Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination, 2013

Mathematics
(Project Maths – Phase 1)

Paper 2

Higher Level

Monday 10 June Morning 9.30 to 12.00

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			
7			
8			
9			
10		Total	

Grade

Instructions

There are 15 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. 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.

Marks will be lost if all necessary work is not clearly shown.

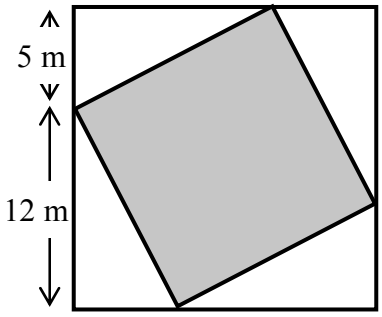
Answers should include the appropriate units of measurement, where relevant.

Answers should be given in simplest form, where relevant.

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

Question 1 **(Suggested maximum time: 10 minutes)**

Liam's garden is in the shape of a square. It has four equal right-angled triangular lawns and a smaller square patio in the centre, as shown.



(a) Find the length of the hypotenuse of one of the right angled triangular lawns.

(b) Find the area of one of the triangular lawns.

(c) Find the area of the square patio in the middle.

(d) The patio is to be paved with rectangular flagstones of length 80 cm and width 50 cm. Calculate the number of flagstones Liam needs to buy to cover the patio, allowing an extra 20% for waste.

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Question 2 **(Suggested maximum time: 15 minutes)**

The ages of the 30 people who took part in an aerobics class are as follows:

18	24	32	37	9	13	22	41	51	49
15	42	37	58	48	53	27	54	42	24
33	48	56	17	61	37	63	45	20	39

The ages of the 30 people who took part in a swimming class are as follows:

16	22	29	7	36	45	12	38	52	13
33	41	24	35	51	8	47	22	14	24
42	62	15	24	23	31	53	36	48	18

(a) Represent this data on a back-to-back stem-and-leaf diagram.

Aerobics class		**Swimming class**
	0	
	1	
	2	
	3	
	4	
	5	
	6	
	Key:	

(b) Use your diagram to identify the median in each case.

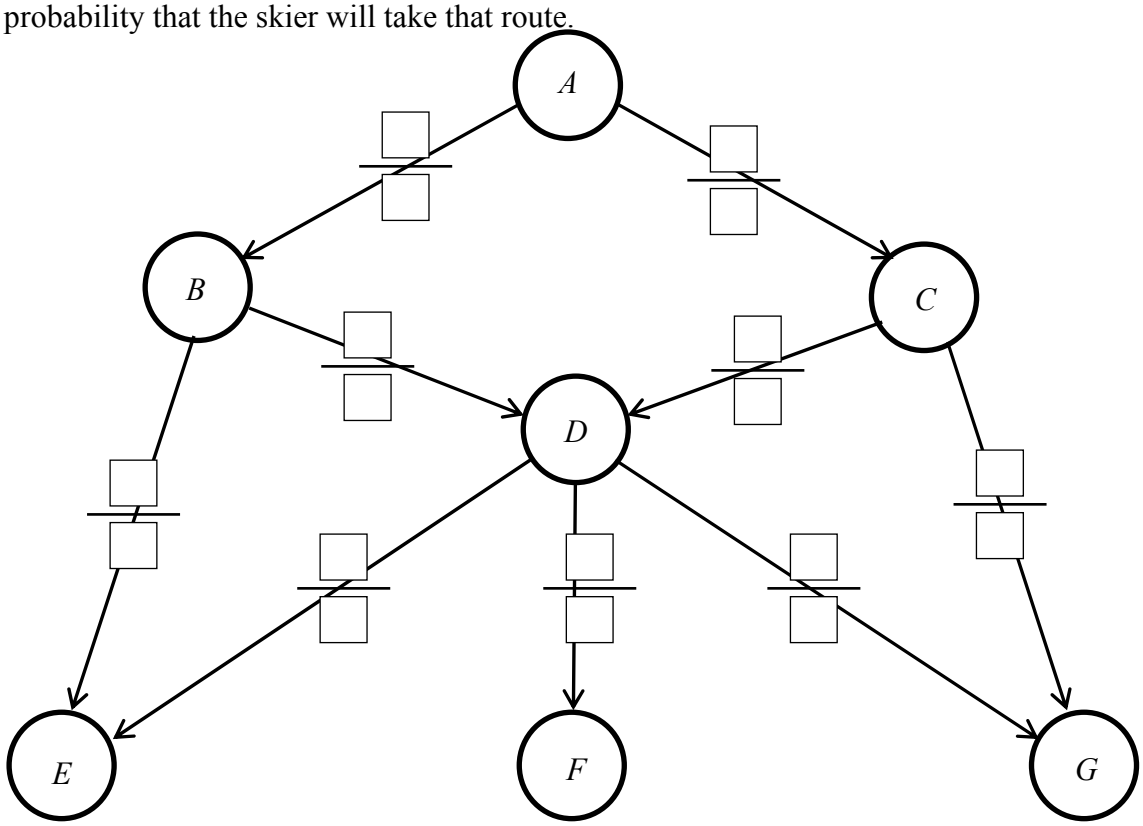
(c) What other measure of central tendancy could have been used when examining this data?

(d) Based on the data make one observation about the ages of the two groups.

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

The arrows represent the different routes that a skier can take when skiing down a mountain.
The circles on the diagram represent different points on the routes.

(a) When leaving any particular point on the mountain a skier is equally likely to choose any of the available routes from that point. Fill in the boxes in the diagram which represent the probability that the skier will take that route.



(b) **(i)** If the skier starts at point *A*, in how many different ways can the skier reach the point *E*?

(ii) If the skier starts at point *A*, find the probability that the skier will reach the point *E*.

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

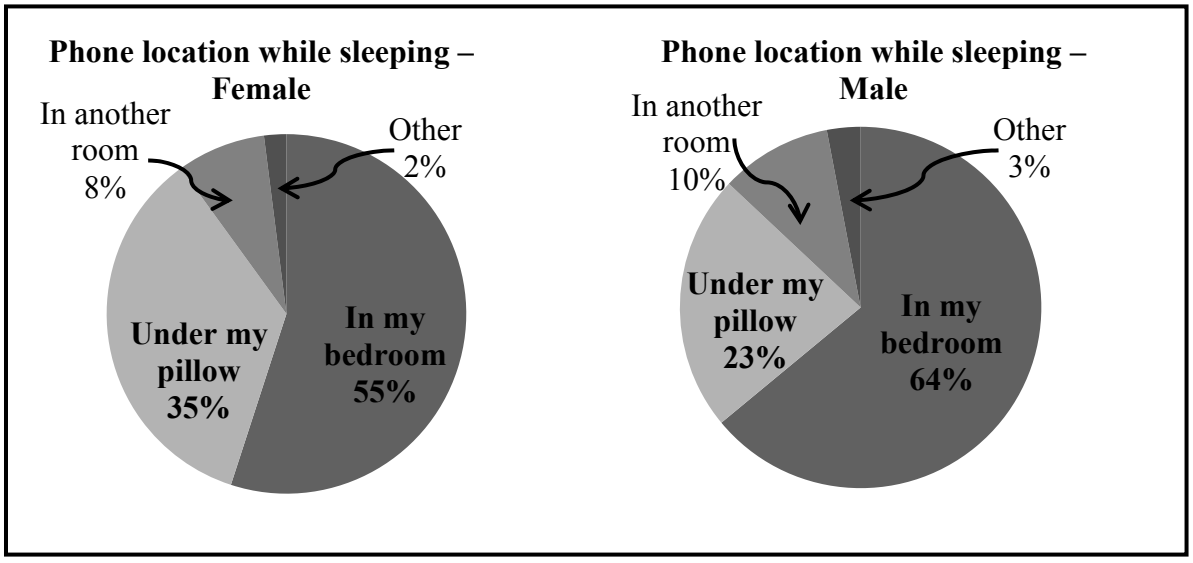
A football strip consists of a shirt, shorts and socks.
Aspen United has two shirts, blue and green, from which to select. They also can select from three different colours of shorts and five different colours of socks, including red in each case.

(a) Calculate how many different strips Aspen United can have.

(b) Willow Celtic plays in an all red strip. When Aspen United plays Willow Celtic, Aspen United are not allowed to use their red shorts or their red socks. Calculate how many different strips Aspen United can have when they play Willow Celtic.

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

In total 7150 second level school students from 216 schools completed the 2011/2012 phase 11 *CensusAtSchool* questionnaire. The questionnaire contained a question relating to where students keep their mobile phones while sleeping.



(a) Given that this question was answered by 4171 girls and 2979 boys, calculate how many female students kept their mobile phones under their pillows.

(b) Calculate the overall percentage of students who kept their mobile phones under their pillows.

(c) A new pie chart is to be drawn showing the mobile phone location for all students.
Calculate the measure of the angle that would represent the students who kept their mobile phones under their pillows.

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Question 6 **(Suggested maximum time: 20 minutes)**

The salaries, in €, of the different employees working in a call centre are listed below.

22 000	16 500	38 000	26 500	15 000	21 000	15 500	46 000
42 000	9500	32 000	27 000	33 000	36 000	24 000	37 000
65 000	37 000	24 500	23 500	28 000	52 000	33 000	25 000
23 000	16 500	35 000	25 000	33 000	20 000	19 500	16 000

(a) Use this data to complete the grouped frequency table below.

Salary (€1000)	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60	60 – 70
No. of Employees							

[Note: 10 – 20 means €10 000 or more but less than €20 000, etc.]

(b) Using mid-interval values find the mean salary of the employees.

(c) **(i)** Outline another method which could have been used to calculate the mean salary.

(ii) Which method is more accurate? Explain your answer.

Answer

Reason

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

In a survey, 54 people were asked which political party they had voted for in the last three elections. The results are as follows:

30 had voted for the Conservatives
22 had voted for the Liberals
22 had voted for the Republicans

12 had voted for the Conservatives and for the Liberals
9 had voted for the Liberals and for the Republicans
8 had voted for the Conservatives and for the Republicans

5 had voted for all three parties.

(a) Represent the information in a Venn diagram.

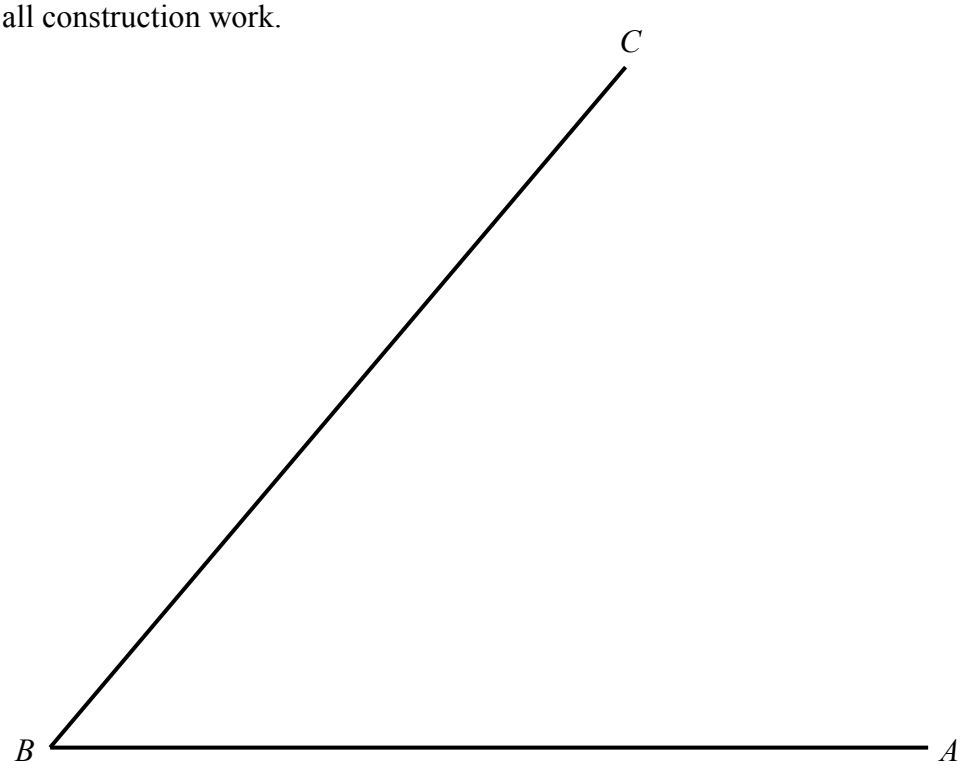
(b) If one person is chosen at random, what is the probability that the person chosen did not vote in any of the three elections?

(c) If one person is chosen at random, what is the probability that the person chosen voted for at least two different parties?

(d) If one person is chosen at random, what is the probability that the person chosen voted for the same party in all three elections?

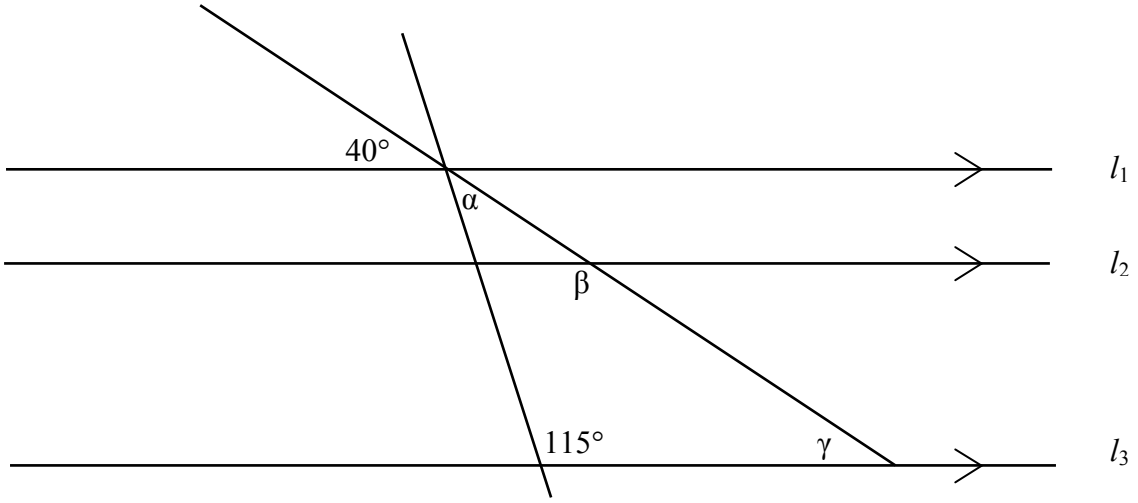
Question 8 **(Suggested maximum time: 5 minutes)**

Construct the bisector of the $\angle ABC$ below, using only a compass and straight edge.
Show all construction work.



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

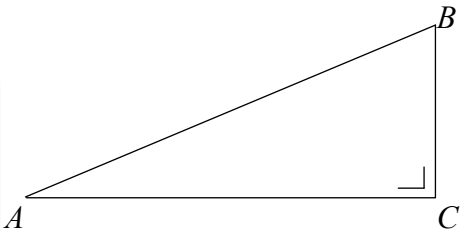
If l_1, l_2 and l_3 are parallel lines, find the measure of the angles α, β and γ.



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

In the triangle ABC, $|AB| = 2$ and $|BC| = 1$.

(a) Find $|AC|$, giving your answer in surd form.



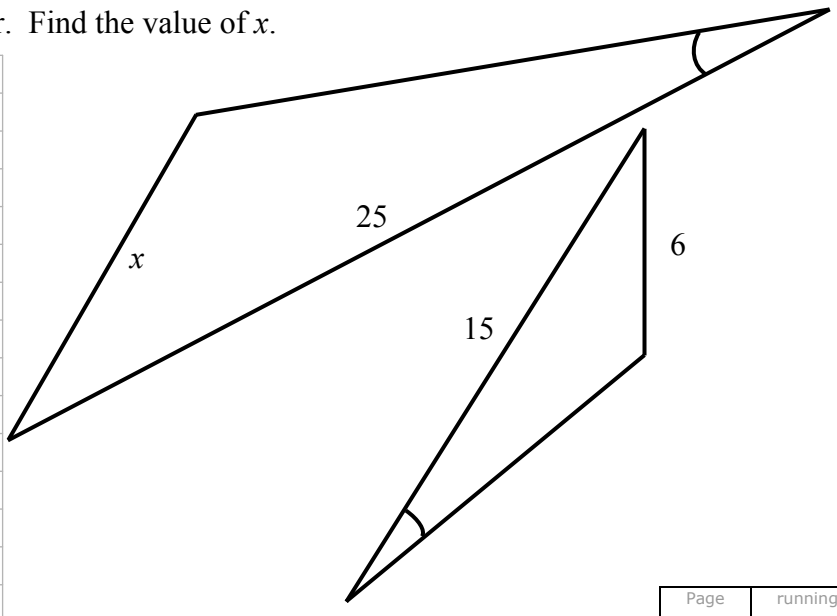
(b) Write $\cos \angle BAC$ and hence find $\left|\angle BAC\right|$.

(c) Sketch a right angled isosceles triangle in which the equal sides are 1 unit each and use it to write cos 45° in surd form.

(d) Show that $\cos 75° \neq \cos 45° + \cos 30°$.

Question 11 **(Suggested maximum time: 5 minutes)**

The two triangles shown are similar. Find the value of x.



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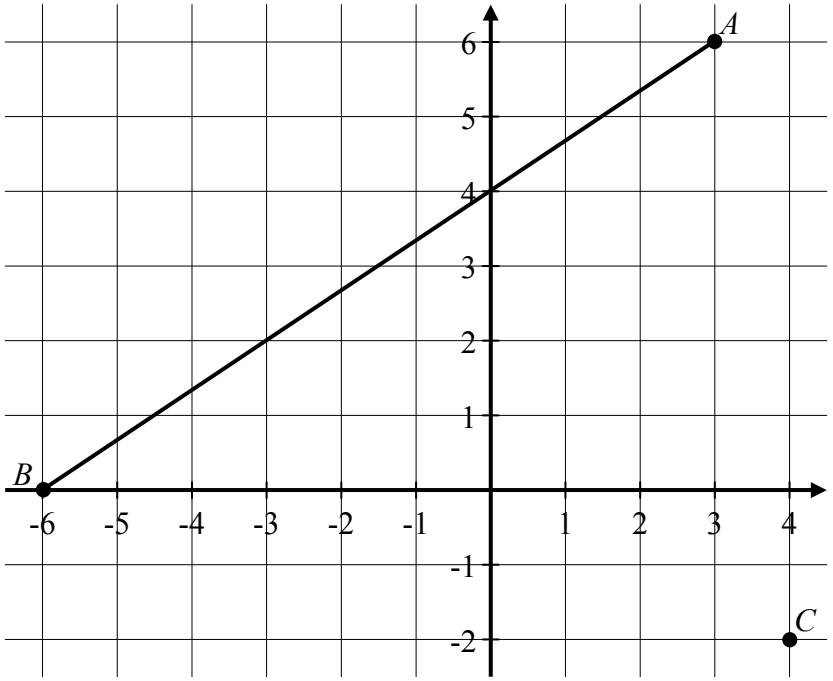
Question 12 **(Suggested maximum time: 20 minutes)**



(a) Write the coordinates of A, B and C.

$A\ (\quad,\quad)$ $B\ (\quad,\quad)$ $C\ (\quad,\quad)$

(b) Find the co-ordinates of D, the mid-point of $[AB]$.

(c) Find the equation of the line AB.

(d) Find the equation of the line through C, perpendicular to AB.

(e) Let E be the point where this perpendicular line through C intersects AB.
Calculate the coordinates of the point E.

(f) Which is the shorter distance, $|CD|$ or $|CE|$? Find this distance.

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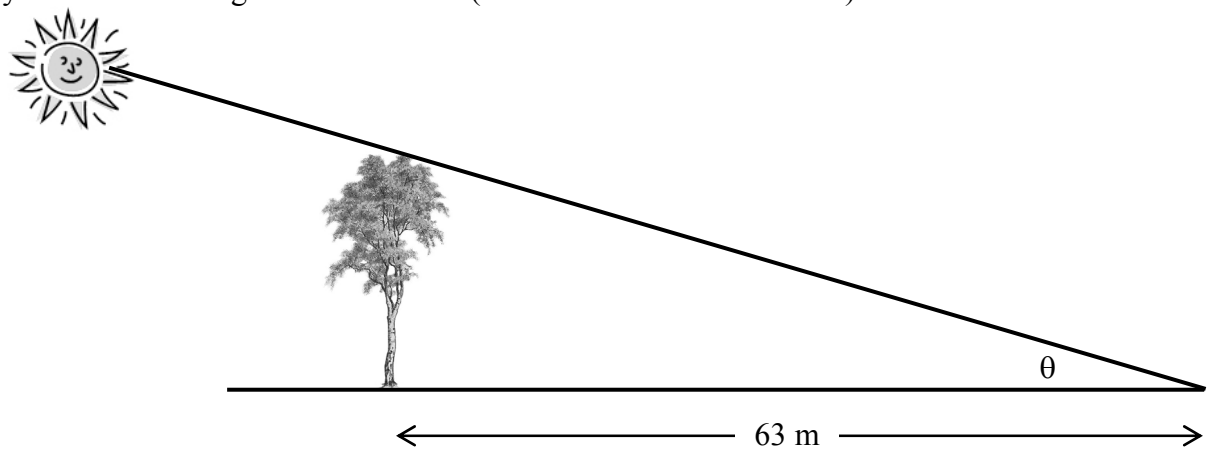
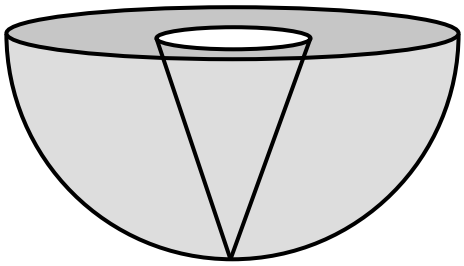
Question 13 **(Suggested maximum time: 5 minutes)**

A tree 32 m high casts a shadow 63 m long. Calculate θ, the angle of elevation of the sun.
Give your answer in degrees and minutes (correct to the nearest minute).



Question 14 **(Suggested maximum time: 10 minutes)**

A solid metal hemisphere has a radius of 12 cm.



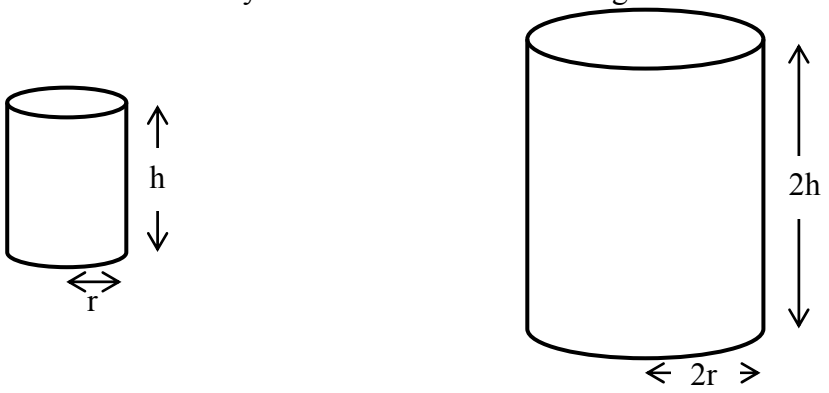
(a) Calculate the volume of the hemisphere. Give your answer in terms of π.

(b) A solid cone of radius 4 cm and height 12 cm is cut from the hemisphere.
Calculate the volume of the cone. Give your answer in terms of π.

(c) The remaining metal in the hemisphere is melted down and recast into cones of the same dimensions as the cone above. How many cones can be formed from the remaining metal?

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

The dimensions of two solid cylinders are shown in the diagrams below.



(a) Calculate the ratio of the curved surface area of the smaller cylinder to the curved surface area of the larger cylinder.

(b) Calculate the ratio of the volume of the smaller cylinder to the volume of the larger cylinder.

You may use this page for extra work.

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