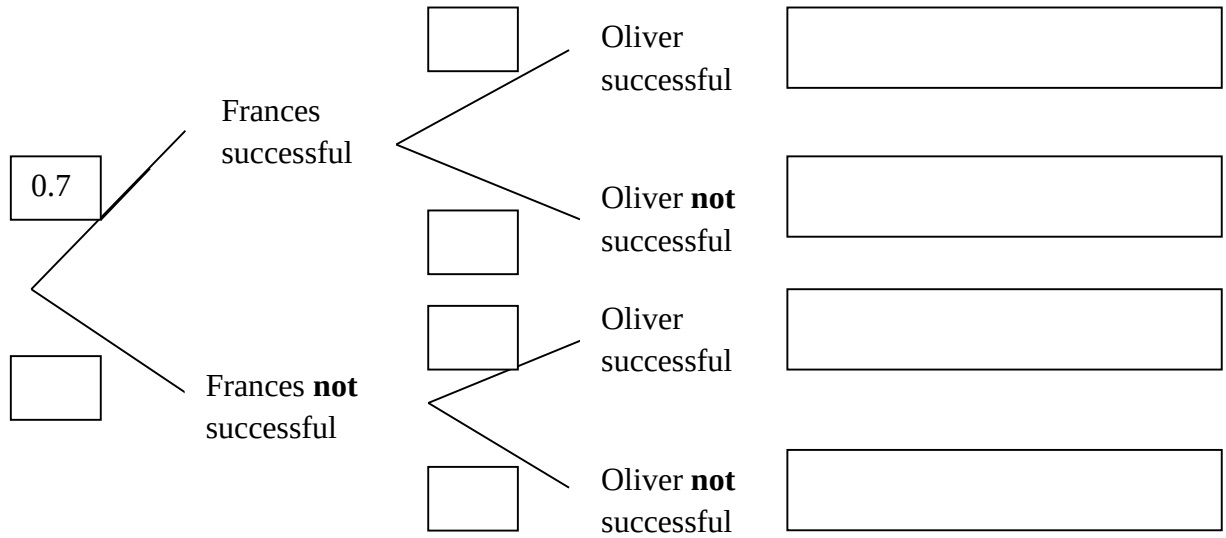
Question **(25 marks)**

(a) Frances and Oliver are on a fitness program for one month. The probability that Frances will finish the program successfully is 0.7 while the probability that Oliver will finish successfully is 0.6

(i) Complete the tree diagram shown using the above information.



(ii) What is the probability that they will both be successful?

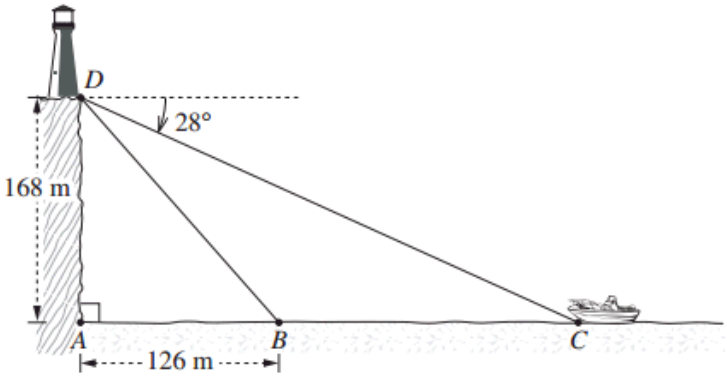
(iii) What is the probability that only one of them will both be successful?

Question **(25 marks)**

(a) (i) A square has an area of 100 cm^2. Calculate the length of one side of the square.

(ii) Find the length of the diagonal of the square. Write your answer in the form $a\sqrt{2}$, $a \in N$.

(b) The base of a lighthouse, D, is at the top of a cliff 168 metres above sea level. The angle of depression from D to a boat at C is 28°. The boat heads towards the base of the cliff, A, and stops at B. The distance AB is 126 metres.



(i) What is the angle of depression from D to B, correct to the nearest minute?
(There is extra space at the top of the next page for you to complete your answer)

(ii) How far did the boat travel from C to B, correct to the nearest metre?

Question **(25 marks)**

(a) Greg needs to conduct a statistical inquiry into how much time people aged 18–25 years have spent accessing social media websites in the last two weeks. He has decided to survey a sample of students from his university. The process of statistical inquiry includes the following steps, which are NOT in order.

A	Writing a report
B	Posing questions
C	Organising data
D	Analysing data and drawing conclusions
E	Collecting data
F	Summarising and displaying data

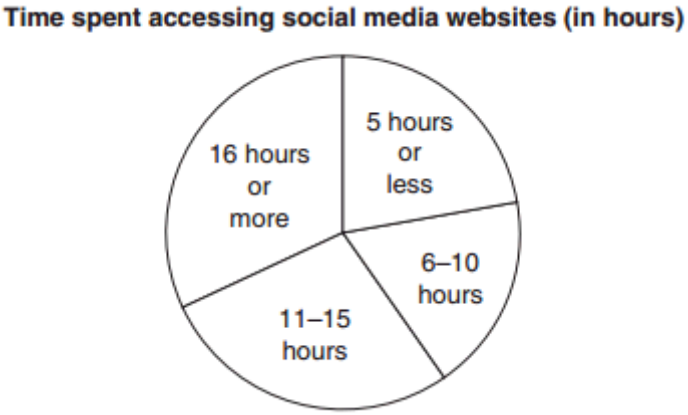
(i) Using the letters A, B, C, D, E and F, list the steps in the most appropriate order for Greg to conduct his statistical inquiry.

1st Step	
2nd Step	
3rd Step	
4th Step	
5th Step	
6th Step	

(ii) Greg conducts his statistical inquiry. At which step in the process would he have drawn a graph of his findings?

(iii) Suggest a way that Greg could choose his sample of University students for his survey to ensure it is not biased in any way.

(b) Greg produces the following graph to present his findings.

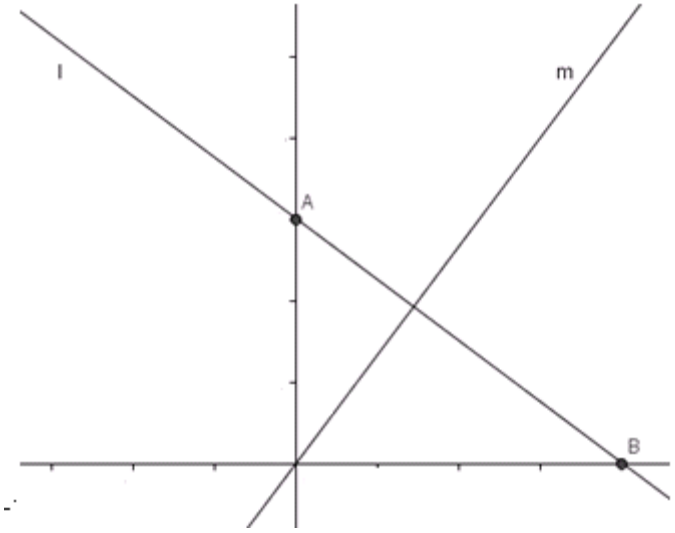


(i) Measure the size of the angle in each segment of his pie-chart.

(ii) If approximately 18 people claim to have spent between 11-15 hours on social media sites, calculate the number of people who Greg surveyed.

Question **(25 marks)**

The diagram shows a line l, with equation $3x + 4y - 12 = 0$, which intersects the y-axis at A. A second line m, with equation $4x - 3y = 0$, passes through the origin O and intersects l at E.



(i) Show that the coordinates of A are (0, 3).

(ii) Show that l is perpendicular to m.

(b) (i) Find the coordinates of the point E, the point of intersection of line *l* and line *m.*
Express your answer in the form $\left(\frac{p}{25}, \frac{q}{25}\right)$, $p, q \in \mathbb{N}$

(ii) Hence or otherwise, find the area of ΔAEO, where *O* is the origin.

Question **(25 marks)**

The circle *C* has equation $(x-10)^2+(y-12)^2=49$.

The centre of *C* is at the point *M*.

(a) (i) Find the coordinates of the point *M*

(ii) Find the length of the radius of the circle *C*

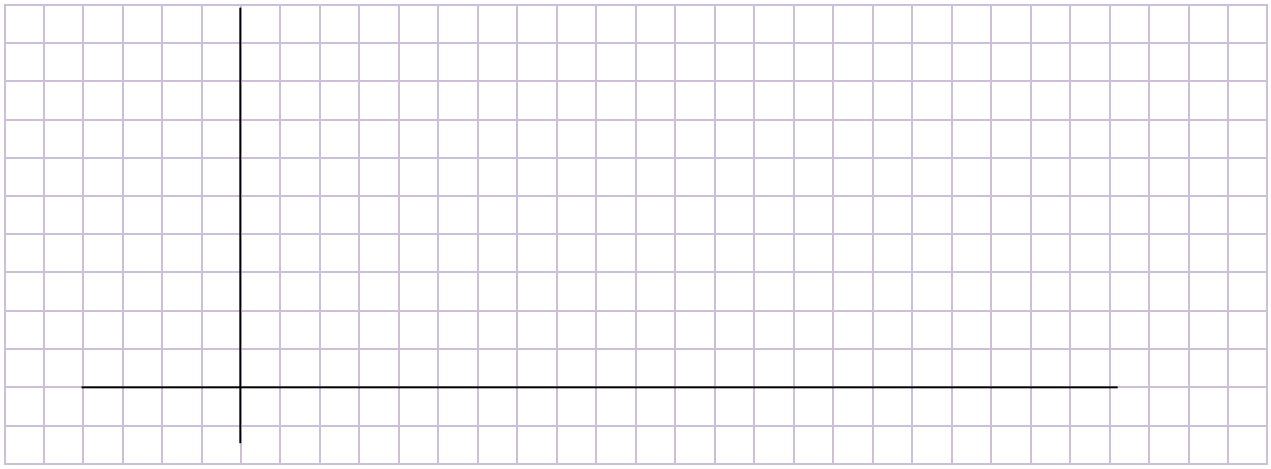
(b) *N* is the point with coordinates (25,32). Find the length of the line *MN*

(c) The tangent to *C* at a point *P* on the circle passes through point *N*. Find the length of the line *NP*.

Question **(25 marks)**

(a) A shape ABCD has coordinates $A(3,3), B(6,3), C(6,9)$ and $D(3,6)$.

(i) Draw the shape in the grid below.



(ii) What name is given to such a shape?

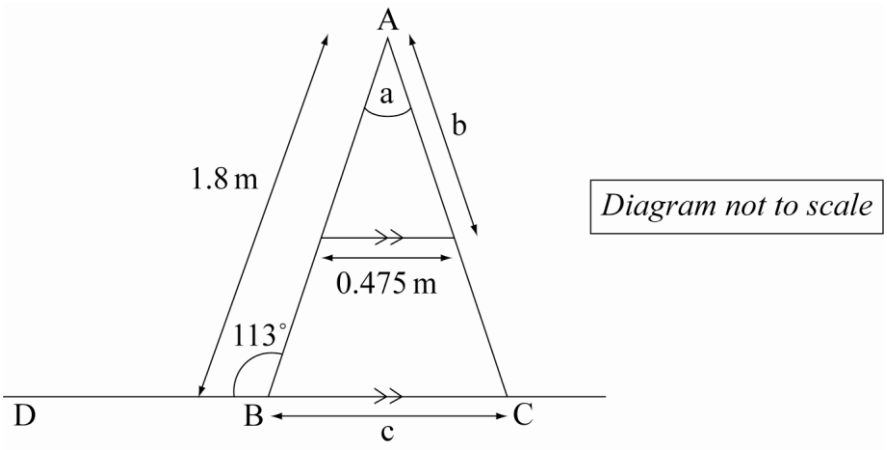
(b) (i) Draw the enlargement of shape A with scale factor $\frac{1}{3}$ and centre of enlargement (0, 0) on the grid above.

(ii) Calculate the area of the original shape, *ABCD*.

(iii) By using the **scale factor only,** calculate the area of the image?

Question **(60 marks)**

(a) Carmel is doing some work in her garden shed. She is using a ladder which has two legs AB and AC. Each leg is 1.8m long. Angle ABD = 113°

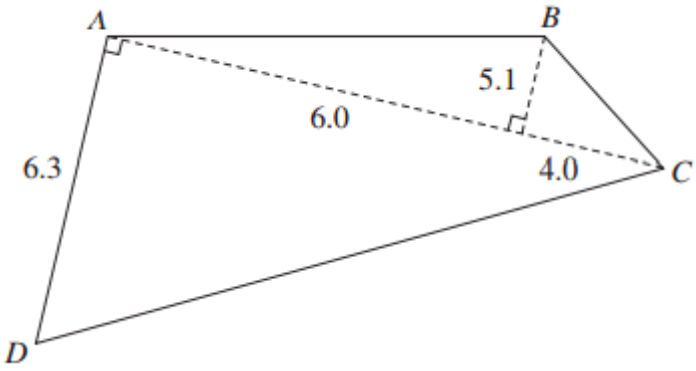


(i) Calculate the size of angle BAC, explaining the reason for each step of your answer.

(ii) Express b in terms of c.

(iii) Calculate the length of c, correct to two decimal places.

(b) The diagram shows the shape of Carmel's garden bed. All measurements are in metres.



(i) Show that the area of the garden bed is 57 square metres.

(ii) Carmel decides to add a 5 cm layer of straw to the garden bed. Calculate the volume of straw required. Give your answer in cubic metres.

(iii) Each bag of straw holds 0.25 cubic metres of straw. How many bags does she need to buy?

(iv) A straight fence is to be constructed joining point A to point B. Find the length of this fence to the nearest metre.

Question **(55 marks)**

Lie detector tests are not always accurate. A lie detector test was administered to 200 people.

The results were:

• 50 people lied. Of these, the test indicated that 40 had lied;

• 150 people did NOT lie. Of these, the test indicated that 20 had lied.

(i) Complete the table below using the information above.

	Test indicated a lie	**Test did not indicate a lie**	**Total**
People who lied			50
People who did NOT lie			150

(ii) For how many of the people tested was the lie detector test accurate?

(iii) For what percentage of the people tested was the test accurate?

(iv) What is the probability that the test indicated a lie for a person who did NOT lie?

(b) According to an article in The Irish Times, in the run-up to the Irish presidential election in 2011, a company offered its services to perform a lie-detector test on all of the **seven** candidates in the race.

(i) Using your data from part (a), what is the probability of all 7 candidates telling the truth to a particular question?

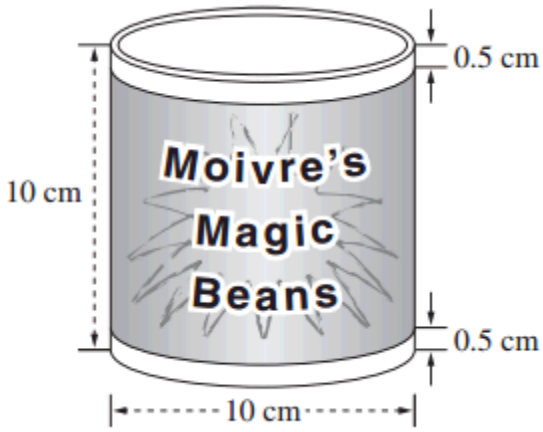
(ii) Assuming that the candidates did agree to this, what is the probability that the first person to tell a lie was the third candidate questioned?

(iii) The company which offered to perform the test on the election candidates claims that their test is reliable 88% of the time.

Using the 200 people as a representative sample from part (a), use a hypothesis test at the 5% level of significance to decide whether there is sufficient evidence to justify the company's claim. State the null hypothesis and your conclusion clearly.

Question **(35 marks)**

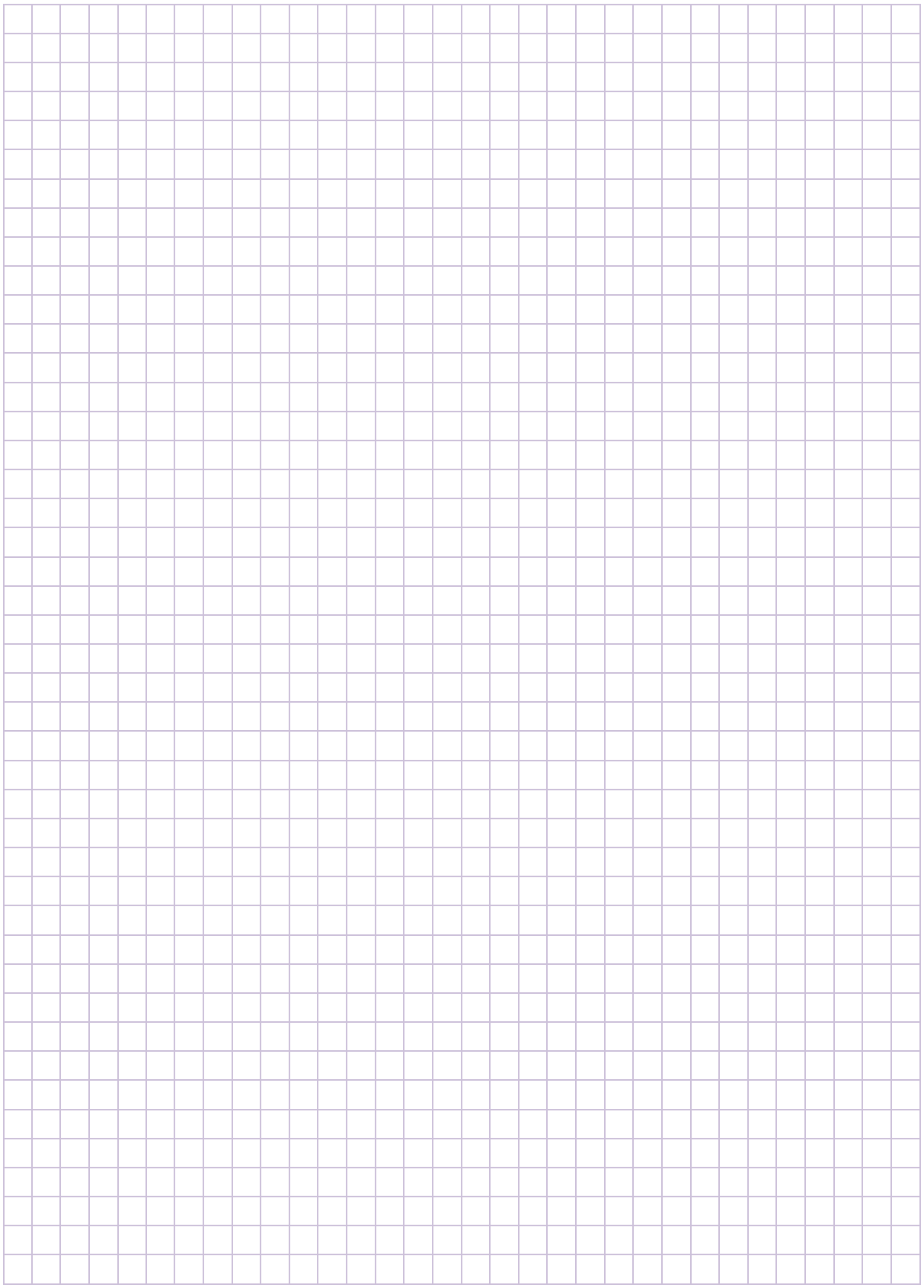
Moivre's manufacturing company produces cans of Magic Beans. The can has a diameter of 10 cm and a height of 10 cm.



(a) Calculate the volume of 1 can of Moivre's Magic Beans, in terms of π.

(b) (i) Moivre's Magic Bean cans are to be packed in rectangular boxes with dimensions 30 cm × 40 cm × 60 cm. What is the **maximum** number of cans that can be packed into one of these boxes?

(ii) The shaded label on the can shown wraps all the way around the can with no overlap. What area of paper is needed to make the labels for all the cans in this box when the box is full? Write your answer correct to the nearest whole number.

(iii) The company is considering producing larger cans. Monica says if you double the diameter of the can this will double the volume. Is Monica correct? Justify your answer with suitable calculations.

You may use this page for extra work.