Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination 2014
Sample Paper

Mathematics
(Project Maths – Phase 2)

Paper 2

Ordinary Level

Time: 2 hours

300 marks

Examination number

Centre stamp

Running total	

For examiner			
Question	Mark	Question	Mark
1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7			
8			
9			
10		Total	

Grade

Instructions

There are 16 questions on this examination paper. Answer **all** questions.

Questions do not necessarily carry equal marks. To help you manage your time during this examination, a maximum time for each question is suggested. If you remain within these times you should have about 10 minutes left to review your work.

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 all necessary work is not clearly shown.

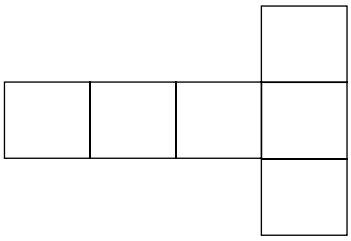
Answers should include the appropriate units of measurement, where relevant.

Answers should be given in simplest form, where relevant.

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

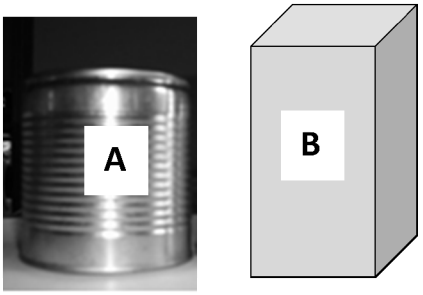
Question 1 **(Suggested maximum time: 2 minutes)**

The shape below, on the right, consists of 6 squares. Each side is 2 cm long. It can be folded to form a cube. Find the surface area of the cube.

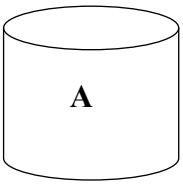


Question 2 **(Suggested maximum time: 10 minutes)**

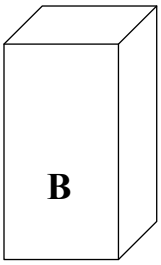
A food production company has to decide between a closed cylindrical tin A or a rectangular carton B to hold a product they are marketing for the first time. Both containers have the same volume.



(i) Tin A has a radius of 3 cm and a height of 10·6 cm. Find the volume of tin A. Give your answer correct to the nearest whole number.



(ii) Carton B has a square base of length 5 cm. Use the answer you got in **(i)** above to find the height of carton B.



(iii) Which one of the above containers do you think the company might choose? Give a reason for your answer.

Container:
Reason:

Question 3 **(Suggested maximum time: 5 minutes)**

Mary is planning to fly to London. The table shows the flights leaving Dublin Airport (DUB) and arriving in London Heathrow Airport (LHR) on a particular day.

Departing			Arriving	
DUB	06:40		LHR	08:05
DUB	07:30		LHR	09:05
DUB	08:50		LHR	10:15
DUB	09:50		LHR	11:10
DUB	12:10		LHR	13:25
DUB	13:40		LHR	14:55
DUB	14:40		LHR	15:55
DUB	15:50		LHR	17:10

(a) **(i)** Mary needs to arrive in Heathrow by 10:30 a.m. What is the departure time of the latest flight that she can take from Dublin Airport? _____

(ii) Find the time of her flight in hours and minutes.

(iii) Mary would like to arrive in Dublin Airport 75 minutes before that flight leaves. At what time should she arrive at the airport?

(b) Mary checks in one bag. The fare summary for her journey is given in the table below. Find how much the taxes and charges amount to.

Fare Summary (€)	
From Dublin to London Heathrow	
Fare	74·99
Taxes and Charges	
Baggage	25·00
Total	**133·88**

(c) The distance from Dublin to London is 464 km. Find the average speed of the airplane during the flight, in km/h.

Question 4 **(Suggested maximum time: 5 minutes)**

A survey was conducted among third-year students. The answers to survey questions can be classified as:

(i) Categorical data where the categories are not ordered
(ii) Ordered categorical data
(iii) Discrete numerical data
(iv) Continuous numerical data.

In each row in the table below, write a short question that will give the type of data stated.

Question:	Type of data:
Q1.	Categorical data where the categories are not ordered
Q2.	Ordered categorical data
Q3.	Discrete numerical data
Q4.	Continuous numerical data

Question 5 **(Suggested maximum time: 10 minutes)**

The following question was asked on the phase 9 *CensusAtSchool* questionnaire:
"Approximately how many hours per week do you spend on social networking sites?"

The data below are from two samples of students chosen at random from the UK and Ireland.

Number of hours	UK Number of students	Ireland Number of students
1	0	0
2	1	1
3	2	3
4	1	2
5	2	2
6	7	2
7	0	3
8	0	0
9	1	5
10	0	2
11	0	3
12	0	3
13	4	4
14	1	2
15	5	0
16	5	5
17	2	1
18	4	2
19	5	4
20	3	2
21	2	0
22	3	0
23	1	0
24	0	0
25	1	4

(i) How many students are in each sample? UK _____ Ireland _____

(ii) Display the data in a way that allows you to compare the two samples.
(Use a separate display for each sample.)

(iii) Based on your answer to part **(ii)**, write down one similarity and one difference between the two samples.

(iv) Based on the data in the table, is it true to say that there are differences between Irish and UK people regarding the time they spend on social networking sites? Explain your answer.

Answer:
Reason:

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Question 6 **(Suggested maximum time: 10 minutes)**

A bag contains red disks, blue disks, and white disks. In an experiment, each student in a class of 24 takes out a disk, records the colour, and replaces it. This is repeated ten times.
The results from the class are recorded in the table below.

Colour	**Red**	**Blue**	**White**	**Total**
Frequency	123	78	39	
Relative frequency $\left(\frac{\text{frequency}}{\text{total}}\right)$				
% of total (relative frequency $\times 100$)				

(i) In your opinion, why is the number recorded for red greater than for blue or white?

(ii) Complete the table above.

(iii) Use the results from the table above to estimate the probability of getting each colour when a disk is taken from the bag.

Colour	**Red**	**Blue**	**White**
Probability			

(iv) Anne says that she thinks there are ten discs in the bag. Is this a reasonable suggestion? Explain your answer.

Answer:
Reason:

(v) Based on the information in the table, how many disks of each colour do you think are in the bag? Give a reason for your answer.

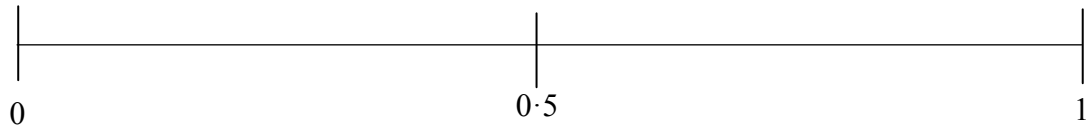
Answer:
Reason:

Question 7 **(Suggested maximum time: 10 minutes)**

(i) Estimate the probability for each of the events **A**, **B**, **C**, **D**, and **E** listed below, and write your answers into the table.

	Probability
A name is picked at random from a list of 50 girls and 50 boys. **A** = A girl's name is picked.	
A fair coin is tossed once. **B** = A head is the outcome.	
One card is drawn at random from a pack of playing cards. **C** = The card is a diamond.	
A day is chosen at random from a list of the days of the week. **D** = The name of the day contains the letter **a**.	
One number is picked at random from the set {1, 2, 3, 4, 5, 7, 11, 13}. **E** = The number chosen is a prime number.	

(ii) Place the letter for each of the events at the most appropriate position on the probability scale below.



(iii) Write down another event that you think has a probability similar to that of **C** in the table above.

(iv) Write down another event that you think has a probability similar to that of **D** in the table above.

(v) In a multiple-choice quiz, three possible answers are given to a question. James does not know the answer and guesses which one is correct. Put an X on the scale above to show the probability that he has chosen the correct answer.

Question 8 **(Suggested maximum time: 5 minutes)**

(a) The mean of a list of five numbers is 8.
Write down two different lists of numbers for which the above statement is true.

List 1:

List 2:

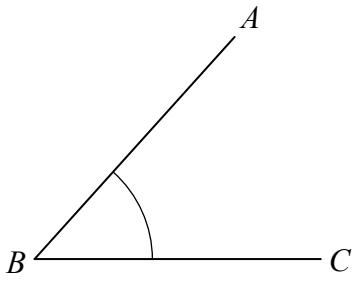
(b) The mode of a list of six numbers is 7.
Write down two different lists of numbers for which the above statement is true.

List 1:

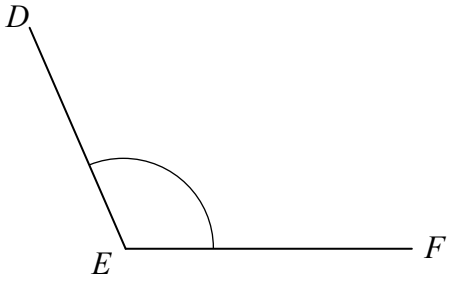
List 2:

Question 9 **(Suggested maximum time: 5 minutes)**

(a) Use a protractor to measure $|\angle ABC|$ and $|\angle DEF|$.

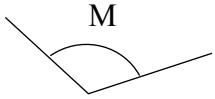


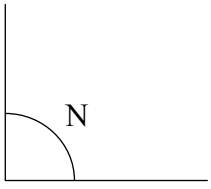
$|\angle ABC| =$ _____

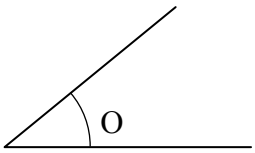


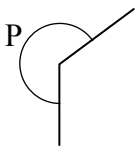
$|\angle DEF| =$ _____

(b) The four angles $\angle$M, $\angle$N, $\angle$O, and $\angle$P are shown in the diagrams below.









Starting with the smallest, arrange the four angles in order of magnitude.

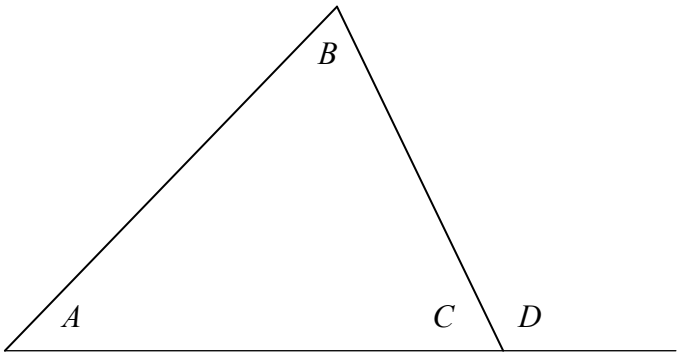
Question 10 **(Suggested maximum time: 10 minutes)**

(i) From the diagram opposite write down three angles which together add up to 180°.

$\square + \square + \square = 180°$

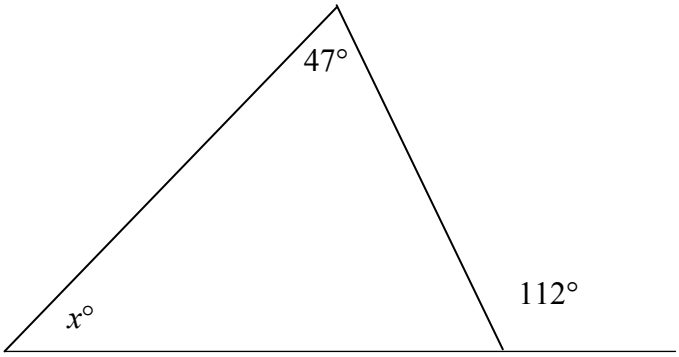
(ii) From the diagram opposite write down two angles which together add up to 180°.

$\square + \square = 180°$



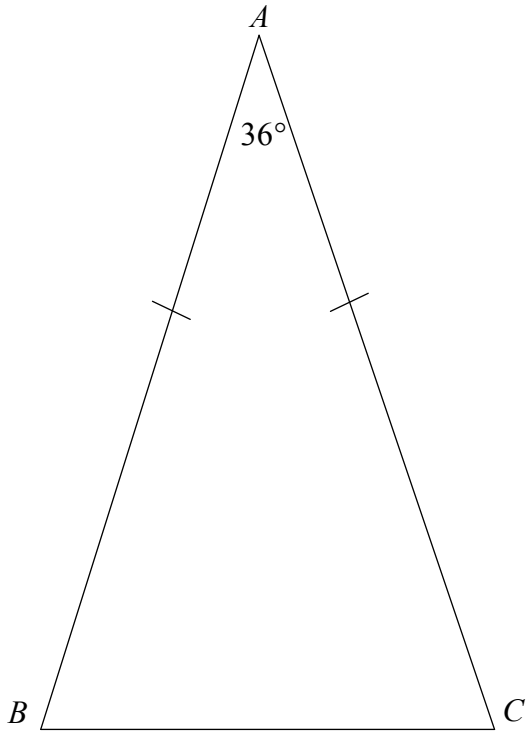
(iii) What can you conclude from your two statements about the relationship between $|\angle D|$ and $(|\angle A| + |\angle B|)$?

(iv) Find the value of x in the diagram.



Question 11 **(Suggested maximum time: 15 minutes)**

The triangle ABC is isosceles, as shown.
$|\angle BAC| = 36°$.



(i) Calculate $|\angle ACB|$.

(ii) On the diagram construct the bisector of $\angle ABC$. Show all construction lines clearly.

(iii) Mark in the point D where your bisector meets the line AC.

(iv) Calculate all the angles in the triangle BCD and write them into the diagram.

(v) Can you conclude that the triangle BCD is also isosceles? Give a reason for your answer.

(vi) Measure $|AC|$ and $|BC|$.

$|AC|$ = _____cm $|BC|$ = _____cm

(vii) Calculate the ratio $\frac{|AC|}{|BC|}$, correct to three places of decimals. $\frac{|AC|}{|BC|}$ = _____

Question 12 **(Suggested maximum time: 5 minutes)**

During a trigonometry lesson a group of students made some predictions about what they expected to find for the values of the trigonometric functions of some angles. They then found the sine, cosine and tangent of $25°$ and $50°$.

(i) In the table given, show, correct to three decimal places, the values they found.

$\sin 25° =$	$\cos 25° =$	$\tan 25° =$
$\sin 50° =$	$\cos 50° =$	$\tan 50° =$

(ii) Maria said: "The value from any of these trigonometric functions will always be less than 1." Was Maria correct? Give a reason for your answer.

Answer:

Reason:

(iii) Sharon said: "If the size of the angle is doubled then the value from any of these trigonometric functions will also double." Was Sharon correct? Give a reason for your answer.

Answer:

Reason:

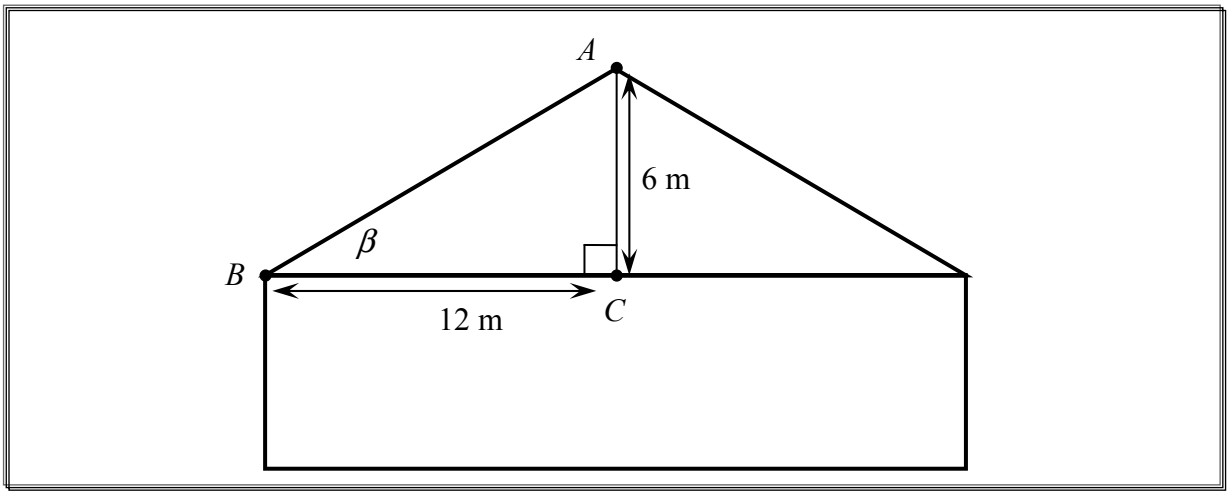
(iv) James said: "The value from all of these trigonometric functions will increase if the size of the angle is increased." Was James correct? Give a reason for your answer.

Answer:

Reason:

Question 13 **(Suggested maximum time: 5 minutes)**

Ella is building a house in Montreal. The roof of the house must have a minimum slope (pitch). This is to allow rain and snow to slide off the roof more easily. The pitch of Ella's roof is "6 in 12". She draws the diagram below to show her house, and marks the angle β.



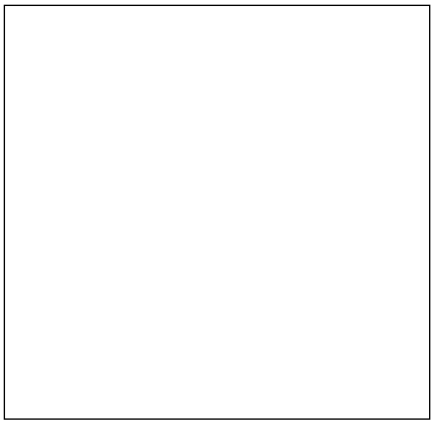
(a) **(i)** Using the right-angled triangle ABC, write down the value of $\tan\beta$ as a fraction.

(ii) Calculate the measure of the angle β. Give your answer correct to the nearest degree.

(b) Find the length of the roof from A to B. Give your answer correct to two decimal places.

Question 14 **(Suggested maximum time: 2 minutes)**

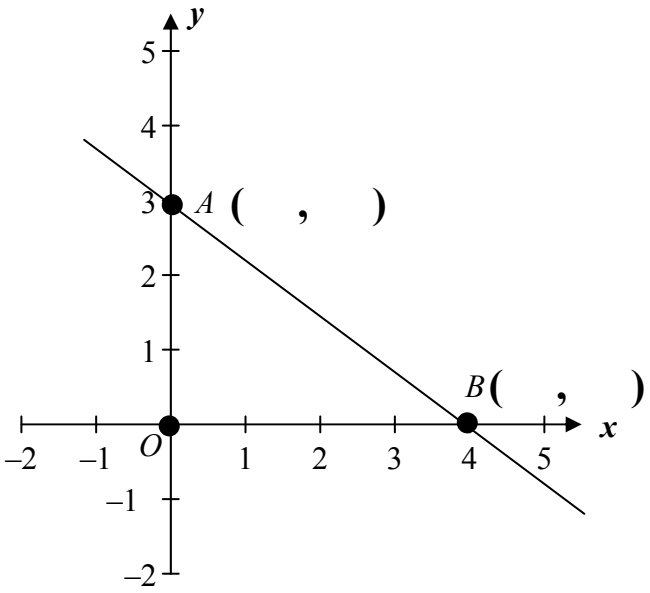
The following diagram shows a square.
Draw in all its axes of symmetry.



Question 15 **(Suggested maximum time: 5 minutes)**

(i) Write down the co-ordinates of the point A and the point B on the diagram.

(ii) Use the distance formula to find $|AB|$.



(iii) Write down the distance from O to A and the distance from O to B.

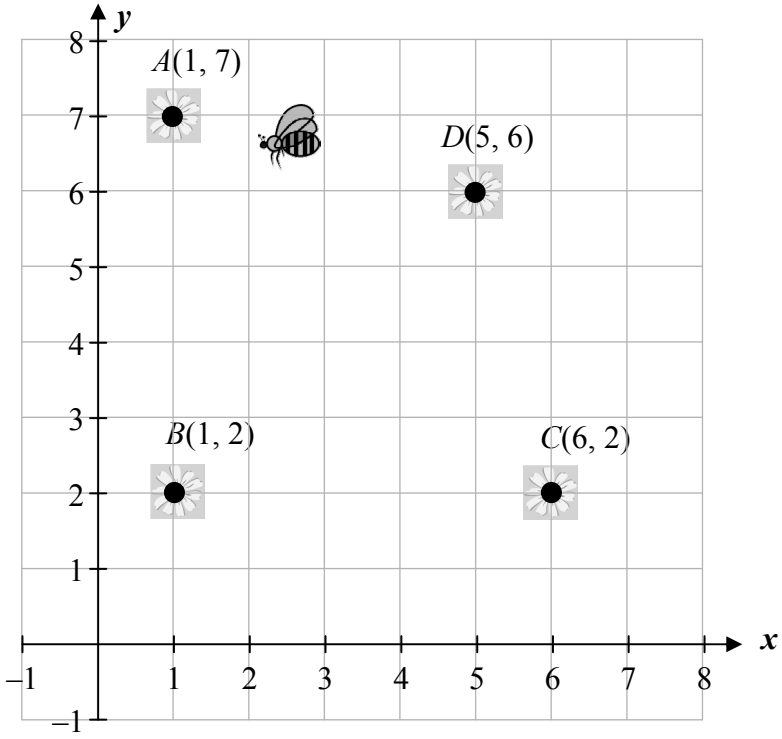
$|OA| =$ ☐

$|OB| =$ ☐

(iv) Use the Theorem of Pythagoras to find the length of the hypotenuse of the triangle OBA.

Question 16 **(Suggested maximum time: 5 minutes)**

A computer game shows the location of four flowers $A(1, 7)$, $B(1, 2)$, $C(6, 2)$, and $D(5, 6)$ on a grid. The object of the game is to collect all the nectar from the flowers in the shortest time.



(i) A bee found a hidden flower half way between flower B and flower D.
Find the co-ordinates of this hidden flower.

(ii) Another flower E can be located by completing the square $ABCE$. Write down the coordinates of the point E.

$E =$ _____

(iii) Bee 1 and Bee 2 are on flower A. Bee 1 flies directly from flower A to B and then on to C. Bee 2 flies from flower A directly to D and then on to C. Write down which bee has travelled the shortest total distance. Give a reason for your answer.

Answer: _____

Reason:

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Note to readers of this document:

This sample paper is intended to help teachers and candidates prepare for the June 2014 examination in *Mathematics* under Phase 2 of *Project Maths*. The content and structure do not necessarily reflect the 2015 or subsequent examinations.

The number of questions on the examination paper may vary somewhat from year to year.

Junior Certificate 2014 – Ordinary Level

Mathematics (Project Maths – Phase 2) – Paper 2

Sample Paper
Time: 2 hours