

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, 21 June 2012

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 3(a).

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

1.

Imperial units: 1 stone = 14 pounds (14lb) 1 pound (1lb) = 16 ounces (16oz)	Metric to Imperial units: 1 kg is approximately 2.2lb
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Use the information given above to answer the following questions.

(a) Jack weighs 122lb. Find how much Jack weighs in stones and pounds.

$$\frac{122}{14} = 8.7 \text{ stone} \quad 0.7 \times 14 = 9.8 \text{ pounds}$$

$$\Rightarrow 10 \text{ pound}$$

(1.d.p)

8 stones 10 pounds

[3]

(b) Wayne weighs 10 stone 4lb. Find how much Wayne weighs in kg.

$$10 \text{ Stone} = 10 \times 14 = 140 \text{ pounds}$$

$$\Rightarrow 10 \text{ stone } 4 \text{ lb} = 140 + 4 = 144 \text{ pound}$$

$$\frac{144}{2.2} = 65.5 \text{ Kg}$$

[4]

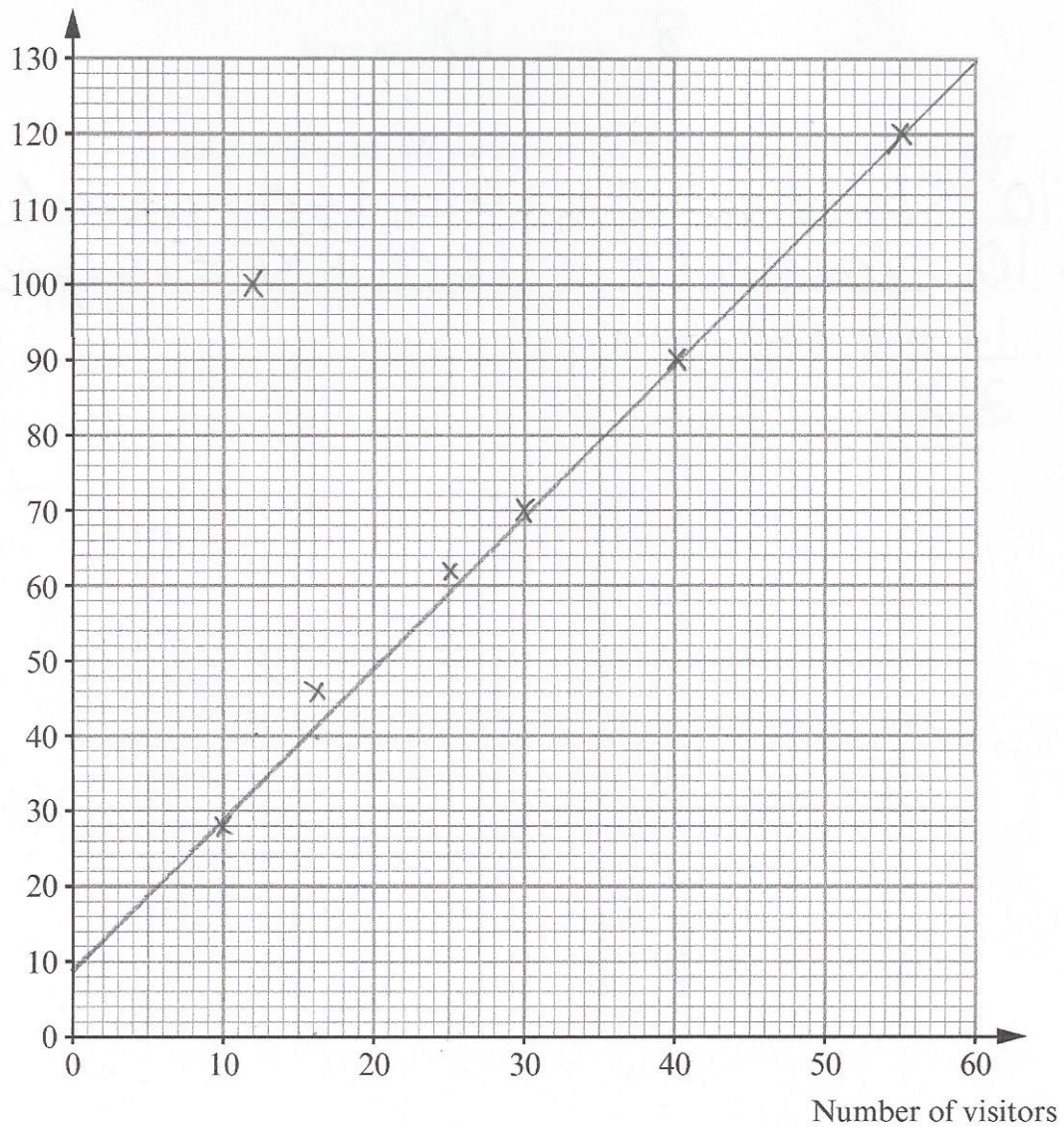
2. The number of visitors to an animal rescue centre and the total donations received were recorded every day for 7 days.
The table below shows the results.

Day	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Number of visitors	40	10	16	30	25	55	12
Total donations, in £s	90	28	46	70	62	120	100

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

[2]

Total donations, in £s



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

(c) Describe the correlation between the number of visitors and the total donations.

Positive

[1]

(d) Which particular day does not fit the correlation?

Sunday

[1]

(e) The animal rescue centre is given a target to raise £100 a day on each of the next 5 days. The manager says this should be possible just by making sure that they advertise and get 50 visitors a day.

The number of visitors on each of the next 5 days were as follows:

62, 55, 51, 52, and 58.

Can the manager be sure of achieving her target of £100 per day in total donations?
You must give a reason for your answer.

No, there is not a definitive relationship between how many visitors and what people donate.

[2]

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

Henry lives in France and is going on holiday to Iceland.

The bank offers him an exchange rate of 1 euro to buy 154.18 Icelandic krona.

Henry wants to exchange 300 euros, but no more than this, into Icelandic krona.

The bank only has 20 krona notes.

Calculate the maximum number of Icelandic krona that Henry can buy and also how much this is going to cost him in euros.

$$\text{Krona} = 300 \times 154.18 = 46254 \text{ Krona}$$

Must be a multiple of 20

$$\Rightarrow 46240 \text{ or } 46260$$

6 Krona ~~change~~ not available

$\therefore 46240$ kronas only 20 krona notes

$$\frac{46240}{154.18} = 299.91 \text{ Euros}$$

[7]

- (b) International exchange rates are published every day.
On a particular day in April 2012, the following information was published.

1 Mexican peso is worth 0.082 Canadian dollars

1 Mexican peso is worth 0.058 euros

Use these same rates of exchange to complete the following statements.

1 Canadian dollar is worth 0.7076 euros

$$1 \text{ MP} = 0.082 \text{ Dollars}$$

$$\Rightarrow 1 \text{ Dollar} = \frac{1}{0.082} \text{ MP} = 12.2 \text{ MP}$$

$$\therefore 1 \text{ Dollar} = 12.2 \times 0.058 \text{ Euro} = 0.7076 \text{ Euro}$$

1 euro is worth 1.413 Canadian dollars

$$1 \text{ D} = 0.7076 \text{ Euro}$$

$$\Rightarrow 1 \text{ Euro} = \frac{1}{0.7076} = 1.413 \text{ dollar}$$

[3]

4.

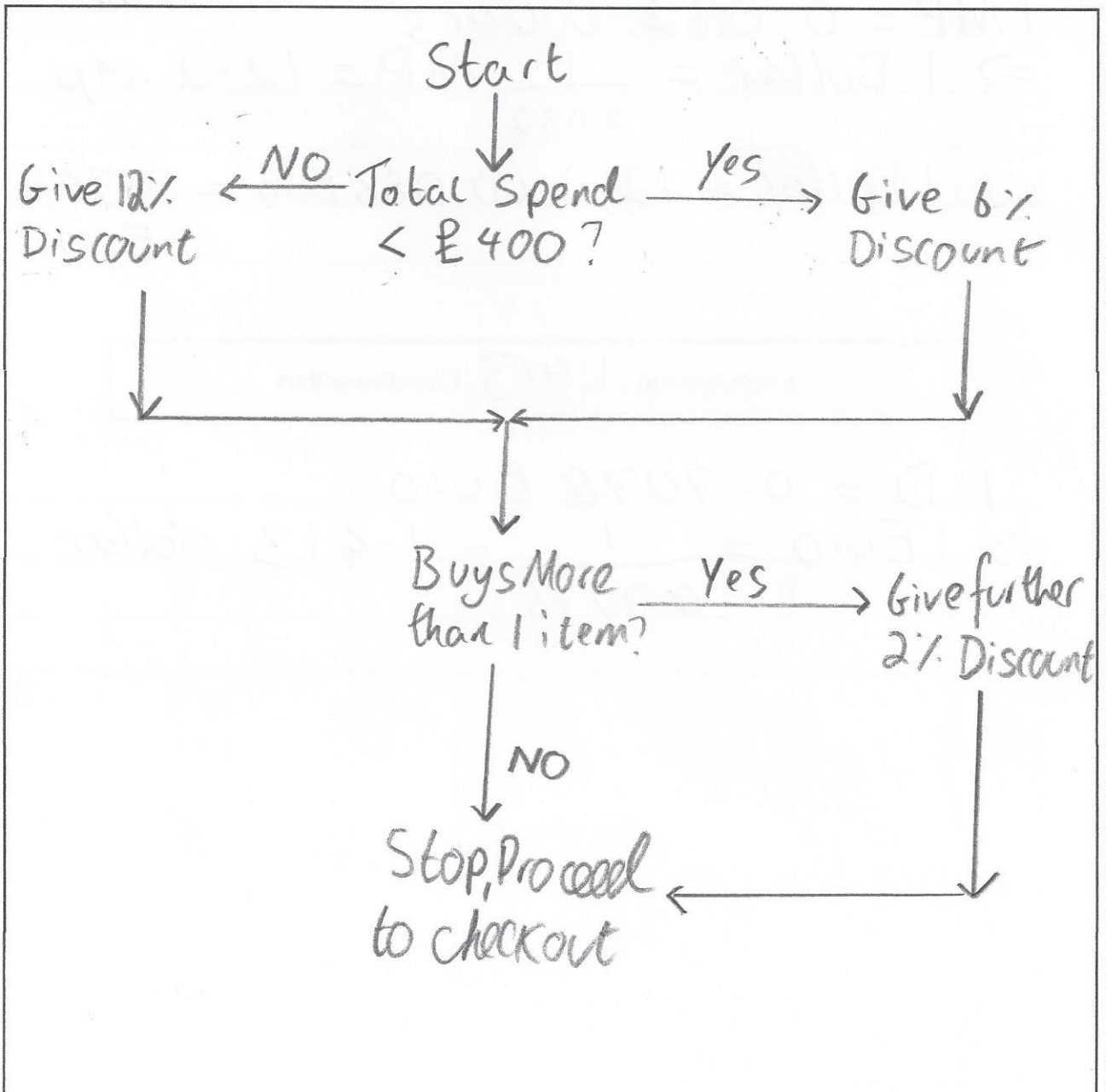
Maple Beech Furniture Store
Fantastic discounts available!
Ask our sales personnel for details

A large furniture store decides to offer various discounts.

Sales personnel are given the following instructions:

- When a customer's total spend is less than £400, then offer a 6% discount.
- When a customer's total spend is £400 or more, then offer a 12% discount.
- After calculating the discount, if a customer is buying more than one item, then offer a **further** 2% discount on the **already discounted price**.

(a) Construct a flowchart to show the most efficient process of giving discounts.



- (b) Calculate how much these customers would pay when buying the following items from Maple Beech Furniture Store.

- (i) Ms Johnson buys a bed for £350.

< £400 \Rightarrow 6% discount ✓

$$\Rightarrow 350 \times (1 - 0.06) = \underline{\underline{£329}}$$

↑
Gives
94%.

6% as a decimal

[3]

- (ii) Mr Grange buys 4 chairs for £160 each, and a table for £450.

$$\text{Total} = (4 \times 160) + 450 = \underline{\underline{£1090}}$$

Spend

> £400 \Rightarrow 12% discount ✓

$$\text{Discount} = 1090 \times (1 - 0.12) = \underline{\underline{£959.2}}$$

\therefore Bought more than 1 item

\Rightarrow further 2%.

$$\Rightarrow 959.2 \times (1 - 0.02) = \underline{\underline{£940.02}}$$

12% as a decimal

2% as a decimal

[6]

5. (a) A survey was carried out to find the mass of each member of a gym who uses a rowing machine. The stem and leaf diagram shows the results of the survey.

Women		Men
	9	0
	8	2 3
3	7	1 4 6 8 8
8 3	6	7 8
7 1 1	5	

Key: Women 3 | 7 means 73 kg
 Men 6 | 7 means 67 kg

- (i) Complete the following table.

	Median in kg	Range in kg	Mode in kg
Women	60	22	51
Men	77	23	78

$$\frac{78+76}{2}$$

$$\frac{63+57}{2}$$

$$73-51$$

$$90-67$$

Women: 73, 68, 63, 57, 51, 51

Men: 90, 83, 82, 78, 78, 76, 74, 71, 68, 67

[3]

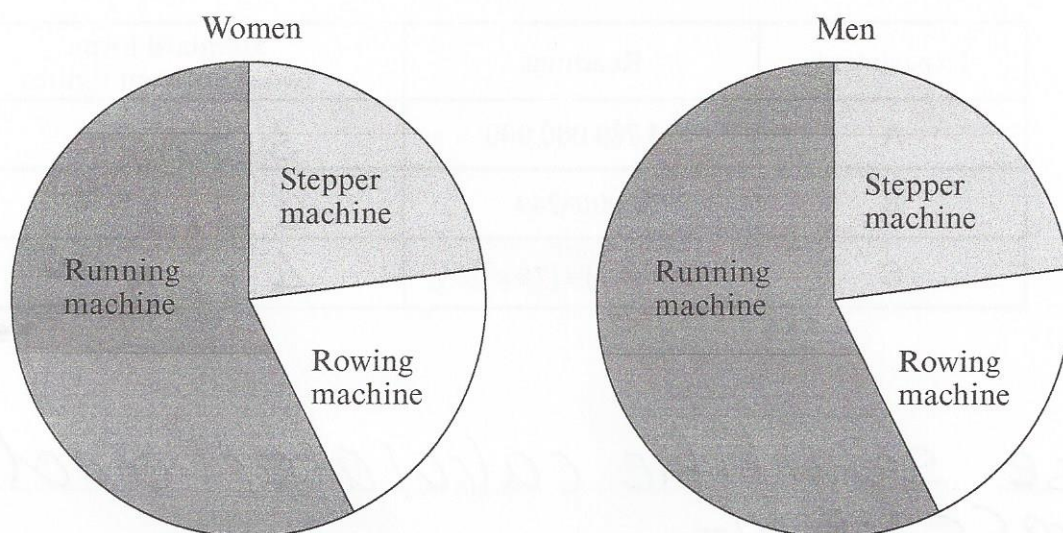
- (ii) Debbie states, "In general the men weigh more than the women".

What statement can be made about the spread of the data?

Greater spread for the men compared to the women.

[1]

- (b) The same men and women were asked, whilst at the gym, how much time they spent on each of three fitness machines, the rowing machine, the stepper machine and the running machine.
The gym instructor produced the following pie charts to display the results of this survey.



Tomas states,

"Men and women at the gym spend the same time on each of the three machines as each other".

Give a reason why Tomas may be wrong.

We cannot derive what time was spent from what was spent.

[1]

6. (a) Michelle works in a research unit.
Michelle is asked to write readings taken from various experiments in standard form, correct to two significant figures, for a science publication.

Complete the table below.

Experiment	Readings	Standard form, two significant figures
A	34 780 000 000	3.5×10^{10}
B	0.0008249	8.2×10^{-4}
C	$(3.2 \times 10^{-5}) \div (7.8 \times 10^8)$	4.1×10^{-14}

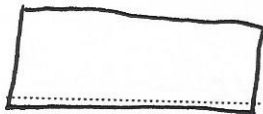
Use scientific calculator and
press ENG.

[5]

- (b) Marc also works in the research unit. He has been asked to complete a table to give lower and upper bounds for calculations that others have made. Complete the table below to give the lower and upper bounds for the perimeter and area of a rectangle.

Show your workings using the lines below the table.

Rectangle			
Length	Width	Perimeter	
10 cm correct to the nearest cm	8 cm correct to the nearest cm	Lower bound	Upper bound
		34 cm	38 cm
Length	Width	Area	
10 cm correct to the nearest cm	8 cm correct to the nearest cm	Lower bound	Upper bound
		71.25 cm ²	89.25 cm ²



10

$$\begin{aligned} \text{Perim Lower} &= 2(7.5) + 2(9.5) \\ &= 34 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Perim Upper} &= 2(10.5) + 2(8.5) \\ &= 38 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Area Upper} &= 10.5 \times 8.5 \\ &= 89.25 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area Lower} &= 9.5 \times 7.5 \\ &= 71.25 \text{ cm}^2 \end{aligned}$$

[5]

7. Gemma is taking part in a sponsored run. The first section of her run is uphill.



- (a) Gemma has set herself a target to meet. In order to meet her target she needs to run the first 1.2 miles uphill section in 9 minutes. Calculate the average speed at which she needs to run in order to meet her target. Give your answer in miles per hour.

$$V = \frac{D}{T} = \frac{1.2}{(9/60)} = 8 \text{ mph}$$

↑ needs to be in hours.

[2]

- (b) The last section of Gemma's run, from the highest point, is 2.6 miles downhill. The vertical drop in height, from the highest point on the route to the finish is h miles. The angle of elevation from the finish to the highest point is 11.2° .

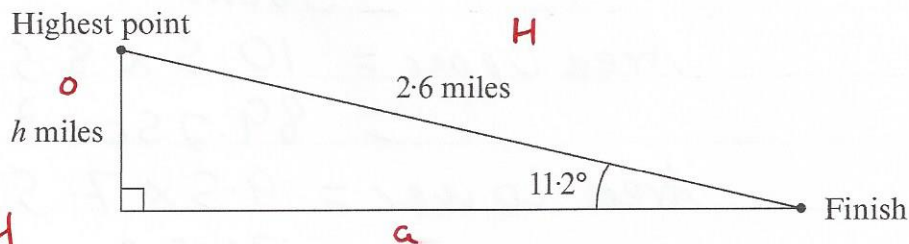


Diagram not drawn to scale

we know θ , H
and want O .

Calculate the vertical drop h .

\sin CAH TOA

$$\sin \theta = \frac{O}{H}$$

$$\Rightarrow \sin(11.2) = \frac{h}{2.6}$$

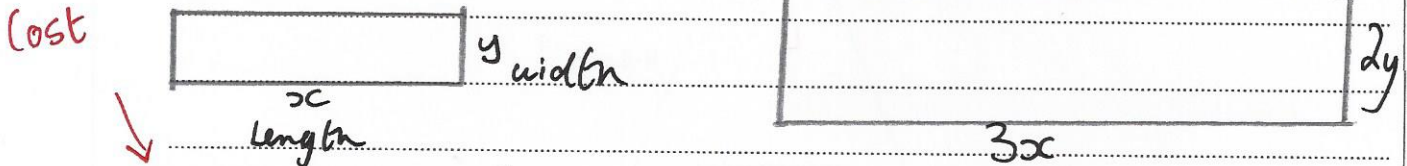
$$\Rightarrow h = \sin(11.2) \times 2.6 = 0.51 \text{ miles}$$

[3]

8. A shop sells thin edging strips to place around rectangular tiles.
The cost of edging a tile on display is £10.
The cost of edging a tile that is three times as long and twice as wide as the tile on display is £27.
Calculate the cost of the edging along each length and along each width of the tile on display.
You must use an algebraic method.

Original

New



$$\Rightarrow \text{Perim} = 2x + 2y \quad \text{Perim} = 6x + 4y$$

$$\begin{aligned} \therefore 2x + 2y &= 10 & \textcircled{1} \\ 6x + 4y &= 27 & \textcircled{2} \end{aligned} \quad \left. \begin{array}{l} \textcircled{1} \\ \textcircled{2} \end{array} \right\} \text{Simultaneous} \\ & & & \text{Eqn.}$$

$\textcircled{2} - 2 \times \textcircled{1}$

$$\begin{aligned} 6x + 4y - 2(2x + 2y) &= 27 - 2(10) \\ 6x + 4y - 4x - 4y &= 27 - 20 \\ 2x &= 7 \end{aligned}$$

To Eliminate
ysub into $\textcircled{1}$

$$\Rightarrow x = \frac{7}{2} = 3.5$$

When $x = 3.5$ in $\textcircled{1} \Rightarrow 2(3.5) + 2y = 10$

$$7 + 2y = 10$$

$$\Rightarrow 2y = 10 - 7$$

$$\therefore x = 3.5 \quad y = 1.5$$

Cost of edging each length £ 3.5

Cost of edging each width £ 1.5

[6]

9. A company that manufactures cones, prints this diagram in their catalogue.

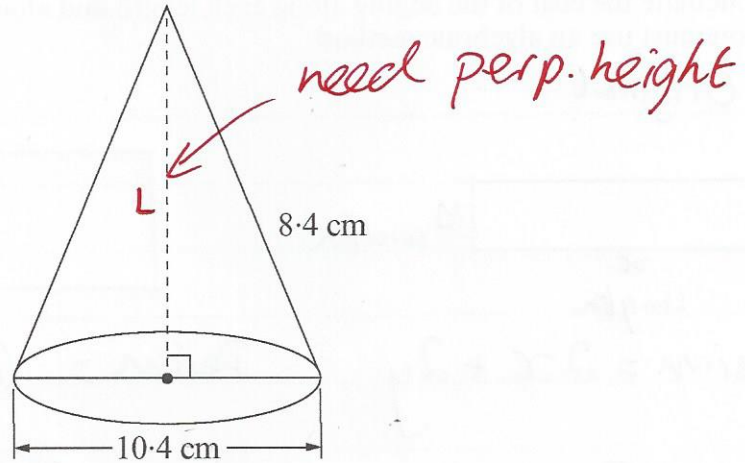


Diagram not drawn to scale

The company receives a request from a customer asking for the volume of the cone. Calculate the volume of the cone shown, which has a diameter of 10.4 cm and a slant height of 8.4 cm.

$$8.4^2 = L^2 + 5.2^2 \quad (\text{use pythag})$$

$$\Rightarrow L^2 = 43.52$$

$$\Rightarrow L = 6.6 \text{ cm}$$

$$\text{Volume of Cone} = \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi \times (5.2)^2 \times 6.6$$

$$= 186.9 \text{ cm}^3$$

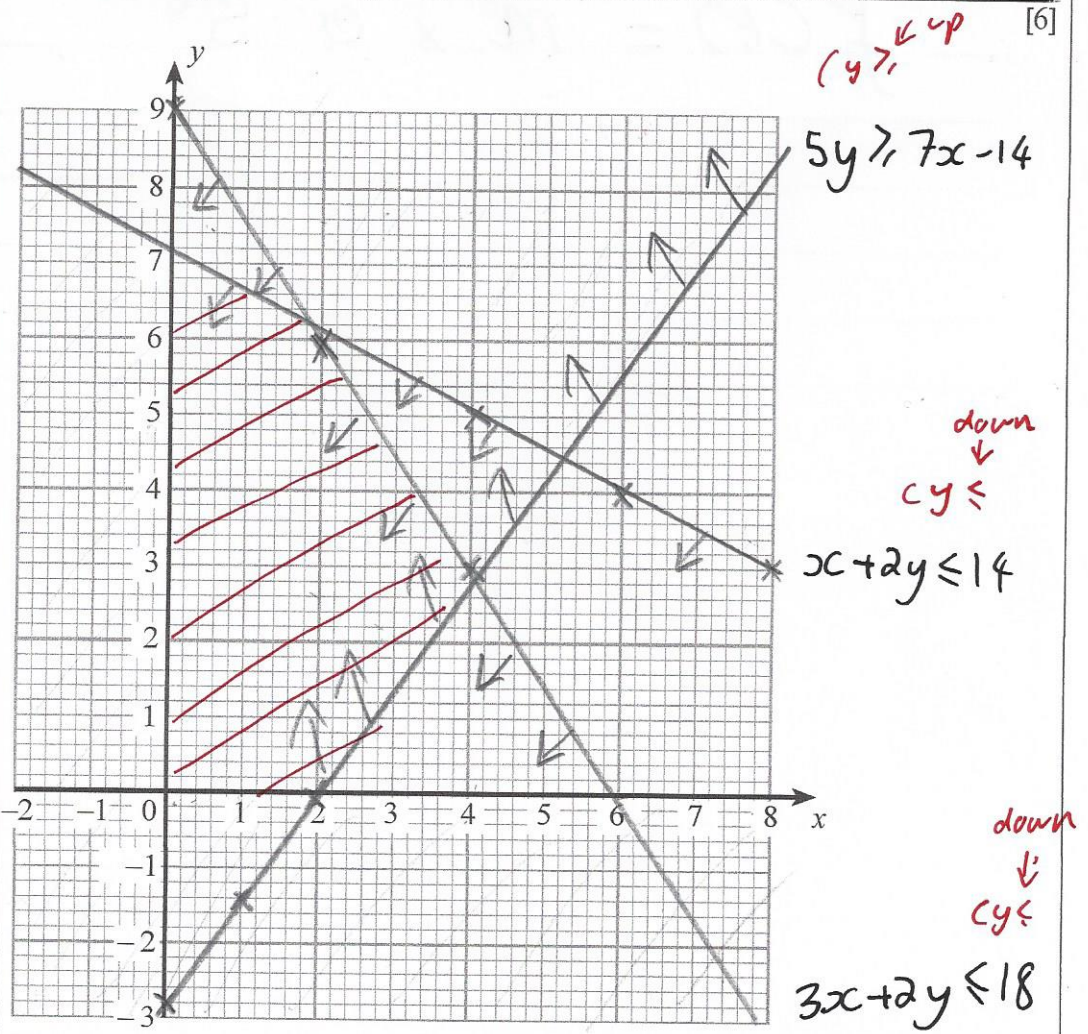
[6]

10. Find the values of x and y that maximise the value of $x + y$, subject to the following constraints.

$$\begin{aligned} x &\geq 0 \\ y &\geq 0 \\ 5y &\geq 7x - 14 \\ x + 2y &\leq 14 \\ 3x + 2y &\leq 18 \end{aligned}$$

$5y \geq 7x - 14$	$x + 2y = 14$	$3x + 2y \leq 18$
$\Rightarrow 5y = 7x - 14$	$\Rightarrow x = 14 - 2y$	$\Rightarrow 3x + 2y = 18$
$\Rightarrow y = \frac{7x - 14}{5}$	when $x = 12$ $y = 1$	$3x = 18 - 2y$
	$x = 14$ $y = 0$	$x = \frac{18 - 2y}{3}$
when $x = 0$ $y = -2.8$	$x = 6$ $y = 4$	$x = 4$ $y = 3$
$x = 1$ $y = -1.4$	$x = 8$ $y = 3$	$x = 2$ $y = 6$
$x = 2$ $y = 0$	$x = 4$ $y = 5$	$x = 0$ $y = 9$

$x + 2y = 14$ ①
 $3x + 2y = 18$ ②
 ② - ①
 $2x = 4$
 $x = 2$
 when $x = 2$ into ①
 $2 + 2y = 14$
 $2y = 12$
 $y = 6$
 \therefore Maximised when $x = 2, y = 6$



11. (a) A particle loses half of its mass every second.
Its initial mass is 100 grams.

- (i) Use the graph paper opposite to show the decreasing mass during the first 8 seconds.

Rough \rightarrow

~~100 \rightarrow 50 \rightarrow 25 \rightarrow 12.5 \rightarrow 6.25 \rightarrow 3.125~~
 ~~\rightarrow 1.5625 \rightarrow 0.78125 \rightarrow 0.39~~

[3]

- (ii) After how many seconds will the mass be 5 grams?

4.3 seconds

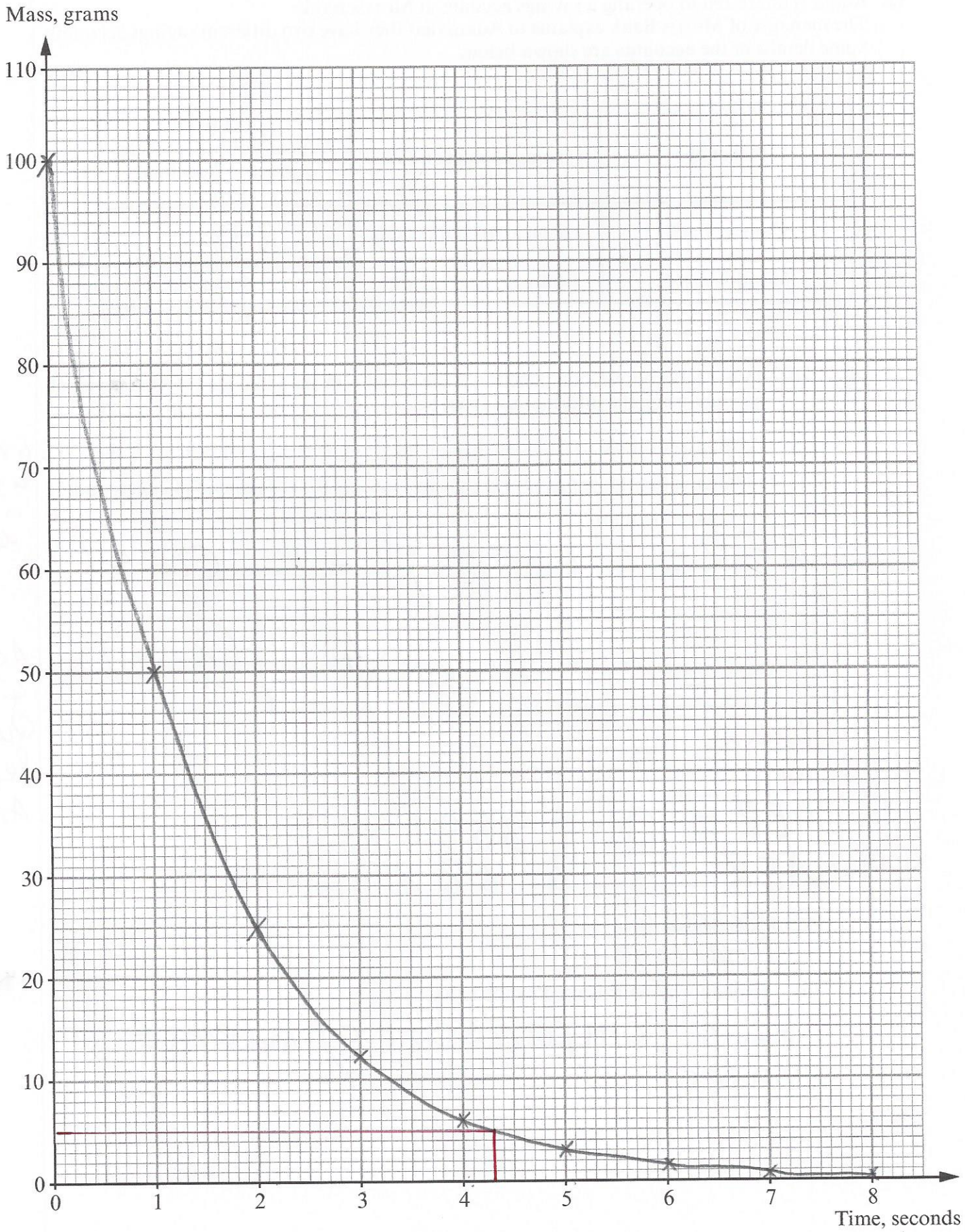
[1]

- (b) A particle has an initial mass m grams.
Its mass halves every second.

Write down a formula for finding the final mass, f grams, of the particle after t seconds.

$$f(t) = m \times 0.5^t$$

[3]



12. Adam is interested in opening a savings account at Morris Bank. The manager of Morris Bank explains to Adam that they have two different savings accounts. Some details of the accounts are shown below.

Account	Nominal interest rate	AER Annual Equivalent Rate, correct to 2 decimal places
Quarter Back	8.6% p.a., paid quarterly	8.88%
Monthly Goal	5.4% p.a., paid monthly	5.54%

- (a) (i) In the table above, complete the AER column in the table for the Quarter Back account using the information given below.

AER, as a decimal, is calculated using the formula $(1 + \frac{i}{n})^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

$$AER = \left(1 + \frac{i}{n}\right)^n - 1 \quad (i = \frac{8.6}{100})$$

$$= \left(1 + \frac{(\frac{8.6}{100})}{4}\right)^4 - 1 \quad (n = 4)$$

$$AER = 0.088813$$

$$\times 100 \rightarrow AER = 8.88\%$$

as decimal
Percentage

[5]

- (ii) Explain why AER is used by the bank.

Fair comparison of interest rates

[1]

- (b) Adam decides to invest £350 in the Monthly Goal account for 3 years.
The account pays an AER rate of 5.54% p.a.
Will Adam have sufficient money in his Monthly Goal account to buy a motor scooter for £410 in 3 years time?
You must show all your working and give a reason for your answer.

$$5.54\% \Rightarrow \frac{5.54}{100} = 0.0554 \text{ (decimal)}$$

Interest on 1st year 100

$$\begin{aligned} \therefore 0.0554 \times 350 &= \text{£}19.39 \text{ per year} \\ 1^{\text{st}} \text{ year Total} &= 350 + 19.39 = \text{£}369.39 \\ 2^{\text{nd}} \text{ year interest} &= 369.39 \times 0.0554 = \text{£}20.464 \\ \Rightarrow 2^{\text{nd}} \text{ year Total} &= 369.39 + 20.464 = \text{£}389.854 \\ 3^{\text{rd}} \text{ year interest} &= 389.854 \times 0.0554 = \text{£}21.5979 \\ \Rightarrow 3^{\text{rd}} \text{ year Total} &= 389.854 + 21.5979 = \text{£}411.45 \\ \therefore &\text{ yes he has more than £410} \end{aligned}$$

[4]

$$\left[\text{Or } (1 + 0.0554)^3 \times 350 \right]$$

↑
(105.54% for 3 years)

13. The diagram shows a circular flower bed, which is split into two sectors, one for spring flowers and the other for roses.
The centre of the circle is O and the area of the minor sector is 31.3 m^2 .

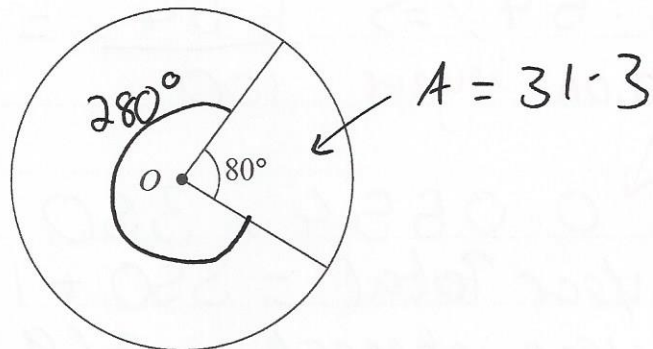


Diagram not drawn to scale

- (a) Calculate the radius of the flower bed.

$$A = \frac{\theta}{360} \times \pi r^2 \quad \checkmark \text{ learn}$$

$$\Rightarrow \sqrt{\frac{A \times 360}{\theta \pi}} = r$$

$$\Rightarrow r = \sqrt{\frac{31.3 \times 360}{80 \times \pi}} = 6.69$$

[3]

- (b) Calculate the perimeter of the major sector of the flower bed.

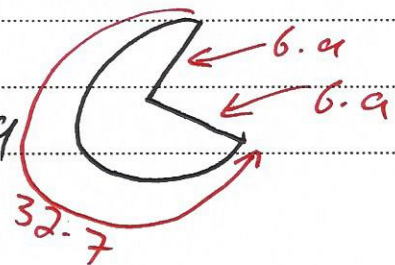
$$\text{Perim} = \frac{\theta}{360} \times 2\pi r \quad \checkmark \text{ learn}$$

$$= \frac{280}{360} \times 2 \times \pi \times 6.69 \quad \checkmark \text{ As Major.}$$

$$= 32.7 \text{ m}$$

$$\therefore \text{Total Perim} = 32.7 + 6.9 + 6.9$$

$$= 46.5 \text{ m}$$



[3]