Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Examination 2017

Mathematics

Paper 2

Ordinary Level

Monday 12 June Morning 9:30 – 12:00

300 marks

Examination number

Centre stamp

Running total

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

Grade

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)**

According to the Central Statistics Office (CSO) there were 65 909 babies born in Ireland in 2015. Of these 32 290 were girls.

(a) **(i)** How many boys were born in Ireland in 2015?

(ii) Find the probability that a baby picked at random from those born in Ireland in 2015 is a boy. Give your answer correct to 2 decimal places.

(b) Eight babies were born in Limerick's Maternity Hospital on 1 May 2015.

(i) Use your answer to **part (a)(ii)** to find the probability that the first three babies born were boys. Give your answer correct to 4 decimal places.

(ii) Find the probability that the third birth was the first girl born in the hospital that day. Give your answer correct to 4 decimal places.

(c) The table below shows the probability of being born on a particular day of the week.

(i) Complete the table.

Day	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Probability	0·14		0·15	0·18	0·15	0·12	0·1

(ii) In a particular week 1300 babies were born.
Find the number of babies expected to be born on the Tuesday of that week.

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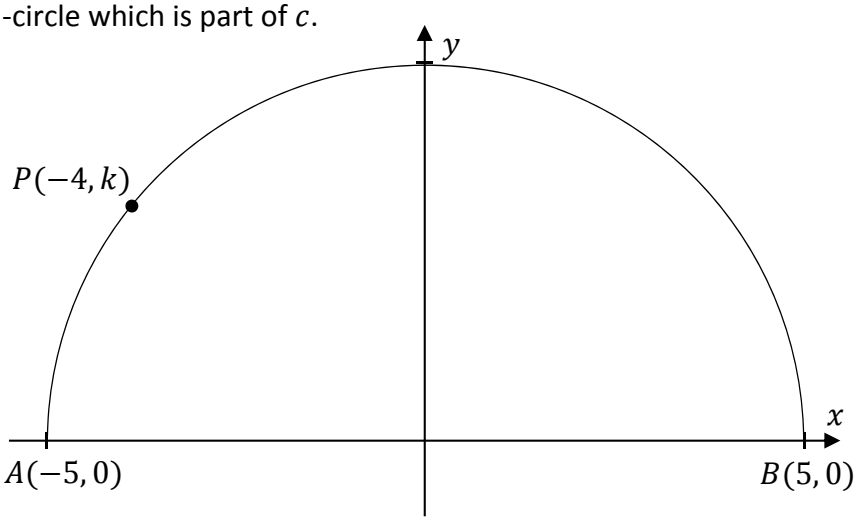
Question 2 **(25 marks)**

(a) The circle c has centre $(0, 0)$ and radius 5 units. Write down the equation of c.

Equation of c: _____

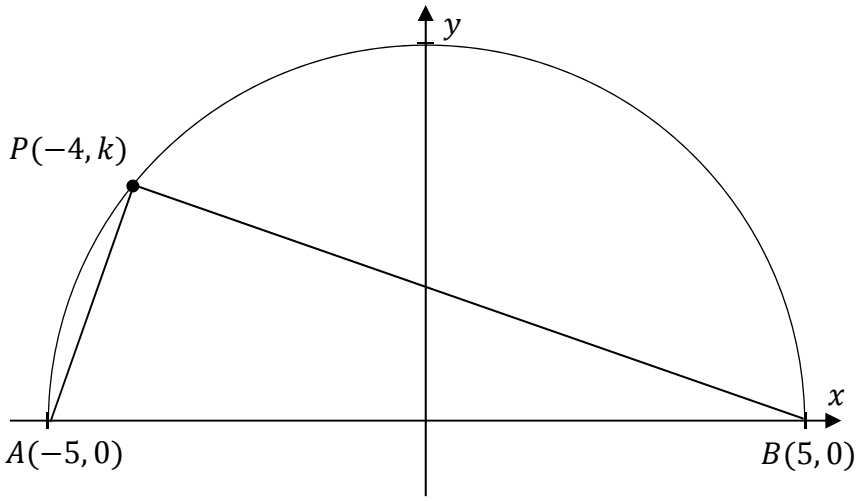
(b) The diagram shows a semi-circle which is part of c.



(i) The point $P(-4, k)$, $k > 0$, is on the semi-circle. Find the value of k.

(ii) Show that the triangle ABP is right-angled at P.

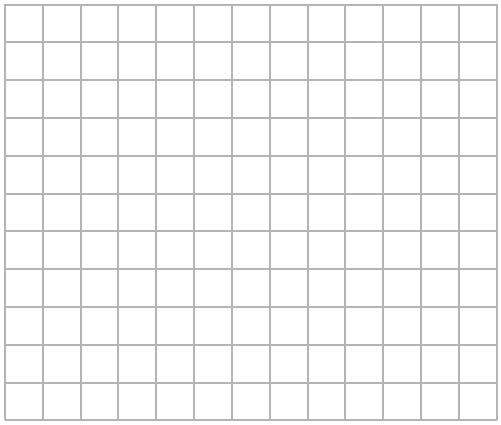
(c) Find the area of the region which is inside the semi-circle but outside the triangle ABP. Give your answer, in square units, correct to 2 decimal places.

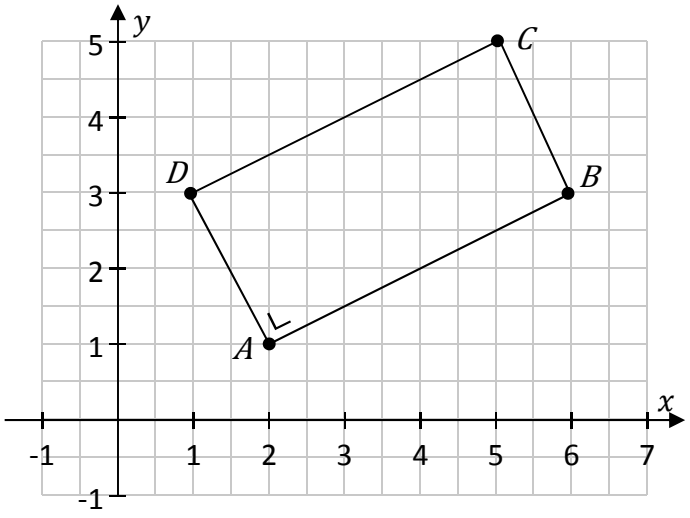


Question 3 **(25 marks)**

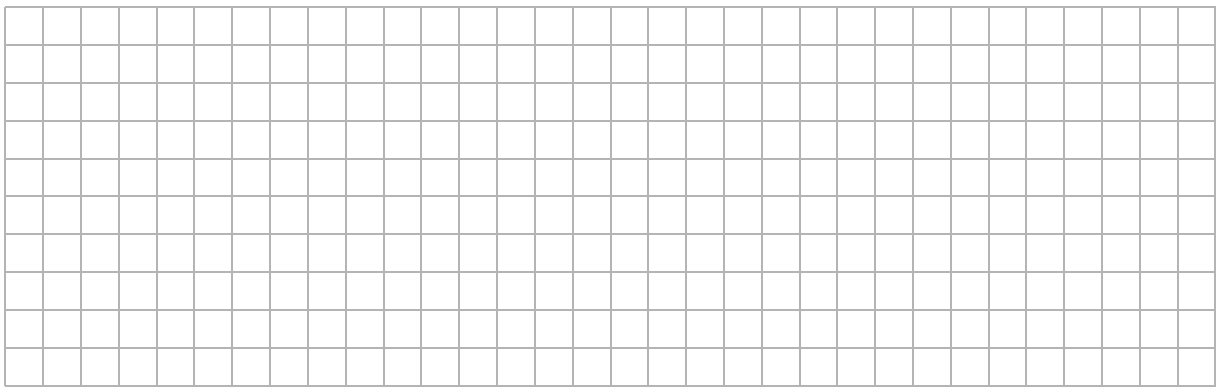
(a) The points $A(2,1)$, $B(6,3)$, $C(5,5)$, and $D(1,3)$ are the vertices of the rectangle $ABCD$ as shown.

(i) Show that $|AD| = \sqrt{5}$ units.

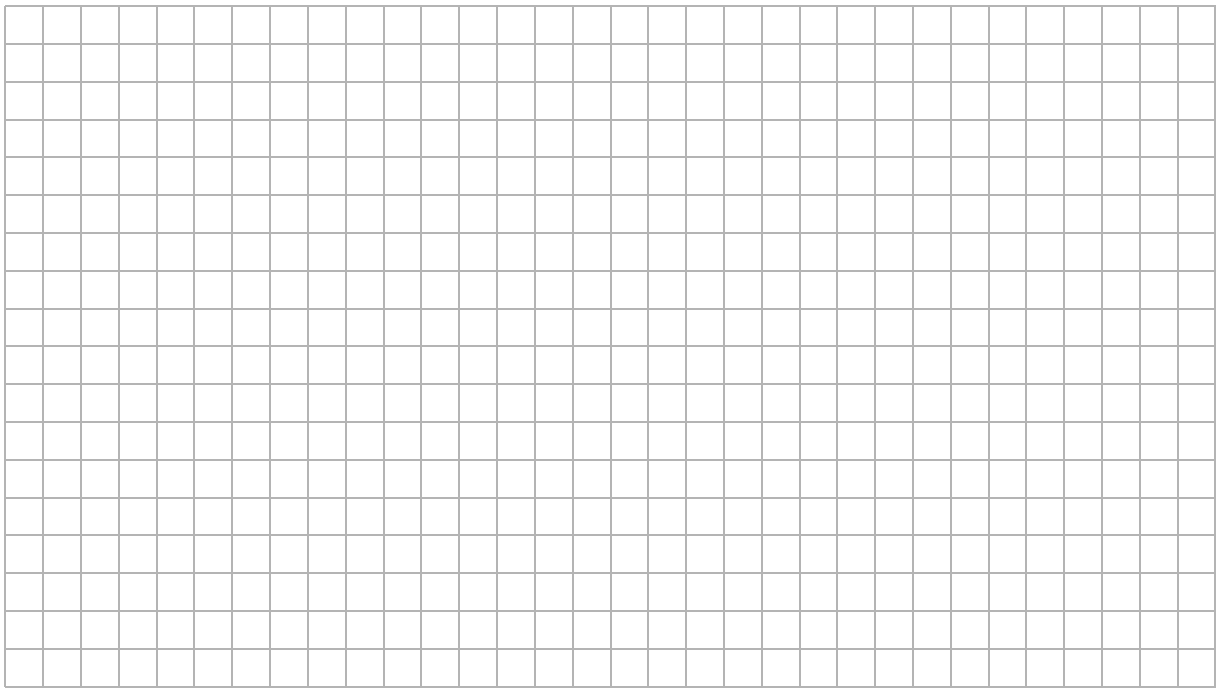




(ii) Find, in square units, the area of the rectangle $ABCD$.



(b) Find the equation of the line BC.
Give your answer in the form $ax + by + c = 0$, where $a, b, \text{and } c \in \mathbb{Z}$.



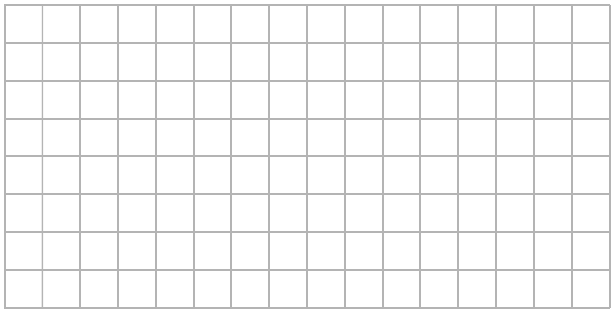
(c) Use trigonometry to find the measure of the angle ABD.
Give your answer correct to the nearest degree.

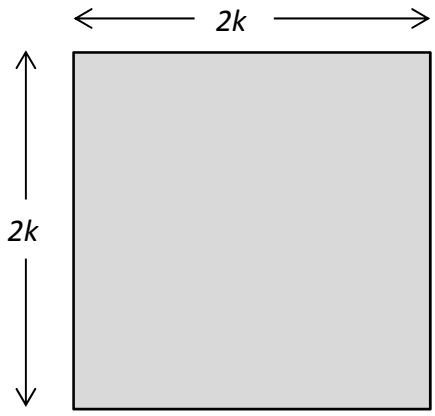
Question 4 **(25 marks)**

(a) Construct the triangle ABC, where $|AB| = 8$ cm, $|AC| = 5$ cm, and $|BC| = 7$ cm.

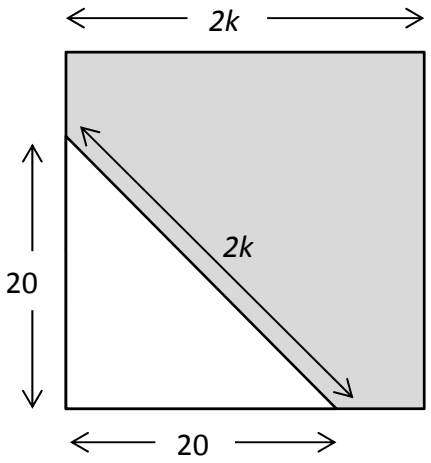
(b) The diagram shows a square of side length $2k$ cm.

(i) Write down, in terms of *k*, an expression for the area of the square.





(ii) An isosceles triangle with side lengths of 20 cm and hypotenuse of length *2k* cm is removed from the square, as shown.
Find the value of *k* (correct to 2 decimal places) **and** the area of the remaining (shaded) section.



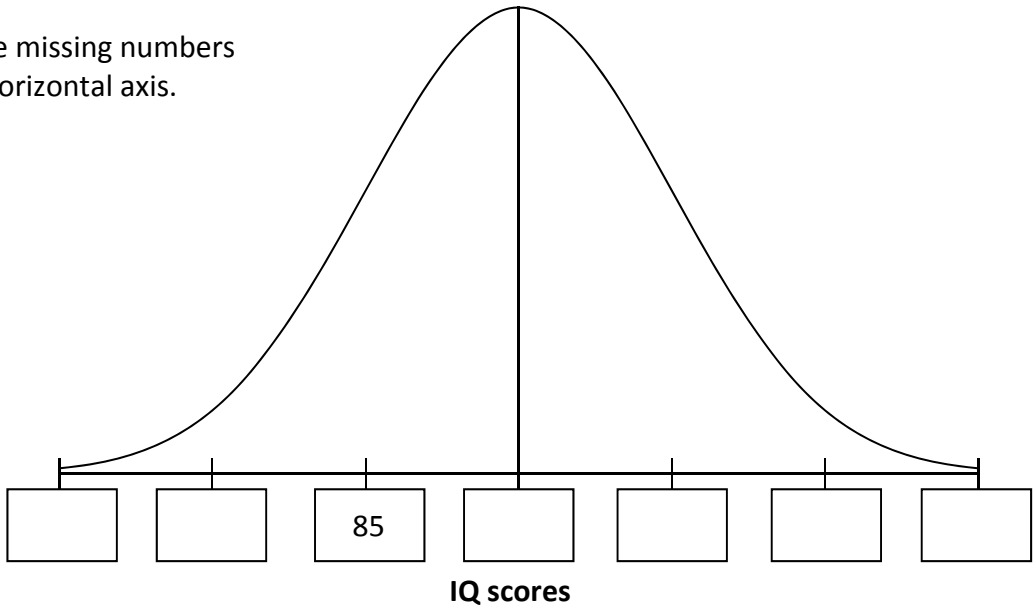
k:

Area of shaded section:

Question 5 **(25 marks)**

(a) In a survey, the IQ scores of 1200 people were recorded. The mean score was 100 points and the standard deviation was 15 points. Assuming that IQ scores are normally distributed, the data are shown on the diagram below.

(i) Fill in the missing numbers on the horizontal axis.



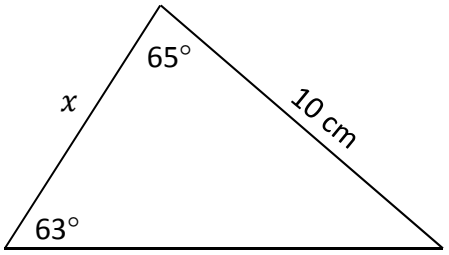
(ii) A person is chosen at random from those surveyed. Use the Empirical Rule to find the probability that this person has an IQ score between 70 and 130 points.

(iii) Use the Empirical Rule to find the approximate number of people surveyed with an IQ score of between 85 and 115 points.

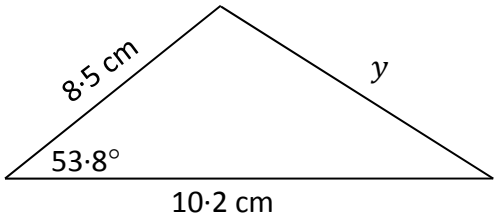
(b) A class of 24 pupils is made up of 10 boys and 14 girls. Chemistry is studied by 6 of the boys and 9 of the girls. A pupil is chosen at random from the class. Find the probability that the pupil chosen is a boy or is a pupil who does **not** study chemistry.

Question 6 **(25 marks)**

(a) Find the distance x in the diagram below (not to scale).
Give your answer correct to 2 decimal places.



(b) Find the distance y in the diagram below (not to scale).
Give your answer correct to 2 decimal places.



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Section B	Contexts and Applications	150 marks

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

Question 7 **(55 marks)**

Cones is a sculpture in the National Gallery of Australia. It consists of 14 identical steel cones arranged into pairs which are joined together as shown.

Picture: http://cs.nga.gov.au

(a) **(i)** The height of each cone is equal to the diameter of its base. If the radius of the base is 2·25 m, write the height of a cone.

(ii) Show that, correct to 2 decimal places, the slant height, l, of a cone is 5·03 m.

(b) In order to maintain the steel's reflective shine, the surface is polished regularly.

(i) Find the curved surface area of the entire sculpture (14 cones).
Give your answer correct to 2 decimal places.

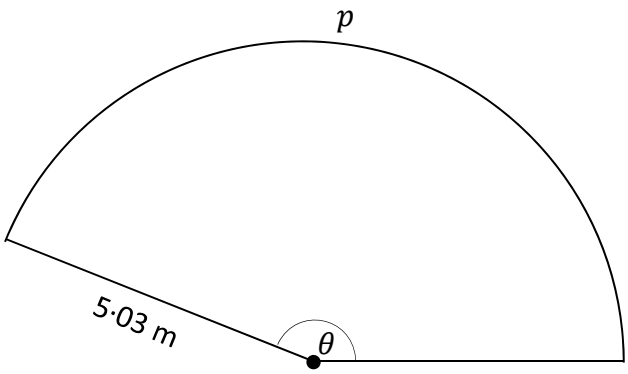
(ii) One litre of polish will cover 12·25 m^2. Find how many litres are needed to polish the entire sculpture. Give your answer correct to the nearest litre.

(iii) A container of polish contains 5 litres and costs A$110. Find the number of containers of polish that must be purchased in order to polish the entire sculpture and hence find the cost of the polish in euro (A$1 = €0·68). Give your answer correct to the nearest euro.

No. of containers: Cost (€):

(c) The diagram (not to scale) shows the net of the outer surface of one of the cones of the sculpture. It is a sector of a circle of radius length 5·03 m with arc length p m and angle θ at the centre, as shown below.

(i) Find p, the length of the arc of the sector. Give your answer correct to 2 decimal places.



(ii) Find θ, the angle at the centre of the sector. Show all your working out.
Give your answer correct to the nearest degree.

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Question 8 **(40 marks)**

The diagram below shows the triangles *CBA* and *CDE*.

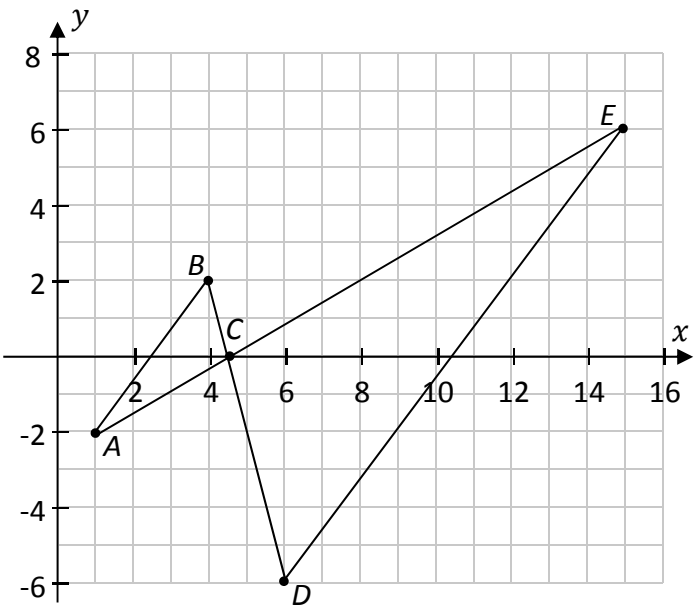
(a) The coordinates of *C* are $(4{\cdot}5, 0)$.
From the diagram, write down the coordinates of the points *A*, *B*, *D*, and *E*.

A = (,)

B = (,)

D = (,)

E = (,)



(b) Show, using slopes, that the line segments [*AB*] and [*DE*] are parallel.

(c) **(i)** Show that the area of the triangle *CBA* is 4 square units.

(ii) Find $|AB|$, the distance from *A* to *B*.

(iii) The triangle *CDE* is an enlargement of the triangle *CBA*.
Given that $|DE| = 15$ units, find the scale factor of the enlargement.

Scale factor =

(iv) Use this scale factor to find the area of the triangle *CDE*.

Question 9 **(55 marks)**

In June 2016 the UK held a referendum on its membership of the EU. Table 1 below summarises the results.

Table 1	
United Kingdom EU Membership Referendum 2016	
	Votes
Leave the EU	17 410 742
Remain a member of the EU	16 141 241
Valid votes	33 551 983
Invalid or blank votes	
Total votes	33 577 342

Source: *The UK Electoral Commission*

(a) **(i)** Write the number of *Invalid or blank votes* into the table.

(ii) Write the number who voted to *leave the EU* as a percentage of the *valid votes*. Give your answer correct to the nearest percent.

(b) Table 2 shows the percentages of "Remain" and "Leave" voters in various age groups of those who voted in the referendum.

Table 2		
Age Group	Remain (%)	Leave (%)
18 – 24	73	27
25 – 34	62	38
35 – 44	52	48
45 – 54	44	56
55 – 64	43	57
65+	40	60

(i) Draw a suitable chart or charts to represent the data in Table 2.

(ii) Find the mean of the "Remain" values given in Table 2 **and** find the mean of the "Leave" values given in Table 2. Give your answers as percentages, correct to 2 decimal places.

Remain:

Leave:

(iii) Explain why the answers to **part b(ii)** do not accurately reflect the actual outcome of the referendum.

This question is continued on the next page

(c) In the days following the UK referendum, a survey was conducted in Ireland on attitudes towards a British exit from the European Union.

(i) 1200 people were surveyed. Find the margin of error of this survey.
Write your answer as a percentage. Give your answer correct to the nearest percent.

(ii) In the Irish survey 578 of the 1200 surveyed agreed that a UK exit would have a negative effect on the Irish economy. Use your answer to **part c(i)** above to create a 95% confidence interval for the proportion of the Irish population who agreed that a UK exit would have a negative effect on the Irish economy.

(iii) After the survey, a political party claimed that 53% of the Irish population believed that the decision of the UK to leave the EU would have a negative effect on the Irish economy. Use your answer to **part c(ii)** above to conduct a hypothesis test, at the 5% level of significance, to test the party's claim.
Give your conclusion in the context of the question.

You may use this page for extra work.

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