L.19

NAME ☞	
SCHOOL ☞	
TEACHER ☞	

Pre-Leaving Certificate Examination, 2018

Mathematics

Paper 2

Ordinary Level

Time: 2 hours, 30 minutes

300 marks

School stamp

For examiner	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

Running total

Grade

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Instructions

There are **two** sections in this examination paper.

Section A	Concepts and Skills	150 marks	6 questions
Section B	Contexts and Applications	150 marks	3 questions

Answer **all nine** questions.

Write your answers in the spaces provided in this booklet. You may lose marks if you do not do so. There is space for extra work at the back of the booklet. You may also ask the superintendent for more paper. Label any extra work clearly with the question number and part.

The superintendent will give you a copy of the *Formulae and Tables* booklet. You must return it at the end of the examination. You are not allowed to bring your own copy into the examination.

You will lose marks if you do not show all necessary work.

You may lose marks if you do not include appropriate units of measurement, where relevant.

You may lose marks if you do not give your answers in simplest form, where relevant.

Write the make and model of your calculator(s) here: | |

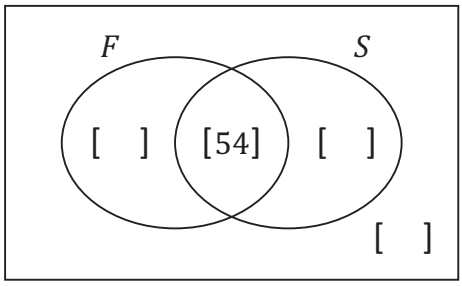
Section A — Concepts and Skills — 150 marks

Answer **all six** questions from this section.

Question 1 **(25 marks)**

A survey of 136 students was carried out. They were asked whether they were studying French (*F*) or Spanish (*S*). Of those surveyed, 87 study French, 85 study Spanish and 54 study both languages.

(a) **(i)** Represent this information on the Venn Diagram.



(ii) A student is chosen at random from those surveyed.
Find the probability that the student studies neither language.

(iii) Two students are chosen at random from those surveyed who study at least one of these languages.
Find the probability that both students study one language only. Give your answer correct to two decimal places.

(b) When the responses of 14 additional students are included in the survey, the probability that a student chosen at random studies both French and Spanish increases to $\frac{2}{5}$.

(i) How many of these additional students study both French and Spanish?

(ii) Find the highest possible number of these additional students who study Spanish only.

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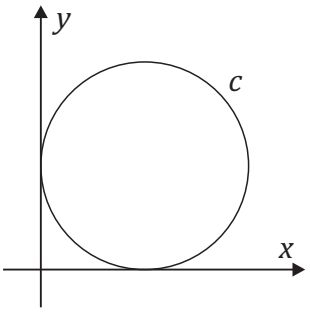
Question 2 **(25 marks)**

The circle c has a radius of 5 cm and touches both the x-axis and the y-axis, as shown.

(a) **(i)** Write down the co-ordinates of the centre of c.
Hence, find the equation of c.



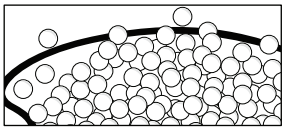
(ii) Verify, using algebra, that the point $P(9, 8)$ is on c.

(b) **(i)** Find the equation of t_1, the tangent to c at P.

(ii) t_2 is another tangent to c at the point Q and t_2 is parallel to t_1.
Find the co-ordinates of Q.

Question 3 **(25 marks)**

A company produces plastic balls for children's ball ponds.
Each ball is in the shape of a sphere with a diameter of 6 cm.



(a) **(i)** Find the radius of each ball.

(ii) Hence, find the volume of each ball, correct to one decimal place.

(b) The balls are packed in rectangular cases which can hold 240 balls.
The width of the case can fit 6 balls and the length can fit 8 balls.

(i) Find the volume of the smallest rectangular case that the balls will fit into.

(ii) What percentage of the volume of the rectangular case is **not** taken up by the balls?
Give your answer correct to two decimal places.

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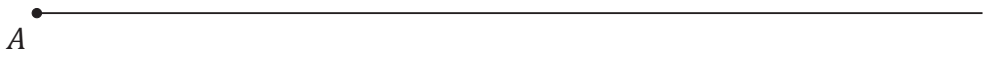
Question 4 **(25 marks)**

(a) **(i)** Construct a triangle ABC, where $|AB| = 10$ cm, $|AC| = 9$ cm and $|\angle CAB| = 30°$.
The point A is given to you. Show all construction lines clearly.



(ii) What is the largest angle in the triangle ABC?
Give a reason for your answer.

Largest angle =

Reason:

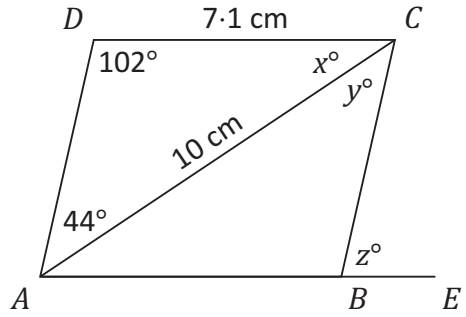
(b) **(i)** On the same diagram above, construct the circumcentre and the circumcircle of the triangle ABC, using a compass and straight edge only.
Show all construction lines clearly.

(ii) Measure the length of the radius of the circle constructed in **part (b)(i)**.

Length of radius =

Question 5 **(25 marks)**

The diagram shows the parallelogram $ABCD$ with $[AB]$ extended to E.



(a) Use the measurements shown on the diagram to find the values of x, y and z.
Give a reason for your answer in each case.

$x =$

Reason:

$y =$

Reason:

$z =$

Reason:

(b) **(i)** Find the area of the triangle ABC. Give your answer correct to one decimal place.

(ii) Hence, or otherwise, find the area of the parallelogram $ABCD$.

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Question 6 **(25 marks)**

(a) A seed company claims that 70% of its seeds will germinate. A research team decided to investigate this claim and tested all the seeds contained in 6 randomly selected packets. The table below summarises the results of the 150 seeds in each packet.

Packet	**1**	**2**	**3**	**4**	**5**	**6**
Number of seeds that germinated	81	85	78	92	81	83

Using a calculator, or otherwise, calculate the mean and the standard deviation of the number of seeds in each packet that germinated, correct to the nearest whole number.

Mean:

Standard deviation:

(b) After testing a large number of seed packets, the research team established that the number of seeds in each packet that will germinate is normally distributed with the same mean and standard deviation as those of the sample investigated in **part (a)** above.

Use the Empirical Rule to find an interval that contains the number of seeds that will germinate in approximately 95% of all packets.

(c) **(i)** Find the margin of error, at 95% confidence, for the sample investigated in **part (a)**. Write your answer as a percentage, correct to two decimal places.

(ii) Use your answer to **part (c)(i)** above to create a 95% confidence interval for the expected rate of germination. Is there sufficient evidence to reject the company's claim, at the 5% level of significance?

Section B — Contexts and Applications — 150 marks

Answer **all three** questions from this section.

Question 7 **(50 marks)**

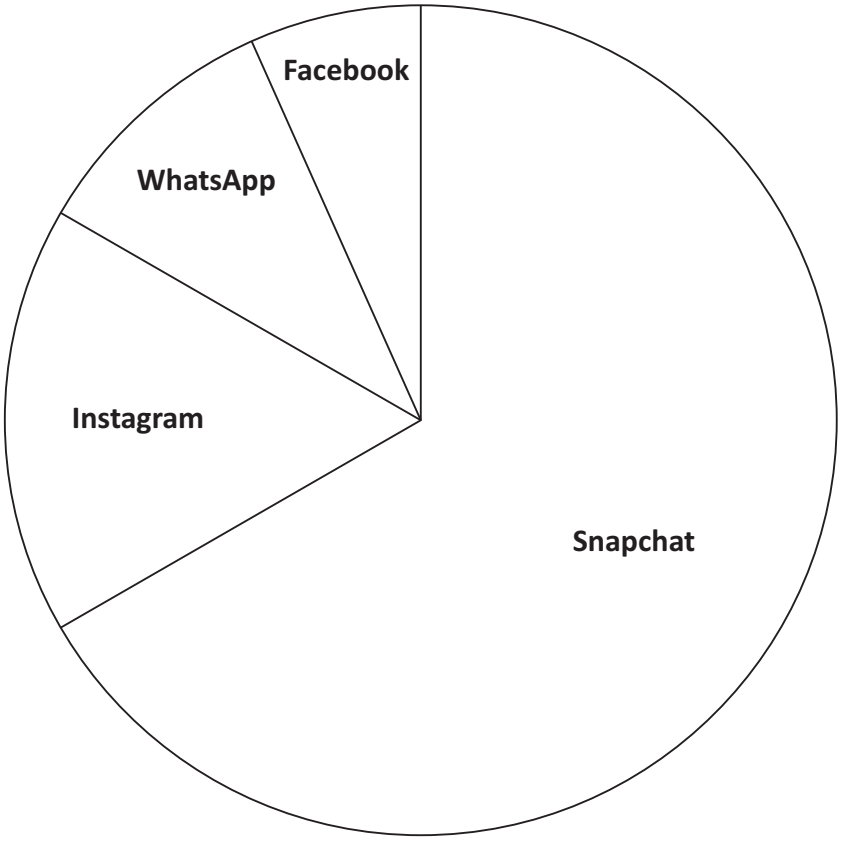
(a) A random sample of 120 students from a school with a total student population of 600 were surveyed about their social media preferences.

(i) Explain 'random sample' and suggest how it might have been achieved.

Random sample:

How it might have been achieved:

The pie chart below shows the preferred social media outlets of the students surveyed.



(ii) Complete the table below to show the preferred social media outlets of the students surveyed.

	Angle measured	Number of students
Snapchat		
Instagram		
WhatsApp		
Facebook		

(b) A random sample of 20 students from transition year were asked about the lengths of time they spent studying and using social media in the lead-up to the summer exams.

The data below shows the number of hours each student spent studying per week.

4	5	5	8	10	7	12	15	13	12
9	7	6	10	11	6	12	15	14	9

Find the mean, mode and median of the data.

Mean:

Mode:

Median:

The standard deviation of the times students spent studying in the sample is 3·4 hours.

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(c) The data below shows the lengths of time the same students spent using social media per week. Each student's data corresponds to the same position in the previous data set, e.g. the first student surveyed spent 4 hours studying and 21 hours using social media.

21	22	18	10	8	4	2	3	1	5
11	16	18	4	3	5	1	2	1	8

The table below shows the summary statistics for the social media data.

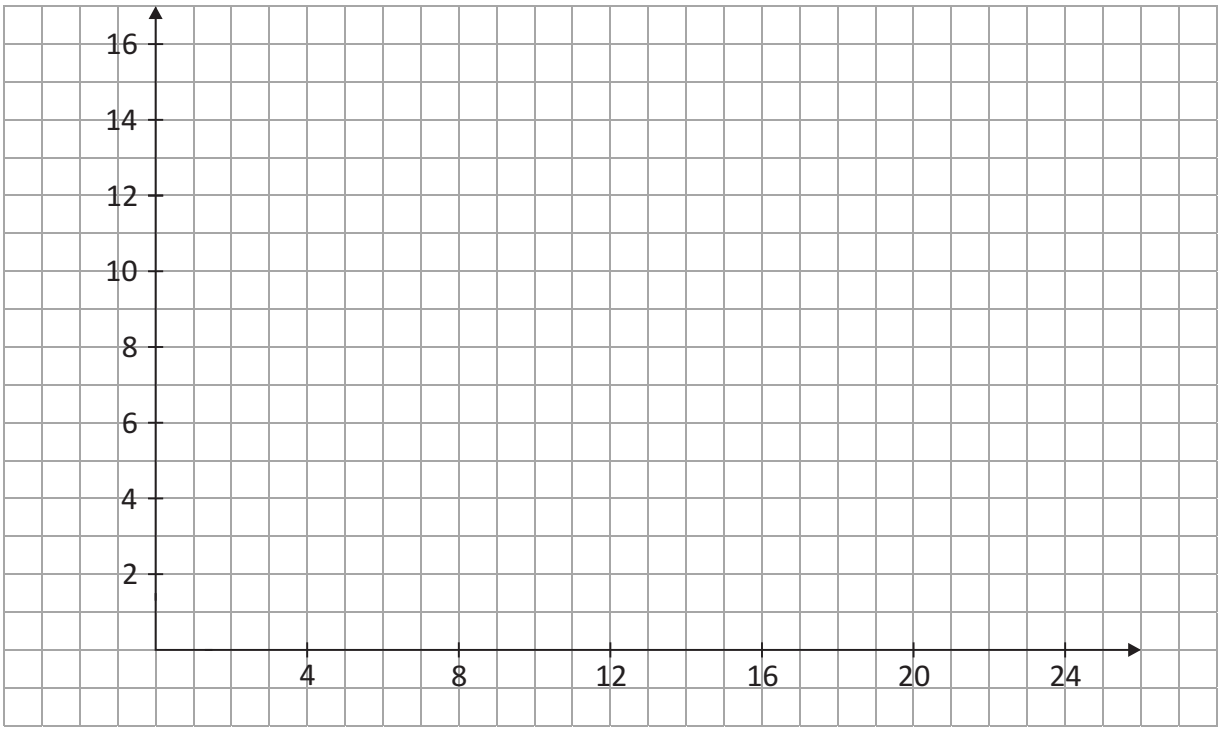
Social media data	
Mean	8·2
Mode	1
Median	5
Standard deviation	6·9

(i) Interpret two differences between the statistics data for social media usage and the statistics data for study in **part (b)**.

Difference 1:

Difference 2:

(ii) Complete the scatter graph below to show the relationship between the lengths of time that students spent studying and using social media.



(iii) The correlation coefficient between the two sets of data is one of the numbers below. Write the letter corresponding to the correct answer in the box.

A 0·2
B 0·86
C –0·2
D –0·86

(iv) What can you conclude from the scatter plot and the correlation coefficient?

(d) **(i)** Complete the following grouped frequency table to illustrate the data collected about the lengths of time that students spent studying.

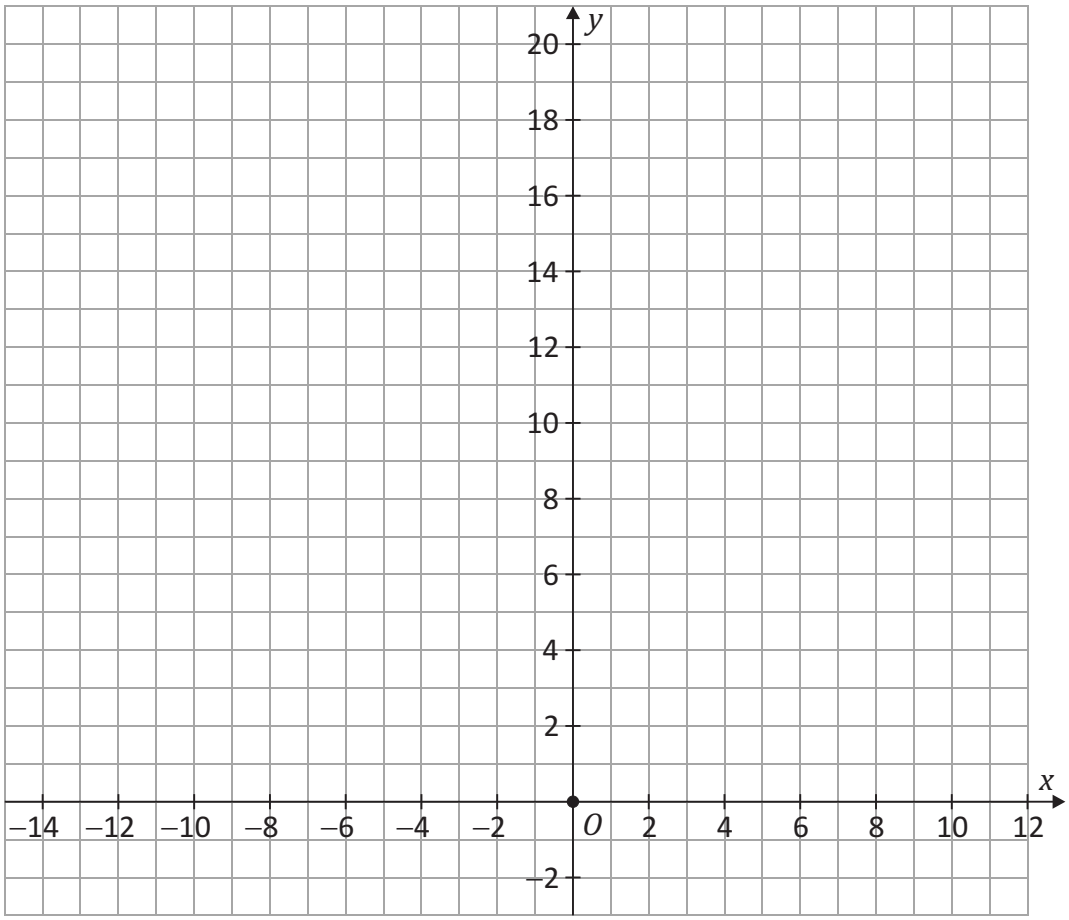
Time spent studying	0 – 5	5 – 10	10 – 15	15 – 20
Number of students				

[Note: 5 – 10 means 5 hours or more but less than 10 hours, etc.]

(ii) Use mid-interval values of the data in the table to estimate the mean time that students in this sample spent studying.

Question 8 **(50 marks)**

Nadia wishes to map her daily run in a local park on the co-ordinate diagram below. She plots the starting point of her run at the point O, the origin on the diagram.



(a) **(i)** Nadia jogs along a straight pathway, which is represented by the line k, from O to the point $A(5, 12)$. Plot and label this point on the diagram above.

(ii) Find the equation of the line k.

(iii) Nadia then jogs partially around a circular pond, c.
The point (0, 14·5) is the centre of c and A is a point on c.
Show c on the diagram above and hence, find the radius and circumference of c.
Give your answers correct to one decimal place.

Radius:

Circumference:

(b) Nadia jogs halfway around the circular pond before she takes another straight pathway, represented by the line l, which is parallel to k.

(i) Find the co-ordinates of the point of contact of circle c and line l.

(ii) Draw line l on the diagram and hence, find the equation of line l.

(iii) Nadia continues along line l until it crosses the x-axis and, from this point, she returns along the x-axis to her starting point.
Use algebra to find the co-ordinates of the point of intersection of line l and the x-axis.

(c) Given that the co-ordinate diagram is drawn using the scale of 1 cm = 200 m,
find the **total** distance of Nadia's run. Give your answer correct to the nearest metre.

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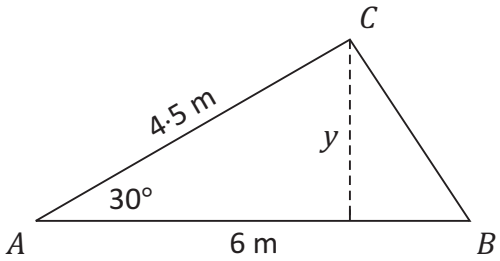
Question 9 **(50 marks)**

An architect is designing the roof of a new house. The width of the house is 6 m and the length is 15 m. The outline of one design option is shown in the diagram below. The length of one surface of the roof is 4·5 m and the pitch of that roof surface is 30°.



(a) **(i)** Find $|BC|$, the length of the other surface of the roof, correct to two decimal places.

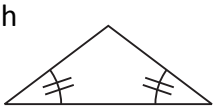
(ii) Find $|\angle ABC|$, the pitch of the other roof surface.
Give your answer correct to the nearest degree.

(iii) Find y, the height of the roof.

(iv) Find the **total** area of the two roof surfaces of the new house.

(b) A condition of planning permission is that the height of the roof does not exceed 2·25 m.

(i) If the pitch of the two roof surfaces is the same, find the maximum pitch of the roof surfaces in order to comply with planning permission. Give your answer in degrees, correct to two decimal places.



(ii) Find the **total** area of the roof surfaces of the house using this design option.

(iii) What does your answer to **part (b)(ii)** show about the total area of the roof surfaces of this design option compared to the option in **part (a)**? Explain why this is the case.

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