**WJEC CBAC**

**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** | | |

**Formula List**

**Area of trapezium** = $\frac{1}{2}(a + b)h$
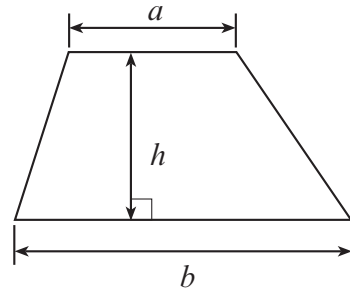
**Volume of prism** = area of cross-section × length
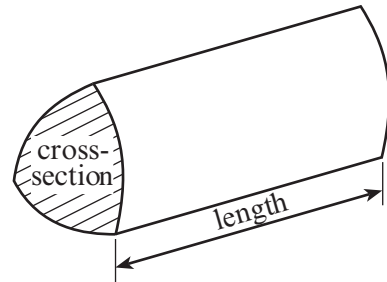
**Volume of sphere** = $\frac{4}{3}\pi r^3$

**Surface area of sphere** = $4\pi r^2$
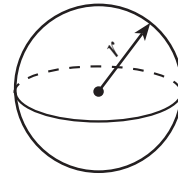
**Volume of cone** = $\frac{1}{3}\pi r^2 h$

**Curved surface area of cone** = $\pi r l$
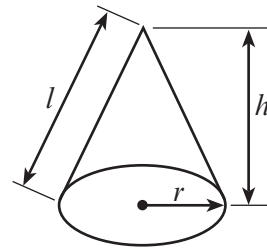
**In any triangle** $ABC$

    **Sine rule** $\quad \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

    **Cosine rule** $\quad a^2 = b^2 + c^2 - 2bc \cos A$

    **Area of triangle** = $\frac{1}{2}ab \sin C$
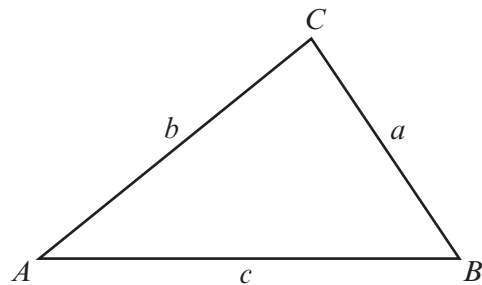
**The Quadratic Equation**

The solutions of $ax^2 + bx + c = 0$

where $a \neq 0$ are given by

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$$

**1.**

| Imperial units:<br>1 stone = 14 pounds (14 lb)<br>1 pound (1 lb) = 16 ounces (16 oz) | Metric to Imperial units:<br><br>1 kg is approximately 2.2 lb |
|---|---|

Use the information given above to answer the following questions.

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

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.................... stones .................... pounds

[3]

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

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[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
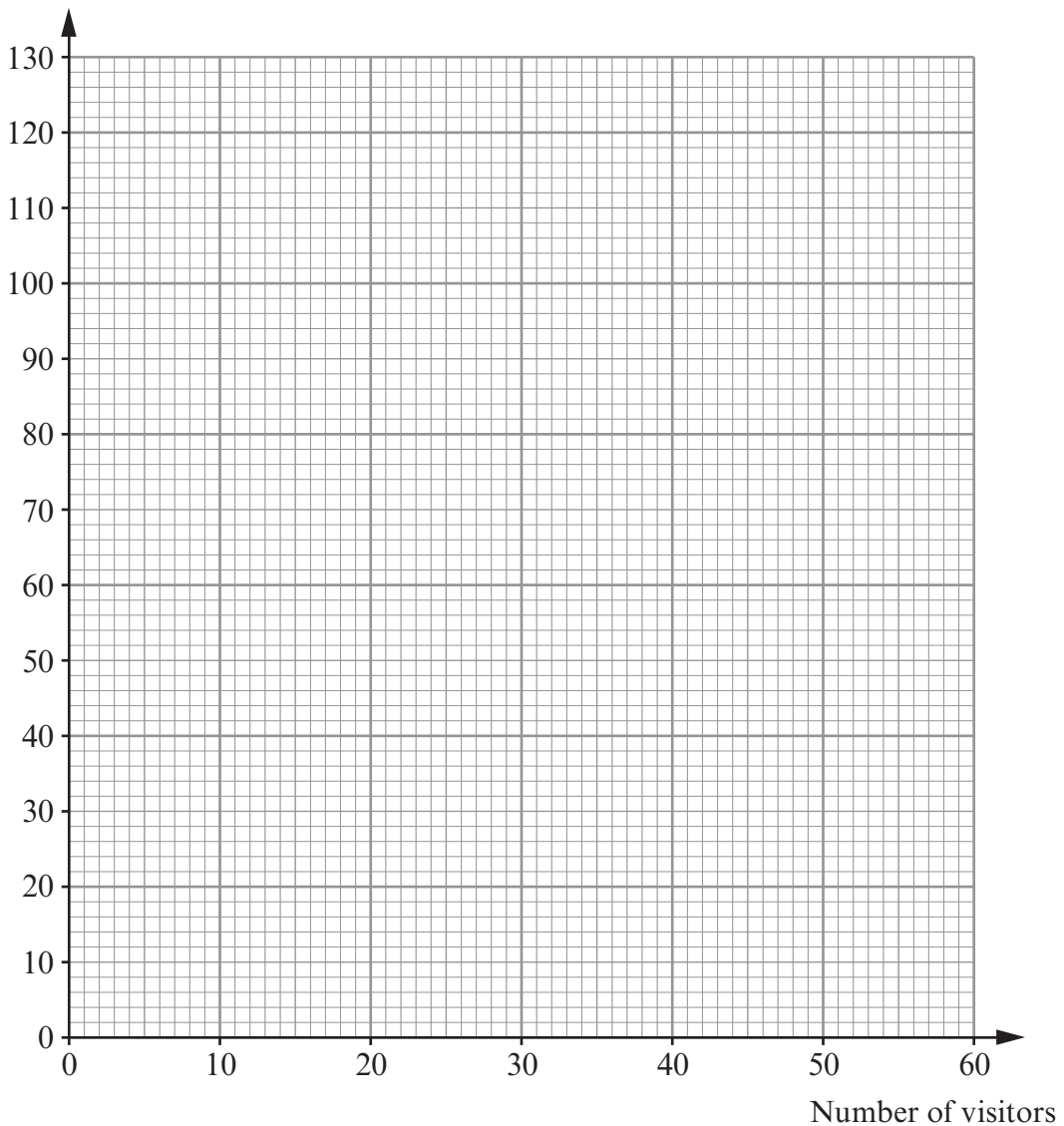


Number of visitors

*(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.

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[1]

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

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[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.

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**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.

[7]

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

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**1 Mexican peso is worth 0.082 Canadian dollars**

**1 Mexican peso is worth 0.058 euros**

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

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**1 Canadian dollar is worth** ................................... **euros**

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**1 euro is worth** ................................... **Canadian dollars**

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**4.**
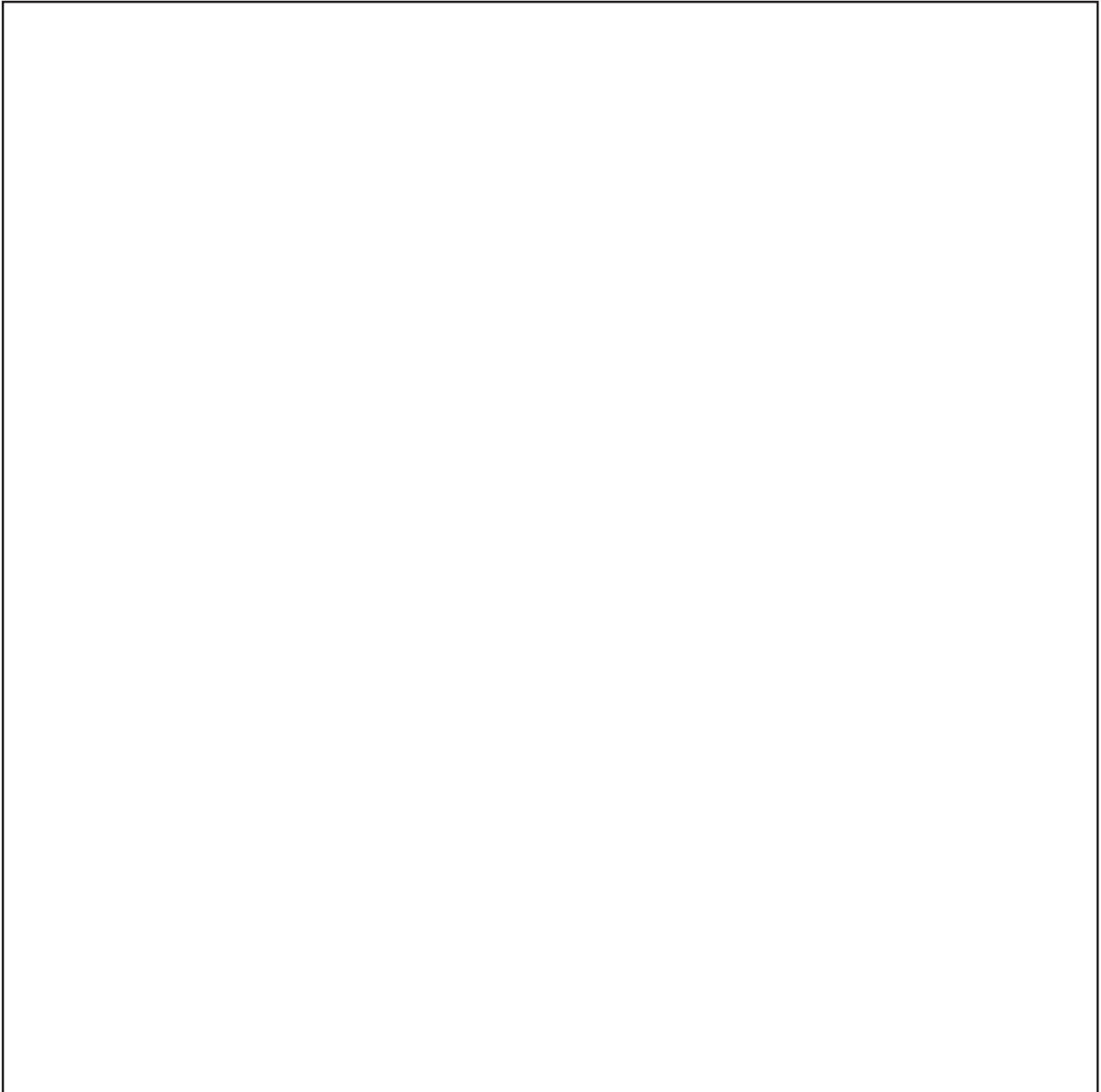
> # Maple Beech Furniture Store
> # Fantastic discounts available!
> # Ask our sales personnel for details

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.

[6]

*(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.

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

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**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 | | | |
| Men | | | |

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

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

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*(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.

Women

Men

Stepper machine

Running machine

Rowing machine

Stepper machine

Running machine

Rowing machine
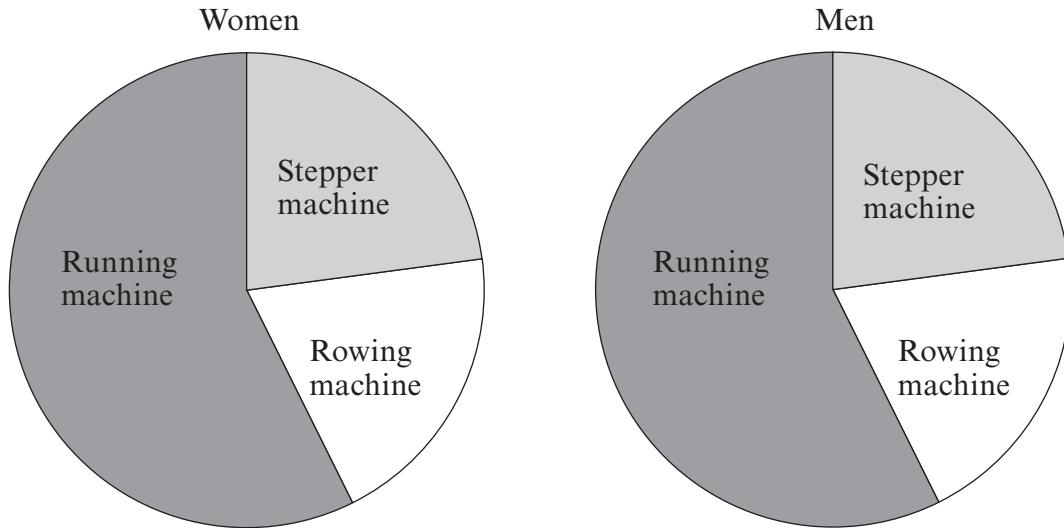
Tomas states,

*"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.

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[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 | |
| B | 0·0008249 | |
| C | $\left(3{\cdot}2 \times 10^{-5}\right) \div \left(7{\cdot}8 \times 10^{8}\right)$ | |

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*(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 | |
| | | Lower bound | Upper bound |
| 10 cm correct to the nearest cm | 8 cm correct to the nearest cm | ......................... cm | ......................... cm |
| Length | Width | Area | |
| | | Lower bound | Upper bound |
| 10 cm correct to the nearest cm | 8 cm correct to the nearest cm | ......................... cm$^2$ | ......................... cm$^2$ |

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[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.

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*(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°.

Highest point

*h* miles        2·6 miles

11·2°            Finish
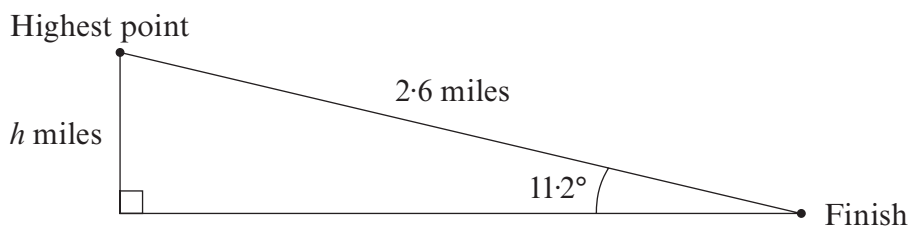
*Diagram not drawn to scale*

Calculate the vertical drop *h*.

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**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.

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Cost of edging each length £ ...........................................

Cost of edging each width £ ...........................................

[6]

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



8·4 cm

10·4 cm

*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.

[6]

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

$$x \geqslant 0$$
$$y \geqslant 0$$
$$5y \geqslant 7x - 14$$
$$x + 2y \leqslant 14$$
$$3x + 2y \leqslant 18$$

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**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.

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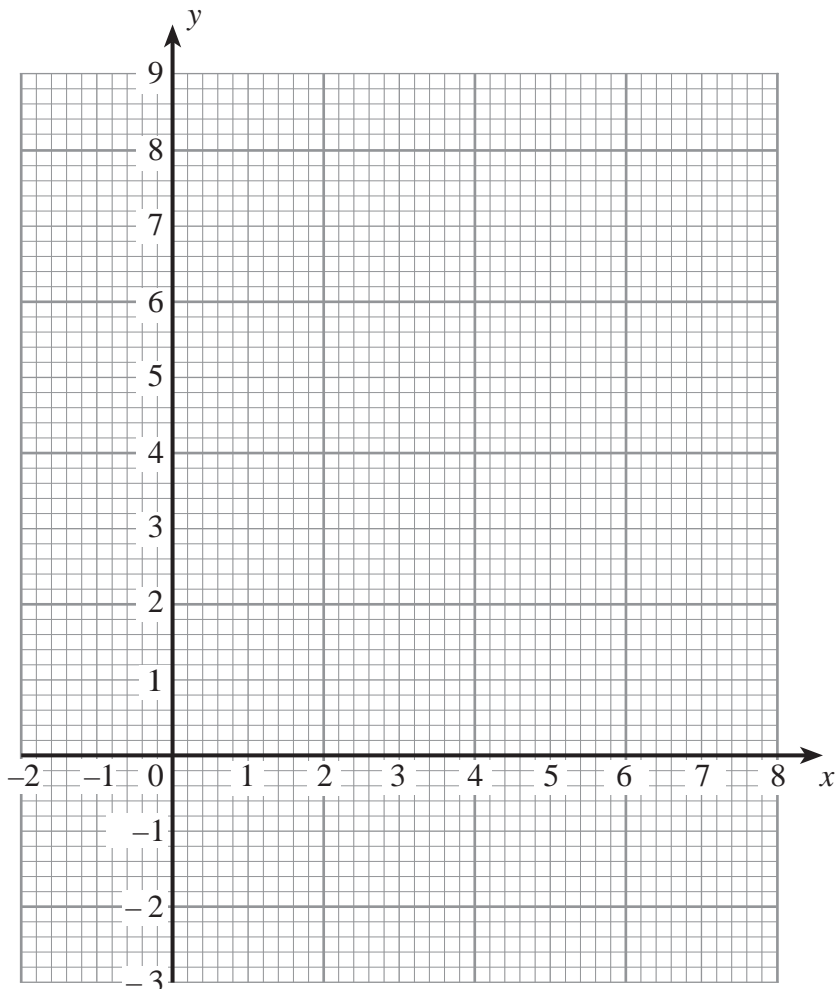
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   (ii) After how many seconds will the mass be 5 grams?

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*(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.

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Mass, grams

Time, seconds

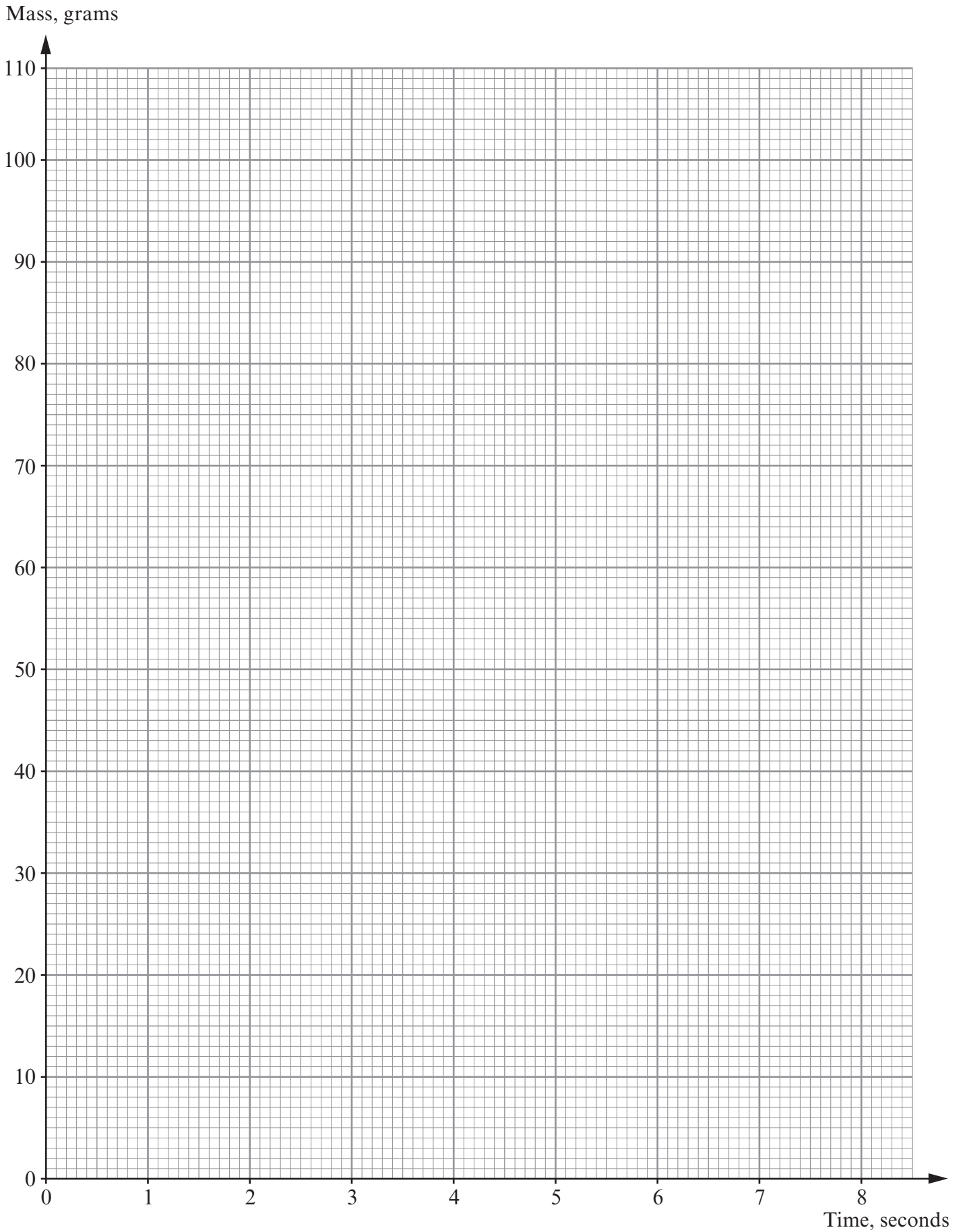**12.** Adam is interested in opening a savings account at Morris Bank.
The manager of Morris Bank explains to Adam that they have two different savings accounts.
Some details of the accounts are shown below.

| Account | Nominal interest rate | AER Annual Equivalent Rate, correct to 2 decimal places |
|---|---|---|
| Quarter Back | 8·6% p.a., paid quarterly | ....................% |
| 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.

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

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*(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.

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**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 m².
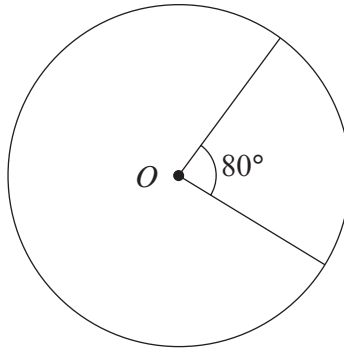


*Diagram not drawn to scale*

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

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

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