to the helpline manager,

"41 calls is not good enough. We need to provide better help for the Internet businesses buying computer systems from us."

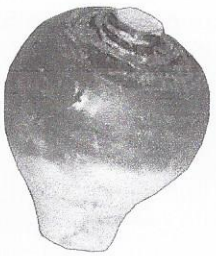
How do you think the helpline manager should respond to the Director's statement?

The town centre shops are in need of more help than the internet business

[1]

Examiner only

8. Two chefs, Osian and Robyn, buy ingredients to make carrot and swede soup.



(a) Osian pays £2.19 in total for his soup ingredients.
He makes 14 portions of soup from his ingredients.
He charges £2.95 for a portion of soup.
There are other costs in making soup, including electricity and rent.
These other costs work out to be 12p per portion of soup made.

Calculate the percentage profit Osian will make if he sells 9 bowls of soup, the other 5 bowls of soup being wasted.

9 + 5 = 14 portions

Cost of 14 portions = (14 × 0·12) + 2·19

= £3·87

Sale of 9 portion = 9 × 2·95

= £26·55

Profit = 26·55 − 3·87 = £22·68

% Profit = $\frac{22·68}{3·87}$ × 100 = 586 %

Profit / Cost

[6]

Examiner only

(b) Robyn sells her soup in cartons.
The height of one carton is 13·4 cm.

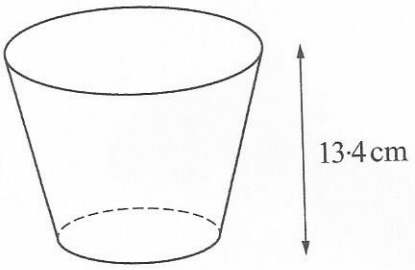


Diagram not drawn to scale

A stack of 4 empty cartons is shown below.

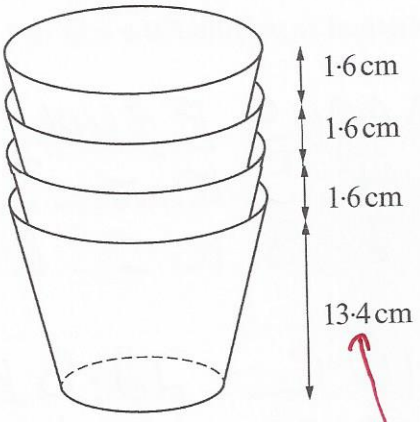


Diagram not drawn to scale

Eliminate

The height of a stack of x cartons is 35·8 cm.
Form an equation and solve it to calculate the number of soup cartons in the stack.

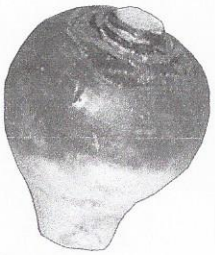
Number of 1·6 cm cups $= \frac{35.8 - 13.4}{1.6} = 14$

$\therefore$ Total number of cups, $x = 14 + 1 = 15$

[3]

Examiner only

(c) Each of the chefs uses their own special soup recipe.
On a different day, they both buy the same variety of carrots and swede from the same market stall.



Probably better to use S for swede.

Osian buys 2 kg of carrots and 4·5 kg of swede.
It costs him £3.69 to buy these ingredients.
Robyn buys 5 kg of carrots and 7·5 kg of swede.
It costs her £6.90 to buy these ingredients.

Let C = Carrot
K = Swede

Use an algebraic method to calculate the cost of 1 kg of carrots and the cost of 1 kg of swede.

Simultaneous Equation

$2C + 4.5K = 3.69$ ①

$5C + 7.5K = 6.90$ ②

① × 5 ⇒ $10C + 22.5K = 18.45$ ③

② × 2 ⇒ $10C + 15K = 13.8$ ④

③ − ④ $\quad 7.5K = 4.65$

$K = £0.62$

Sub $K = 0.62$ into ①

$2C + (4.5 \times 0.62) = 3.69$

$2C = 0.9$

$\Rightarrow C = £0.45$

[6]

∴ Carrot 45p per kg, Swede 62p per kg

Examiner only

9. Mr Read and his daughter Jade each decide to buy a life insurance policy.
They look in a leaflet produced by *Heathbat Life Insurance*.
A section of the leaflet is shown below.

Heathbat Life Insurance

Annual premiums for life insurance policies

Published April 2013

	Life cover £20000			
	Male		Female	
	Non smoker	Smoker	Non smoker	Smoker
Age 20 to 29	£392	£592	£360	£560
Age 30 to 39	£480	£690	£408	£608
Age 40 to 49	£678	£904	£516	£725
Age 50 to 59	£814	£1130	£623	£886
Age 60 to 69	£926	£1330	£825	£1246
Age 70 to 79			£1180	£1560

Medical certificate are required for males and females aged over 55
No policies available for males aged 70 or over

Mr Read and Jade notice there are a number of interesting differences in the annual premiums for the life cover.
Give two possible reasons why there are differences in the annual premiums.

Reason 1:

Premium increases with age as risk of death/illness increases

Reason 2:

Females pay less as have a longer life expectancy.

[2]

Examiner only

10. *(a)* During an experiment, a scientist notices that the number of bacteria halves every second.
There were $2{\cdot}3 \times 10^{30}$ bacteria at the start of the experiment.
Calculate how many bacteria were left after 5 seconds.
Give your answer in standard form correct to two significant figures.

$2 \cdot 3 \times 10^{30} \times (0 \cdot 5)^5 = 7 \cdot 1875 \times 10^{28}$

$\therefore \quad 7 \cdot 2 \times 10^{28}$ (2.S.f)

n ← number of years halves by

0.5

[4]

(b) In a different experiment the number of bacteria is reduced by a quarter each second.
On this occasion the number of bacteria initially was x.
Form an equation to calculate the number of bacteria, r, remaining after t seconds.

$r = x \times (0 \cdot 75)^t$

$1 - \frac{1}{4} = 0 \cdot 75$

reduced by a quarter

[3]

Examiner only

11. A company produces coloured speech bubble stickers.

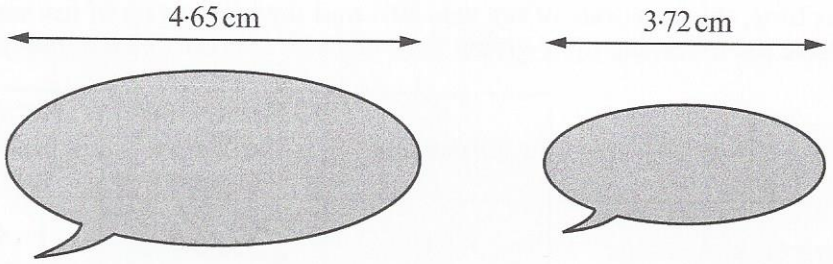


Diagram not drawn to scale

The two coloured speech bubble stickers shown above are similar.

One of the company's printer cartridges contains sufficient ink to produce 24 500 of the larger coloured speech bubble stickers.
A printer cartridge costs £25.
Calculate the cost of buying enough printer cartridges to print 15 million of the smaller coloured speech bubble stickers.

Area Scale Factor Rule

Scale factor = $\frac{4.65}{3.72} = 1.25$
Small → Large

$\therefore$ Area Scale Factor $= 24\,500 \times (1.25)^2$
$= 38281$ stickers

How many cartridges needed.

£25 → 38281 stickers

$\Rightarrow \frac{15,000,000}{38281} = 392$ cartridges

$\Rightarrow 392 \times 25 = £9800$

Total Cost

[6]

Examiner only

12. *(a)* *Morleys Building Society* had an account called *'Morley's Gold Account'* which paid 3·24% Gross.
At that time, the basic rate of tax was 20% and the higher rate of tax was 40%.
Complete the following table giving your answers correct to 2 decimal places.

	Gross rate	Net rate for basic rate taxpayers	Net rate for higher rate taxpayers
Morley's Gold Account	3·24%	2.44 %	1·94 %

Basic $\Rightarrow 1 - 0.2 = 0.8 \therefore 3.24 \times 0.8 = 2.44$
20%. 80%.

Higher $\Rightarrow 1 - 0.4 = 0.6 \therefore 3.24 \times 0.6 = 1.94$
40%. 60%.

[4]

Examiner only

(b) Alex has £25000 to invest in a savings account.
She has picked up a leaflet in *Freads Building Society.*
The information shown below is taken from the leaflet.

Freads Building Society savings account information, updated 04/05/13

	Term	Interest paid	Minimum	Maximum
Oak savings account	2 years	6 monthly	£500	£100000
Sycamore savings account	2 years	12 monthly	£1000	£50000

The building society tells Alex that the *Oak savings account* would pay her 2·3% interest every 6 months, and the *Sycamore savings account* would pay her 4·6% per annum.

(i) Without calculations, which of these savings accounts would have the greater AER?
You must give a reason for your answer.

Oak, has a higher anual interest as after 6 months 2.3% added, then 2.3% added on top after year of already grossed money. [1]

(ii) Alex decides to invest her £25000 for two years.
Calculate the difference between the interest she would receive if she selected to invest in the *Oak savings account* rather than the *Sycamore savings account.*
Show all your working.

Oak: $25,000 \times (1.023)^4 = £27380.57$ (4th number of interest in 2 years)

1 + 2·3%

Sycamore: $25000 \times (1.046)^2 = £27352.90$ (2 times in 2 years)

1 + 4·6%

∴ Difference = 27380·57 − 27352·90
= £27·67

[6]

Examiner only

13. The table below gives the density of 3 metals.

Metal	Density
Platinum	21·4 g/cm^3
Gold	19·3 g/cm^3
Silver	10·5 g/cm^3

Density can also be measured in 'troy ounces/cubic inch'.
The density of gold is 10·13 troy ounces/cubic inch.
Calculate the density of platinum in troy ounces/cubic inch.

10·13 => Gold

$\frac{21·4}{19·3}$ => 1·11 (Platinum is 1·11 times more dense than gold)

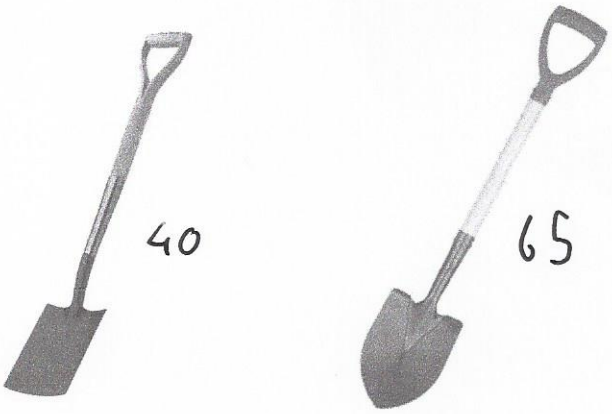
Platinum = 1·11 × 10·13 = 11·23 troy ....

Platinum = 11·23 troy ounces/cubic inch.

[2]

Examiner only

14. A garden centre sells two types of spades.



Rounded-end spades cost £40 each and pointed-end spades cost £65 each.

The garden centre manager says that last weekend fewer than 45 spades were sold and more than £1560 was taken from sales of spades.

Let R represent the number of rounded-end spades sold and let P represent the number of pointed-end spades sold.

(a) Write down two inequalities, in terms of R and P that satisfy the information given by the garden centre manager.

$R + P < 45$

$\Rightarrow 40R + 65P > £1560$

[2]

(b) Use the graph paper opposite to find a region that is satisfied by your inequalities. You must clearly indicate your region.

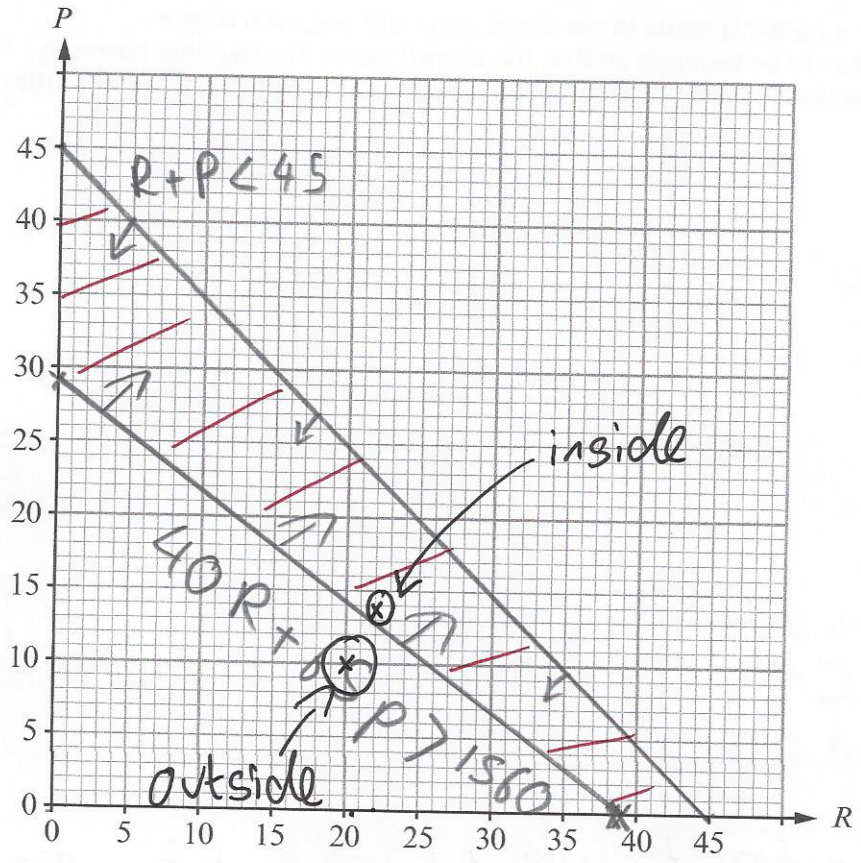
$R + P < 45$ when $R=0$ $P=45$, $P=0$ $R=45$

$40R + 65P > 1560$

when $P=0$ $R = \frac{1560}{40} = 39$

$R=0$ $P = \frac{1560}{65} = 24$

[3]



(c) Here are some statements made by sales assistants about the sales of spades last weekend.

Statement made by Iwan.

"20 rounded-end spades and 10 pointed-end spades were sold"

Statement made by Sid.

"22 rounded-end spades and 14 pointed-end spades were sold"

Use your graph to complete the following table to indicate whether each statement could be true or not.
You **must show on your graph** how you justify your decisions.

Name	Statement	Could be true? Yes or No
Iwan	20 rounded-end spades and 10 pointed-end spades were sold	No, outside region
Sid	22 rounded-end spaces and 14 pointed-end spades were sold	Yes, inside region

[2]

Examiner only

15. A piece for a jigsaw is made in the shape of a right-angled triangle.
The piece has to be accurate so that the overall jigsaw fits together correctly.
The lengths shown on the right-angled triangle are correct to the nearest millimetre.

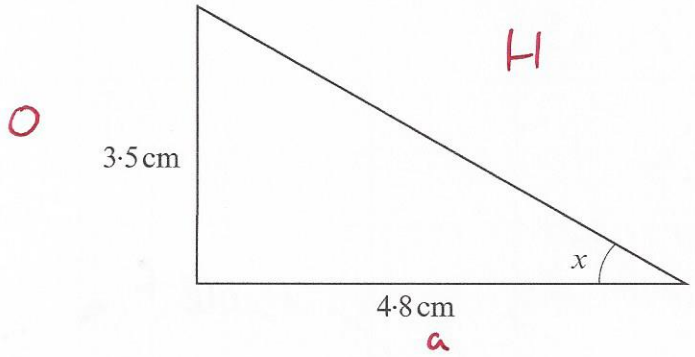


Diagram not drawn to scale

E.g $\frac{10000}{4}$

Calculate the **greatest** and **least** possible values for angle x.

SOH CAH TOA

$\tan x = \frac{O}{A}$

denominator Big numerator Small

Greatest when $O = 3.55$ $A = 4.75$

$\Rightarrow x = \tan^{-1}\left(\frac{3.55}{4.75}\right) = 36.77°$

denominator Small Numerator big

least when $O = 3.45$ $A = 4.85$

$\Rightarrow x = \tan^{-1}\left(\frac{3.45}{4.86}\right) = 35.43°$

Greatest value of x = 36.77 °

Least value of x = 35.43 °

[4]

Examiner only

16. A company makes a solid part for use in an engine.
The solid part is made by connecting a cylinder onto a hemisphere with the same radius.
A thin straight rod holds the solid part vertical when placed in the engine.
This rod is connected to the horizontal plate in the engine and the top rim of the cylinder, as shown in the diagram below.

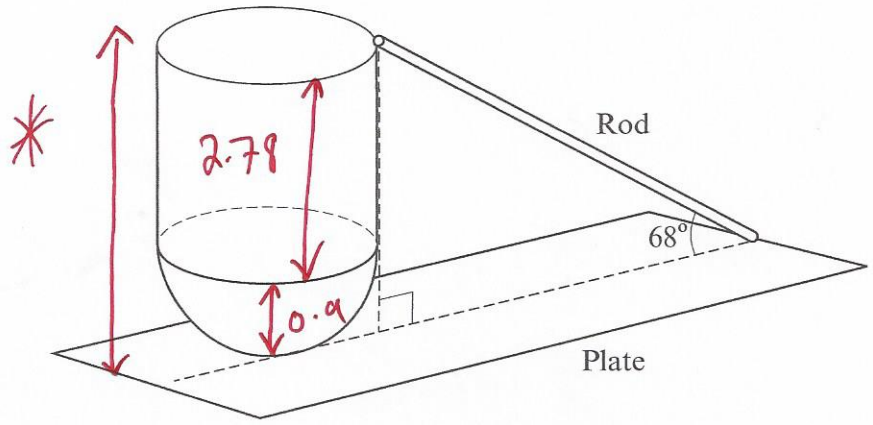


Diagram not drawn to scale

The total volume of the solid part is 8·6 cm^3.
The radius of the hemisphere and cylinder is 0·9 cm.
Calculate the length of the rod.

* ½ Volume of Sphere

Need to figure out height of cylinder

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

$= \frac{1}{2} \times \frac{4}{3} \times \pi \times (0.9)^3$

$= 1.53 \text{ cm}^3$

Volume of cylinder $= 8.6 - 1.53 = 7.07 \text{ cm}^3$

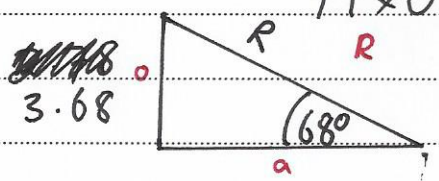
$\Rightarrow 7.07 = \text{Volume of cylinder} = \pi \times 0.9^2 \times h$

$\Rightarrow h = \frac{7.07}{\pi \times 0.9^2} = 2.78 \text{ cm}$

* radius

$\therefore$ Total height $= 2.78 + 0.9$

$= 3.68$



SOH CAH TOA

$\sin 68 = \frac{3.68}{R} \quad \therefore R = 3.97 \text{ cm}$

[10]

END OF PAPER