OCR
Oxford Cambridge and RSA

F

Wednesday 4 November 2015 – Morning

GCSE APPLICATIONS OF MATHEMATICS

A381/01 Applications of Mathematics 1 (Foundation Tier)

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Scientific or graphical calculator
- Geometrical instruments
- Tracing paper (optional)

Duration: 1 hour

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Your answers should be supported with appropriate working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

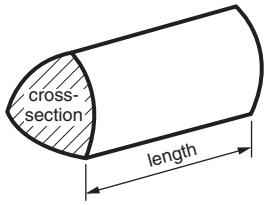
INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- Your quality of written communication is assessed in questions marked with an asterisk (*****).
- The total number of marks for this paper is **60**.
- This document consists of **20** pages. Any blank pages are indicated.

You are permitted to use a calculator for this paper

Formulae Sheet: Foundation Tier

Volume of prism = (area of cross-section) × length



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1 **(a)** The world land speed record in 2014 was 763.035 miles per hour (mph).

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(i) What is 763.035 mph correct to the nearest whole number?

(a)(i) ..... mph **[1]**

(ii) The world land speed record in 1900 was about a tenth of the present record.

Make a sensible estimate of the world land speed record in 1900.

(ii) ..... mph **[2]**

(iii) The world land speed record was 394.20 mph in 1960.
It had increased to 622.407 mph by 1970.

By how much had the world land speed record increased from 1960 to 1970?

(iii) ..... mph **[1]**

(b) Land speed records are calculated from the time taken to cover a measured mile. Vehicles make a run in each direction (outward and return).

(i) The speed for a run, s mph, is worked out using this formula

$$s = \frac{3600}{t}$$

where t seconds is the time to cover the measured mile.

In 1983 *Thrust 2*, a jet car, gained the world record.

It took 5.767 seconds to cover the measured mile on the outward run.

Calculate its speed on the outward run.

(b)(i) ..... mph **[2]**

(ii) The outward and return times over the measured mile are used to calculate the official speed.

official speed = 7200 ÷ (outward run time + return run time)

All times are in seconds.

The return time over the measured mile was 5.599 seconds.

Calculate the official speed of *Thrust 2*.

(ii) ..... mph **[2]**

(iii) The rules state that the measured mile must be

$$\text{“no more than } \frac{1}{10\,000} \text{ different from an exact mile.”}$$

A mile is 1 609.344 metres.

Calculate $\frac{1}{10\,000}$ of a mile. Give your answer in centimetres.

(iii) ..... cm **[2]**

(c) The first jet powered car used for land speed records was *Spirit of America*.
It was the first vehicle to go faster than 400 mph.

Spirit of America was powered by a J47 jet aeroplane engine.
This engine had a maximum thrust of 22 000 Newtons.

(i) It only reached 90% of maximum thrust on its first record run.

What was this thrust?

(c)(i) ..... Newtons **[2]**

(ii) The thrust was 21 000 Newtons on the second run.

What fraction of the maximum thrust was this?
Give your answer in its simplest form.

(ii) ..... **[2]**

(d) In 1964 *Spirit of America* crashed on the Bonneville Salt Flats.
It left the world's longest skid mark.
The driver, Craig Breadlove, was not injured.

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The length of the skid left by a car can be used to find the speed at which it began to skid.

The speed at which a car begins to skid, s mph, is given by

$$s = \sqrt{90kd}$$

where k is a number which depends on the road surface and
d is the length of the skid in metres.

The skid mark left by *Spirit of America* was 9 600 m long.
The value of k on the salt road surface was 0.2.

Use the formula to find the speed at which *Spirit of America* began to skid.

(d) ..... mph **[3]**

(e) Tests are being carried out on a vehicle which will run at 1 000 miles per hour! It is called *Bloodhound*.

Bloodhound will be powered by a jet engine and a rocket.

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The rocket burns fuel according to the equation

$$f = 48t$$

where f is the amount of fuel burnt in kilograms and

t is the time, in seconds, the rocket has been burning.

(i) How much fuel is burnt in 4 seconds?

(e)(i) ..... kg **[1]**

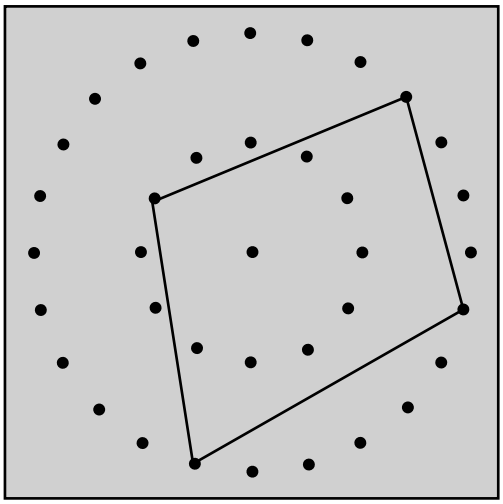
(ii) The rocket's fuel tank holds 960 kg of fuel.

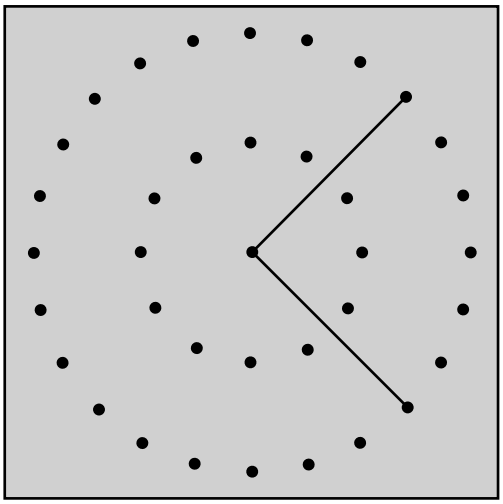
What is the longest time the rocket can burn for?

(ii) ..... seconds **[2]**

2 Amy designs mathematical apps for tablet computers.

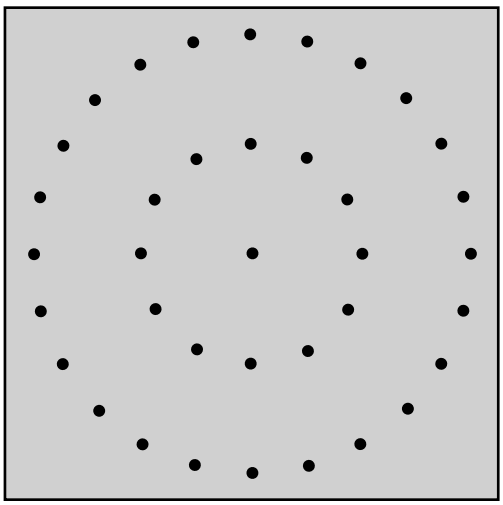
(a) Her latest app lets users click on dots to draw shapes and angles.
The dots are arranged in circular patterns.



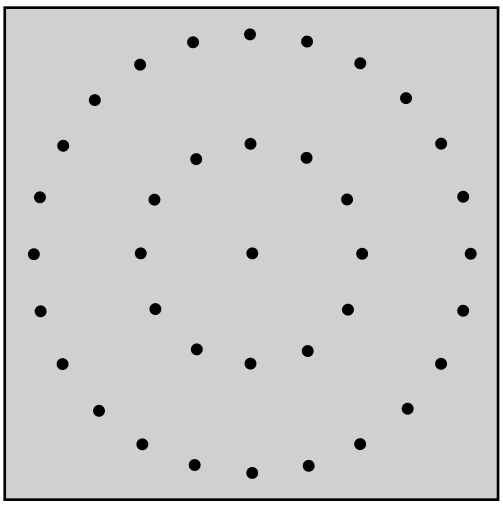


(i) On the screens below use a ruler to draw the shape named above the screen.

A regular hexagon



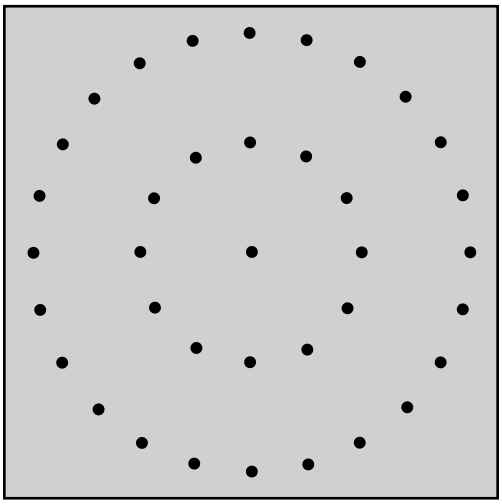
A rectangle



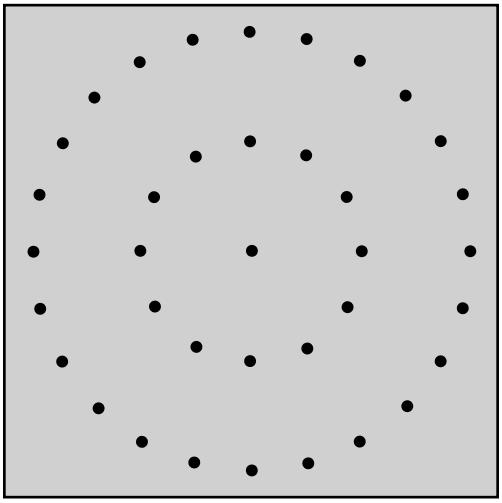
[2]

(ii) On the screens below use a ruler to draw and label the angle named above the screen.

A 30° angle

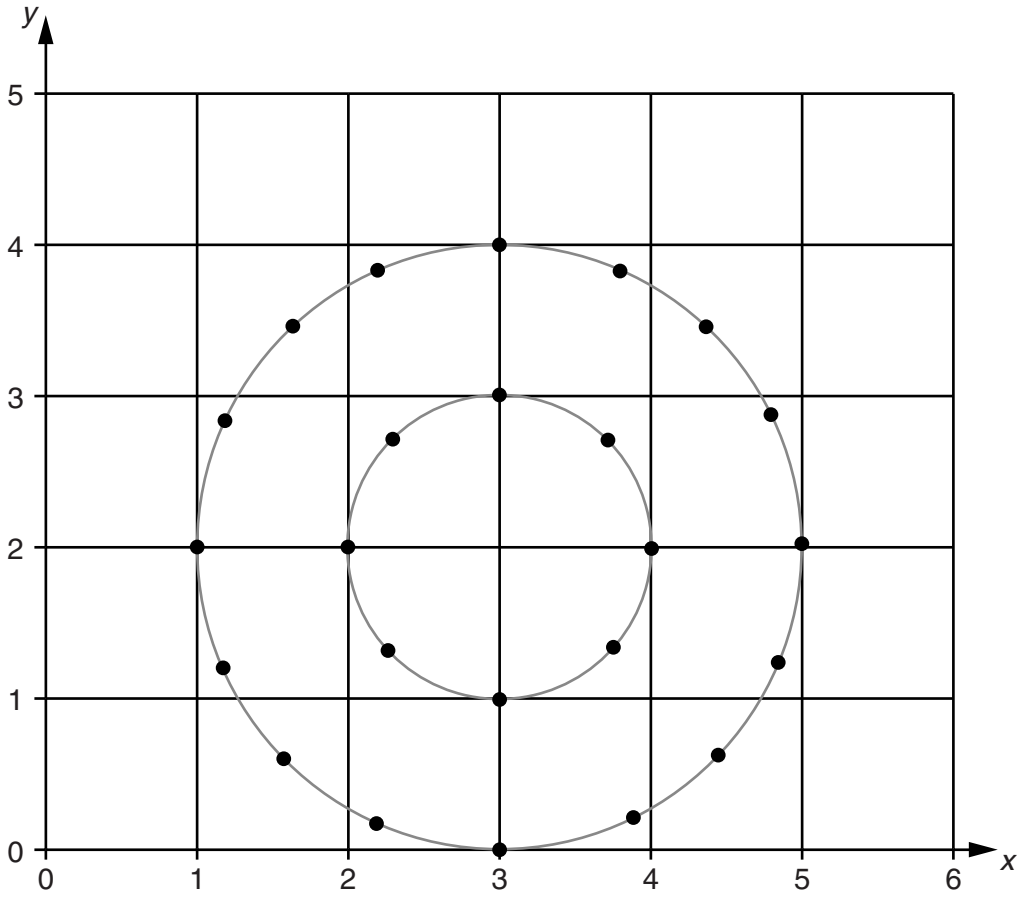


A 15° angle



[2]

(b) The app can also be used for measurements and coordinates.



(i) Use a ruler to measure the diameter of the larger circle in millimetres.

(b)(i) ..... mm **[1]**

(ii) What are the coordinates of the centre of the two circles?

(ii) (..... , ...) **[1]**

3* Jake always looks online for bargains.

Is Jake right?
Support your answer with clear calculations.

.....

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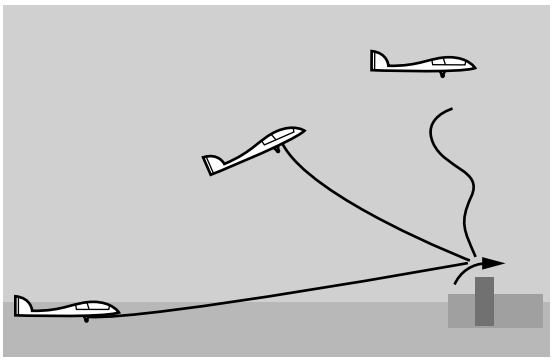
..... **[4]**

4 Jamil's Aunt Wendy is interested in learning to glide.
At a nearby gliding club the gliders are launched from the ground to begin each flight.



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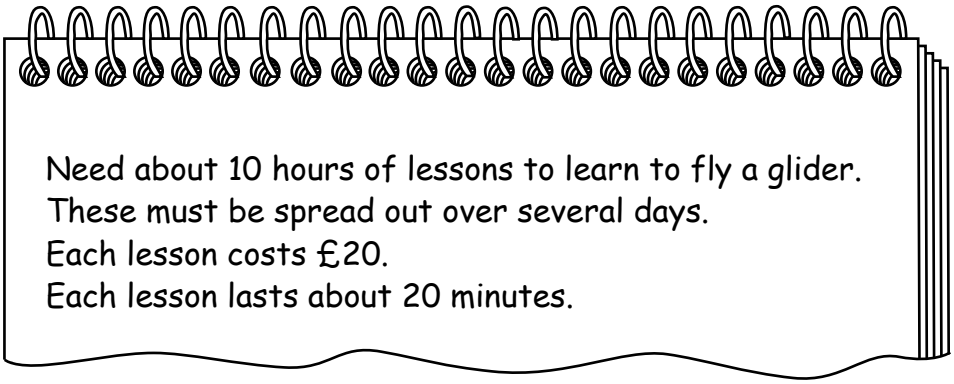
(a) Jamil's family wants to buy Wendy some gliding lessons so she can learn to fly a glider. Jamil makes these notes.



(i) How much does one hour of lessons cost?

(a)(i) £ ..... **[2]**

(ii) How much does it cost to learn to fly a glider by taking these flying lessons?

(ii) £ ..... **[1]**

(iii) Jamil sees this on a notice board at the flying club.

Could Wendy save money by joining the club and paying for launch and flying times?

Remember she'll need 10 hours of flying.
Write down any assumptions you make.

.....

.....

.....

.....

..... **[5]**

(b) There are a total of 4 adults and 5 youngsters in Jamil's family.

They decide to group together and give Wendy £400 for lessons.

- The adults **each** give a fifth of the £400 to help pay for the lessons.
- The youngsters pay the rest equally amongst them.

How much will each of the adults and each of the youngsters pay?

Each adult pays £ .....

Each youngster pays £ .....
[4]

(c) This is a photo of Wendy after her first lesson.

(i) Estimate the real length of the cockpit shown by the black arrow.
Give your answer in metres.

(c)(i) ..... m **[1]**

(ii) Estimate the real height of the wing above the ground (the white arrow).
Give your answer in centimetres.

(ii) ..... cm **[1]**

(d) Gliders need long thin wings to glide well.

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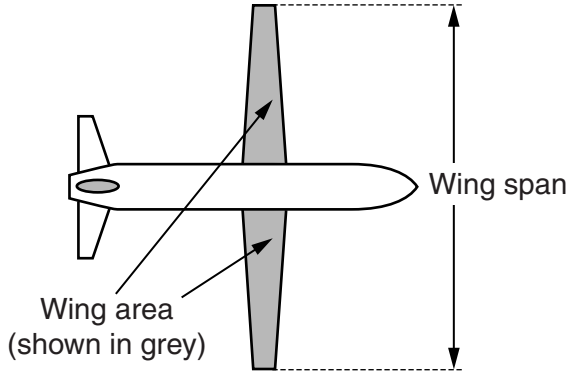
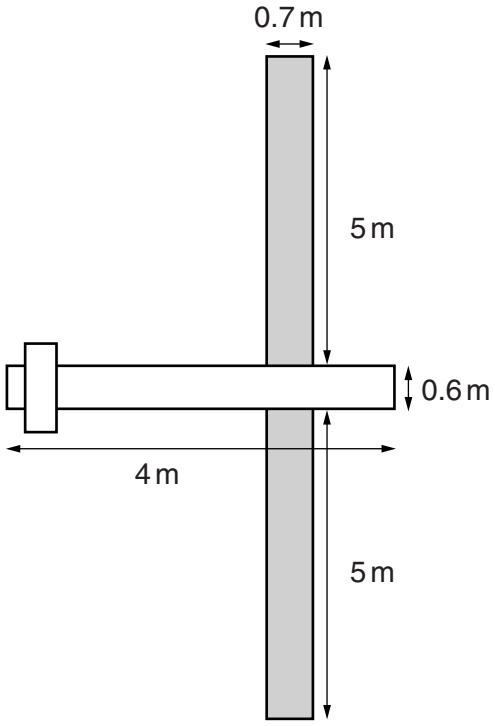


The 'Longness and thinness' of a wing is measured by its **aspect**.

Aspect is calculated by dividing the square of the wing span by the wing area.

Here is a sketch of the glider Wendy learns to fly in.
Its wings are rectangular in shape.



(i) Calculate the wing area.

(d)(i) ..... m^2 **[2]**

(ii) Calculate the **aspect** of Wendy's glider.

(ii) ..... **[3]**

(iii) This is the instrument panel on Wendy's glider.

What speed is shown on the dial?

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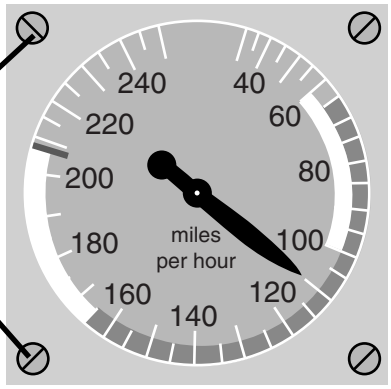


(iii) ..... miles per hour **[1]**

(e) Temperature drops with height above the ground.
This drop in temperature, d° C, at h kilometres above ground level is given by this formula.

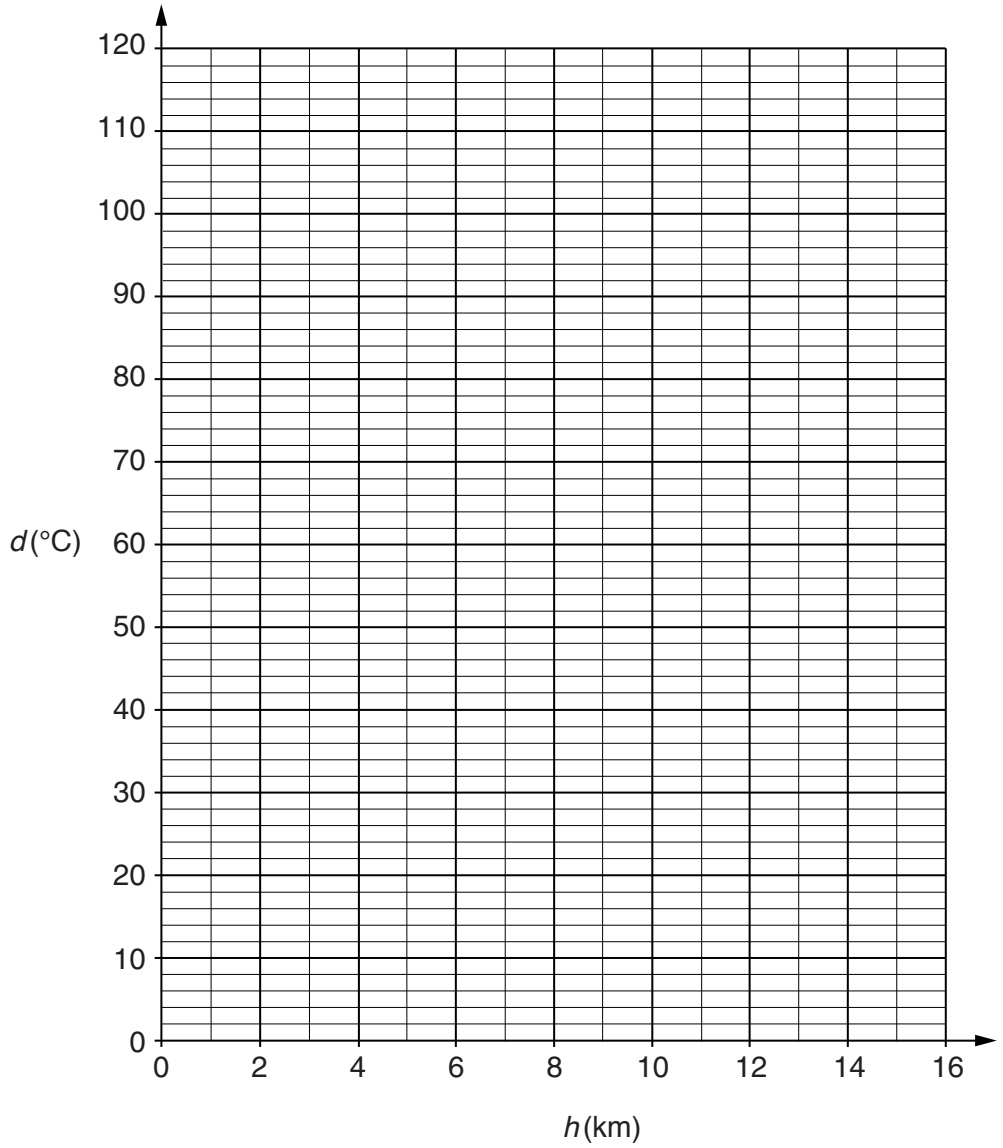
$$d = 6.4h$$

(i) Complete this table of results.

***h* (km)**	0	5	10	15
***d* (°C)**	0			96

[1]

(ii) Draw the graph connecting d and h on the grid opposite. **[2]**

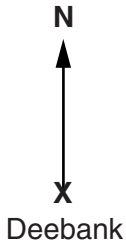


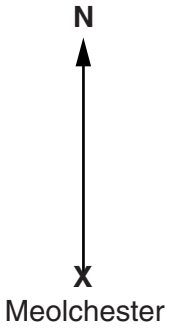
(iii) Jamil reads that a typical cruising height for a passenger jet is about 30 000 feet.
He knows that 1000 feet is 0.3 km.
Jamil says "The outside temperature for a passenger jet is more than 60° C lower at cruising height than the temperature on the ground."

Use this information and your graph to help you check if Jamil is correct.
Show your working and how you used your graph.

[3]

(f) Wendy plans to fly Jamil from the gliding club at Meolchester to another gliding club at Deebank.



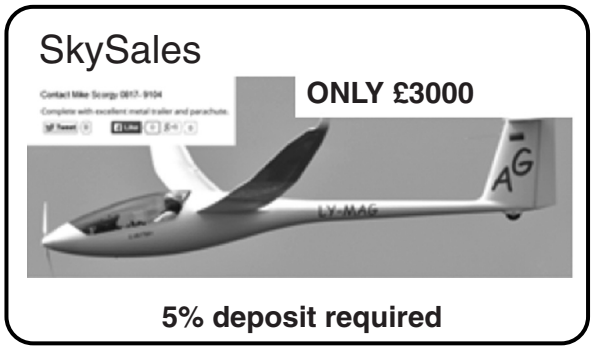


Draw the course and measure the bearing that they must take.

(f) ..... ° **[2]**

(g) Wendy is thinking of buying a glider.
She sees this on the internet.

How much deposit will she need to pay?



(g) £ ..... **[2]**

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