Index No:_____ SEC23/1a.13m

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2013 SESSION

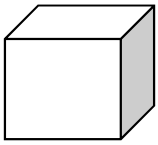
SUBJECT: Mathematics **PAPER:** I – Section A (Non-Calculator Section)
DATE: 6th May 2013 **TIME:** 20 minutes

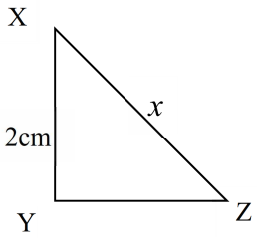
ATTEMPT ALL QUESTIONS.

Write your answers in the space available on the examination paper.
The use of calculators and protractors is NOT allowed.
It is not necessary to show your working.
This paper carries a total of 20 marks.

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)
1 Work out $\frac{4 \times 13 \times 27}{39 \times 18}$. _____ **Ans**	
2 Arrange in order, starting from the smallest: 3.2, π, $\frac{25}{7}$, -4. _____ **Ans**	
3 A regular pentagon has sides of length 12cm. How long is its perimeter? _____ **Ans**	

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)
4 Find the value of $2a^2 - b^2$ where $a = 3$ and $b = -1$. _____ **Ans**	
5 Find the average weight of 3 boxes weighing 5.2 kg, 3.7 kg and 3.1 kg respectively. _____ **Ans**	
6 Work out: $108^2 - 92^2$. _____ **Ans**	
7 ABCD is a cyclic quadrilateral with angle B = 80º. What is the size of angle D? _____ **Ans**	
8 Write down 0.00452, in standard form. _____ **Ans**	
9 Solve the equation $x(2 - x) - 1 = 5 - x^2$. _____ **Ans**	

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)
10 Find the total surface area of a cube with sides 10 cm.  _____ **Ans**	
11 The number of boys and girls in a mixed school are in the ratio of 13 : 7, there being more boys than girls. If there are 420 children in all, how many of these are girls? _____ **Ans**	
12 Find x if $(-1)^x = 1$ and x is smaller than 2. _____ **Ans**	
13 In a local village of 3,000 households, the number of households using internet increased from 63% to 75% in the past year. How many new internet connections were made during the past year? _____ **Ans**	
14 In triangle PQR, $\angle$ PQR is 25^o and PR = RQ. Find $\angle$ PRQ. _____ **Ans**	

QUESTIONS AND ANSWERS ALL QUESTIONS CARRY ONE MARK	SPACE FOR ROUGH WORK (IF NECESSARY)
15 I throw a die numbered 1 to 6. What is the probability that I get a number less than 5? _____ **Ans**	
16 Express 34,865 m in km correct to 3 significant figures. _____ **Ans**	
17 Find the least common multiple of 10, 13 and 26. _____ **Ans**	
18 Write down the 21st term in the sequence: $\frac{x}{10}, \frac{x^2}{20}, \frac{x^3}{30}, \ldots$ _____ **Ans**	
19 XYZ is a triangle, right-angled at Y. XZ is x cm long and XY is 2 cm long. Write down an expression for YZ, in terms of x.  _____ **Ans**	
20 Ms Vella had a pay rise of 5%, so that her new salary is now €1,680 per month. What was her monthly pay before the rise? _____ **Ans**	

Index No:_____ SEC23/1b.13m

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2013 SESSION

SUBJECT:	**Mathematics**
PAPER NUMBER:	I – Section B (Calculator Section)
DATE:	6th May 2013
TIME:	1hr and 40 minutes

ANSWER ALL QUESTIONS

Write your answers in the space available on the examination paper.

Show clearly all the necessary steps, explanations and construction lines in your working.

Unless otherwise stated, diagrams are drawn to scale.

The use of non-programmable electronic calculators with statistical functions and mathematical instruments is allowed.

Candidates are allowed to use transparencies for drawing transformations.

This paper carries a total of 80 marks.

For Office Use Only											
Mental	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**

DO NOT WRITE ABOVE THIS LINE

1 **(i)** Express 0.5632 litres in millilitres.

1 mark

(ii) Change the speed of 42 km per hour to metres per second.

2 marks

(iii) Convert an area of 3.7 m^2 into cm^2.

2 marks

(iv) Change £340 to €, to the nearest cent, if the exchange rate is €1 = £0.818

3 marks

2 Solve the simultaneous equations: $2a - 3b = 26$; $4a + 5b = -25$.

4 marks

3 **(a)** What is the value of $2 - 10 \times (-4)$?

2 marks

(b) Use a calculator to work out $\frac{\pi}{2}\left(\sqrt{5sin\ 30°}\right)$, correct to 3 decimal places.

2 marks

4 **(a)** If $x + 3y = 15$ and $z = 9$, what is the value of $x + 3(y + z)$?

3 marks

(b) A formula for the period T of Simple Harmonic Motion is $T = 2\pi\sqrt{\frac{m}{k}}$, where T is in seconds and m is in kg.

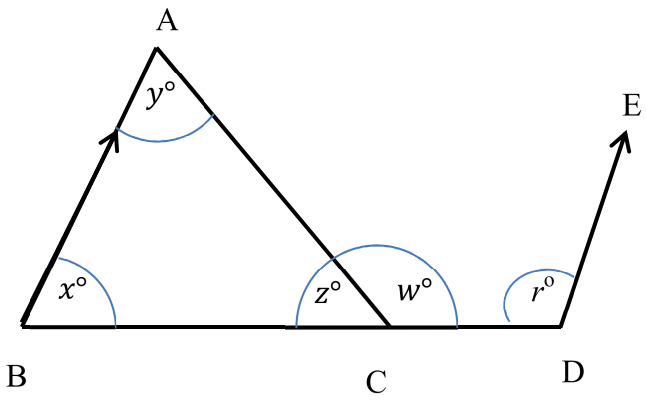
(i) Make k the subject of the formula.

3 marks

(ii) If T = 0.5 s and k = 125, work out the value of the mass m in kg, correct to 3 significant figures.

3 marks

5 ABC is a triangle and BCD is a straight line. DE is parallel to BA.



The diagram is not drawn to scale.

(i) Prove that $w = x + y$.

3 marks

(ii) If y is twice x and w is 105^{o}, find:

(a) the value of x,

(b) the value of r

5 marks

6 The five levels on a microwave oven have the power settings shown below:

Heat Level	Power in Watts
1: High	800W
2: Medium - High	600W
3: Medium	450W
4: Medium - Low	300W
5: Low	100W

It is to be assumed that the cooking time is inversely proportional to the power used.

(i) If using 1 Kilowatt of electricity for 1 hour costs €0.20, how much is the cost of cooking a dish for 10 minutes in the microwave oven at the Medium-High setting?

4 marks

(ii) A cake takes 6 minutes to cook on Medium heat (level 3). How long would it take to cook on the Low heat (level 5)?

3 marks

(iii) A recipe for sweet and sour pork suggests a cooking time of 24 minutes on Medium - Low (level 4). On which setting would the same dish take only 9 minutes, although the result may not be so tasty?

3 marks

7 Emily recorded the running times of the films in her DVD collection and tabled her results as follows:

Time in minutes	Number of films
$90 < t \leq 100$	3
$100 < t \leq 110$	1
$110 < t \leq 120$	4
$120 < t \leq 130$	5
$130 < t \leq 140$	7
$140 < t \leq 150$	2

(i) Calculate the mean time of a film, correct to the nearest minute.

3 marks

(ii) Which is the modal class?

1 mark

(iii) Which class contains the median? Explain the reason for your answer.

2 marks

(iv) Emily selects a film at random. What is the probability that the chosen film lasts more than 130 minutes?

2 marks

DO NOT WRITE ABOVE THIS LINE

8 **(a)** Find the size of the interior angle of a regular hexagon.

3 marks

(b) Each interior angle of a regular polygon is 156°. How many sides does this polygon have?

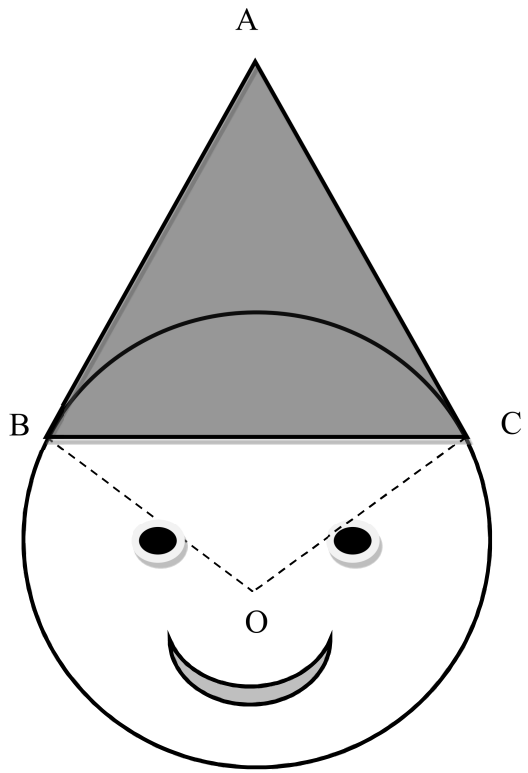
3 marks

(c) Find a formula for the number of sides of a regular polygon, whose interior angles are each x degrees.

3 marks

9 In a class, each child is to construct a mask showing a clown for the Carnival party.
The teacher uses cardboard to cut out an **equilateral** triangle ABC for the clown's hat.
The teacher also cuts out a circle of radius 10 cm for the clown's face.

The triangle is then glued to the face as shown below, so that the sides AB and AC are **tangents** to the circle.



(i) Draw a line of symmetry in the given figure (which is not drawn to scale).

1 mark

(ii) Show that the angle subtended at the centre O of the circle, by the chord BC is 120°.

3 marks

(iii) Calculate the length of the sides of triangle ABC in cm, correct to 2 decimal places.

2 marks

(iv) Find the length of the perpendicular from O to BC in cm, correct to 2 decimal places.

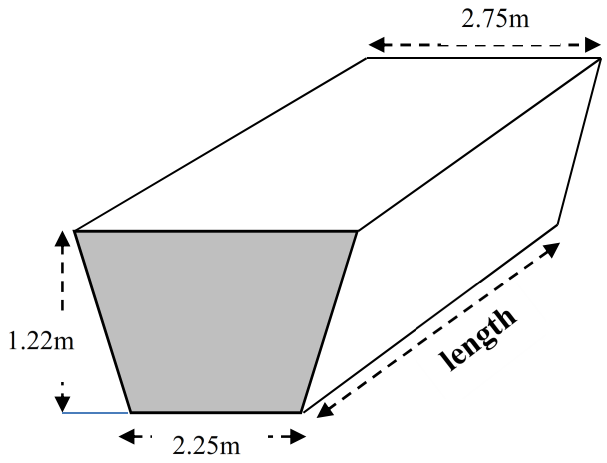
2 marks

(v) Find the area of that part of the circle that is not covered by the hat. Give your answer in cm^2, correct to 2 decimal places.

4 marks

DO NOT WRITE ABOVE THIS LINE

10 A skip has a capacity of 8.8 m^3. It is in the shape of a prism with a trapezium cross-section as shown.



The figure is not drawn to scale.

(i) Sand is poured into the skip at the rate of 0.2 m^3 per minute. Find the time taken to fill the skip completely.

2 marks

(ii) Find the area of the trapezium cross-section of the skip.

3 marks

(iii) Calculate the length of the skip. Give your answer in metres, correct to two decimal places.

3 marks

END OF EXAMINATION

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MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2013 SESSION

SUBJECT:	**Mathematics**
PAPER NUMBER:	IIA
DATE:	7th May 2013
TIME:	4:00 p.m. to 6:00 p.m.

ANSWER ALL QUESTIONS.

Write your answers on the booklet provided.

Show clearly all the necessary steps, explanations and construction lines in your working.

Unless otherwise stated, diagrams are drawn to scale.

The use of non-programmable electronic calculators with statistical functions and mathematical instruments is allowed.

Candidates are allowed to use transparencies for drawing transformations.

This paper carries a total of 100 marks.

Table of formulae

Area of triangle	$\frac{1}{2}ab\sin C$
Curved Surface Area of Right Circular Cone	πrl
Surface Area of a Sphere	$4\pi r^2$
Volume of a Pyramid / Right Circular Cone	$\frac{1}{3}$ base area × perpendicular height
Volume of a Sphere	$\frac{4}{3}\pi r^3$
Solutions of the equation $ax^2 + bx + c = 0$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Sine Formula	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Cosine Formula	$a^2 = b^2 + c^2 - 2bc\cos A$

1 **(a)** Factorise: **(i)** $x^2y - 9y^3$ **(ii)** $10x^2 + 13xy - 3y^2$

4 marks

(b) Find the value of x such that: **(i)** $6^{-x} = \frac{1}{36}$

(ii) $\frac{5^0}{5^x} = 25,$

(iii) $(2x^{-1})^2 = 64$

7 marks

---

2 An aeroplane makes a flight of 4800 km, correct to the nearest 10 km. The flight takes 4 hours 20 minutes, correct to the nearest 10 minutes. Calculate in km/h, to the nearest integer:

(i) the average speed of the aeroplane;

2 marks

(ii) the lowest possible speed of the aeroplane;

3 marks

(iii) the highest possible speed of the aeroplane.

3 marks

---

3 Mr Galea inherited a sum of money. He decided to deposit half of it in a Bank paying simple interest at 4% and invest the other half in a business venture paying him compound interest at 4%.

(i) After 10 years he finds that the Bank has paid him €4,208 in interest. Find the sum of money that he invested in the Bank.

3 marks

(ii) Calculate to the nearest Euro, the interest Mr Galea earned from the Business venture, after 10 years.

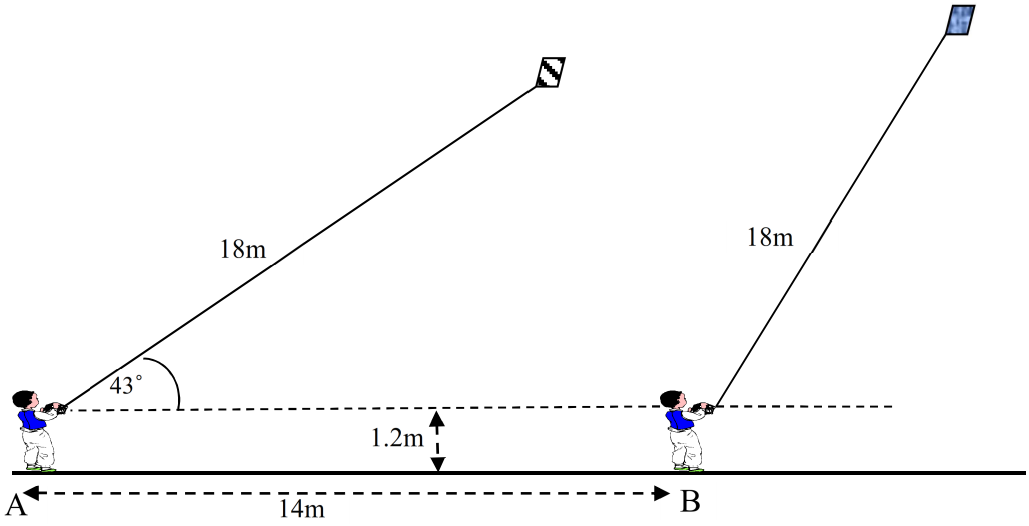
4 marks

(iii) What is Mr Galea's inheritance worth altogether, after 10 years? Give your answer to the nearest Euro.

2 marks

---

4 Twins Andy (A) and Bobby (B) are on a straight horizontal line, flying their kites as shown in the diagram. They are separated by a distance of 14 m and their strings are both 18 m long. Both boys are holding the string at 1.2 m above the ground and the kites are flying in the same vertical plane.
The angle of elevation of the kite from Andy's hand is 43°.



(i) Find how high above the ground is Andy's kite flying, giving your answer in metres, correct to one decimal place.

3 marks

(ii) If Bobby's kite is flying 3.47 m higher than Andy's kite, what is the angle of elevation of Bobby's kite from his hand? Give your answer to the nearest degree.

3 marks

(iii) Calculate the horizontal distance between the two kites, giving your answer in metres, correct to one decimal place.

5 marks

---

5 Consider the functions $f(x) = 3x + 5$ and $g(x) = 1 - 2x$.

(i) Show that $f^{-1}(2) < g(-3)$.

3 marks

(ii) Find the value of a such that $f(2a) = g^{-1}(a) - 2$.

3 marks

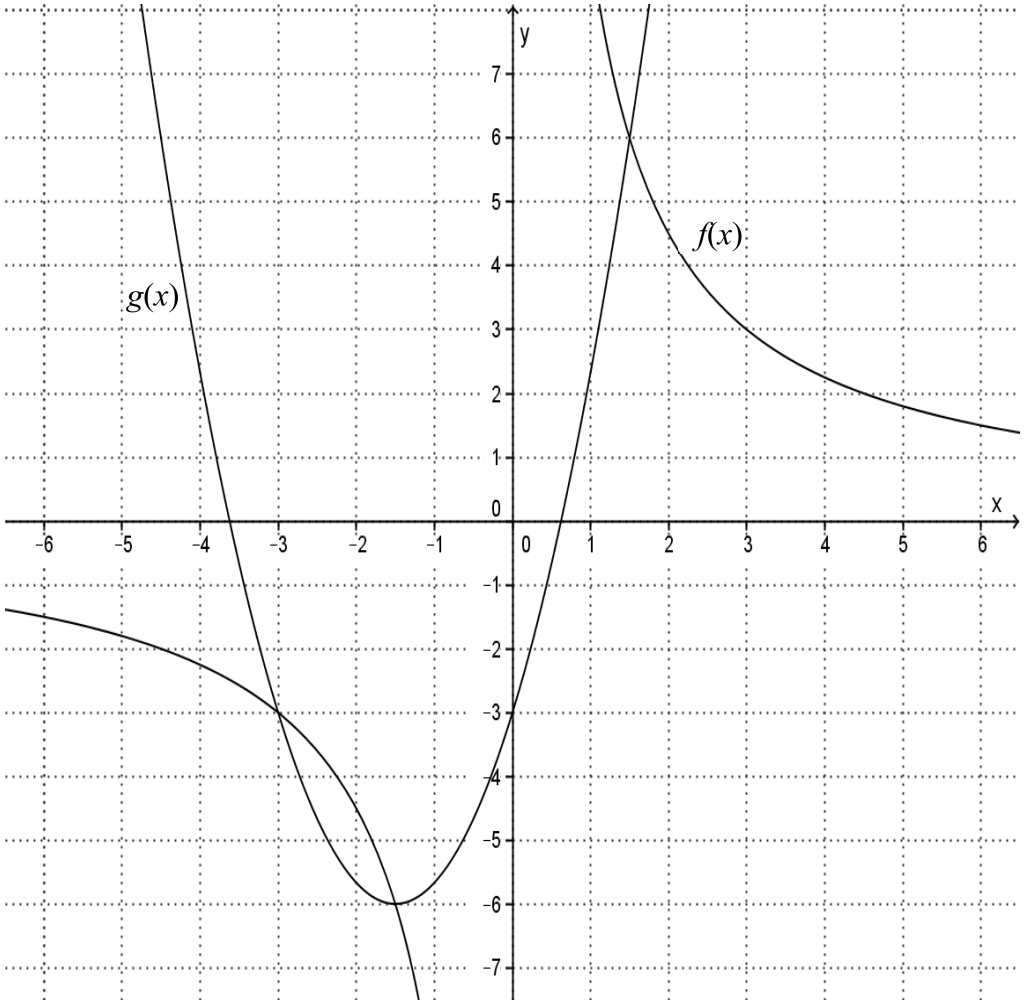
(iii) Solve the equation $\frac{f(x)}{2} + \frac{g(x)}{3} = -23$.

4 marks

---

6 The diagram below shows the two graphs of $y = f(x)$ and $y = g(x)$ where:

$$f(x) = \frac{9}{x} \quad \text{and} \quad g(x) = \frac{4}{3}x^2 + 4x - 3$$



(i) What is the minimum value of $g(x)$?

1 mark

(ii) Write down a negative value of x for which $f(x) > g(x)$.

1 mark

(iii) From the graphs, determine the values of x for which $x(4x^2 + 12x - 9) = 27$.

3 marks

(iv) Write down approximate solutions to the equation $4x^2 + 12x - 9 = 0$.

2 marks

7 During an experiment, the mass and the volume of two objects made from different materials were measured. The density, which is $\frac{mass}{volume}$ was calculated.

	Mass in kg	**Volume in m^3**	**Density**
Material A	**3**	x	
Material B	**2**	y	

(i) It was noted that the density of material A is 5 kg/m^3 more than the density of material B. Obtain an equation in terms of x and y, relating the densities of A and B.

3 marks

(ii) If the volume of the object of material B is 1 m^3 more than the volume of the object from material A, express y in terms of x.

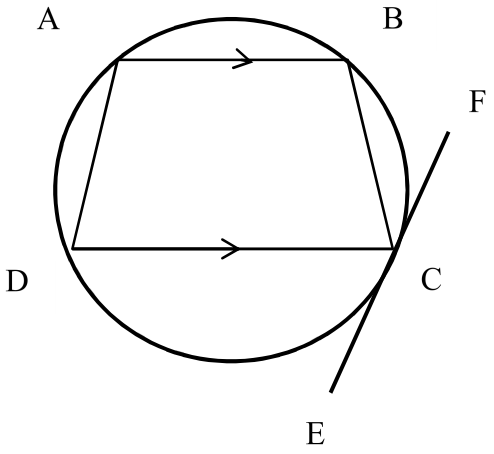
1 mark

(iii) Solve the two equations you obtained to find the values of x and y, in m^3 correct to 2 decimal places.

6 marks

---

8 ABCD is a trapezium inscribed in a circle such that AB is parallel to DC. EF is a tangent to the circle, touching it at C.



(i) Prove that angle ADC = angle BCD.

3 marks

(ii) Prove that triangles ACD and BCD are congruent. Hence show that if a trapezium is inscribed in a circle, the sides that are not parallel must be equal.

4 marks

(iii) Given that angle BCF = 50° and angle ADB = 32°, find angle DAC.

3 marks

---

9 The votes, out of 100, obtained by singers in a song contest were recorded in a spreadsheet as follows:

	A	B	C	D
1	**Votes**	**Half-way value**	**No. of singers**	**Cumulative Frequency**
2	1 - 10	5.5	2	
3	11 - 20	15.5	4	
4	21 - 30	25.5	5	
5	31 - 40	35.5	4	
6	41 - 50	45.5	6	
7	51 - 60	55.5	10	
8	61 - 70		12	
9	71 - 80		15	
10	81 - 90		5	
11	91 - 100		2	
12				
13				

You can complete the table given above, but do not copy it on your script.

(i) What **formula** should be placed in the cell **C12** if it is to show the total number of singers participating in the contest?

1 mark

(ii) If an award was given to singers obtaining more than 80 votes, how many singers failed to get an award?

2 marks

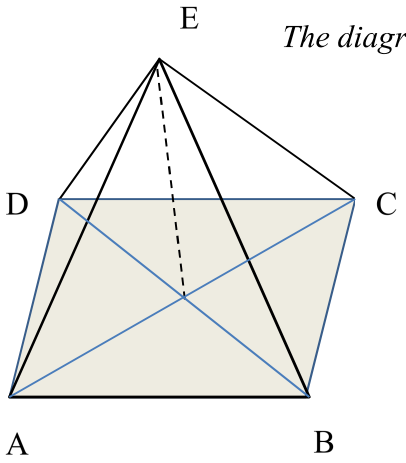
(iii) On the graph paper provided, draw the cumulative frequency curve for the given data.

6 marks

(iv) From your graph, determine the lower quartile, the upper quartile and the interquartile range.

3 marks

10 The Great Pyramid of Giza in Egypt has a **square** base of side 230.4 m and its vertical height is 146.5 m. The pyramid is modelled by the diagram shown below.



The diagram is not drawn to scale.

(i) Calculate the volume of this pyramid in m^3, giving your answer correct to 3 significant figures, in standard form.

3 marks

(ii) Calculate the angle between the plane BCE and the base ABCD, to the nearest degree.

3 marks

(iii) If the model uses a scale of 1: 1000, calculate correct to 2 decimal places:

(a) the length in cm, of the side EB in the model;

3 marks

(b) the area of the base of the model in m^2.

3 marks

END OF EXAMINATION

Index No:_____ SEC23/2B.13m

MATRICULATION AND SECONDARY EDUCATION CERTIFICATE EXAMINATIONS BOARD
UNIVERSITY OF MALTA, MSIDA

SECONDARY EDUCATION CERTIFICATE LEVEL

MAY 2013 SESSION

SUBJECT:	**Mathematics**
PAPER NUMBER:	IIB
DATE:	7th May 2013
TIME:	4:00 p.m. to 6:00 p.m.

ANSWER ALL QUESTIONS

Write your answers in the space available on the examination paper.

Show clearly all the necessary steps, explanations and construction lines in your working.

Unless otherwise stated, diagrams are drawn to scale.

The use of non-programmable electronic calculators with statistical functions and mathematical instruments is allowed.

Candidates are allowed to use transparencies for drawing transformations.

This paper carries a total of 100 marks.

For Office Use Only										
Question No	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Mark										

Question No	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Mark										

Total

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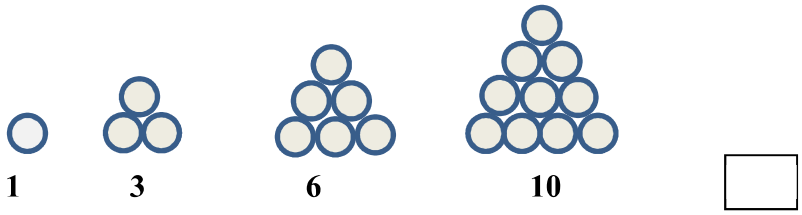
1 Express 0.00052 in standard form.

1 mark

2 Find the number that comes next in the given sequence :



2 marks

3 Simplify $\left(\frac{1}{9}\right)^{2} \times \left(\frac{3}{4}\right)^{4} \div \left(\frac{1}{2}\right)^{9}$.

2 marks

4 What is the probability that if I throw two dice, I get two sixes?

2 marks

5 A firm makes a profit of €1,275 on an outlay of €7,500. Express this profit as a percentage.

2 marks

6 Write down the value of p such that $\left(\frac{1}{2}\right)^{p} = 0.0625$.

2 marks

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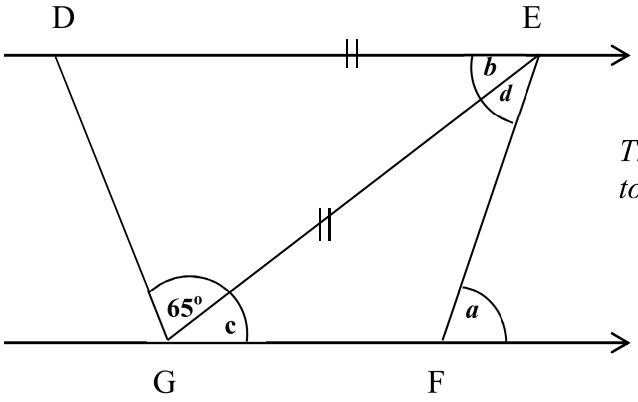
7 In the figure below, DE is parallel to GF and DE = GE. Angle DGE = 65°.



The diagram is not drawn to scale

(i) What is the type of quadrilateral DEFG called?

1 mark

(ii) Find the angles marked ***b*** and ***c***, giving reasons for your answer.

3 marks

(iii) If angle ***a*** = 80°, find the angle marked ***d*** .

2 marks

8 **(i)** Given that $f(t) = t^2 + 2t - 1$, find $f(1)$ and $f(-1)$.

2 marks

(ii) What is the value of t when $f(t) - f(-t) = 40$?

2 marks

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9 The following table shows how much it costs to send parcels to Australia, Italy and the United Kingdom.

Country	First kg	Next ½ kg	Next ½ kg	Next ½ kg	Any Other kg
Australia	€31.43	€8.08	€5.15	€4.80	€4.00
Italy	€19.47	€5.46	€3.82	€2.90	€2.00
U.K.	€23.04	€6.85	€4.20	€3.10	€2.50

(i) Calculate how much it would cost to send a parcel:

(a) weighing 1.5 kg to the United Kingdom;

1 mark

(b) weighing 2.5 kg to Australia.

2 marks

(ii) How much did a parcel sent to Italy weigh, if the postage cost €35.65?

2 marks

---

10 A school bazaar raised €7,200. One quarter of this sum was paid out in expenses. Three-quarters of the remainder was used for the renovation of the hall and the rest was donated to charity. How much of the amount raised went to charity?

4 marks

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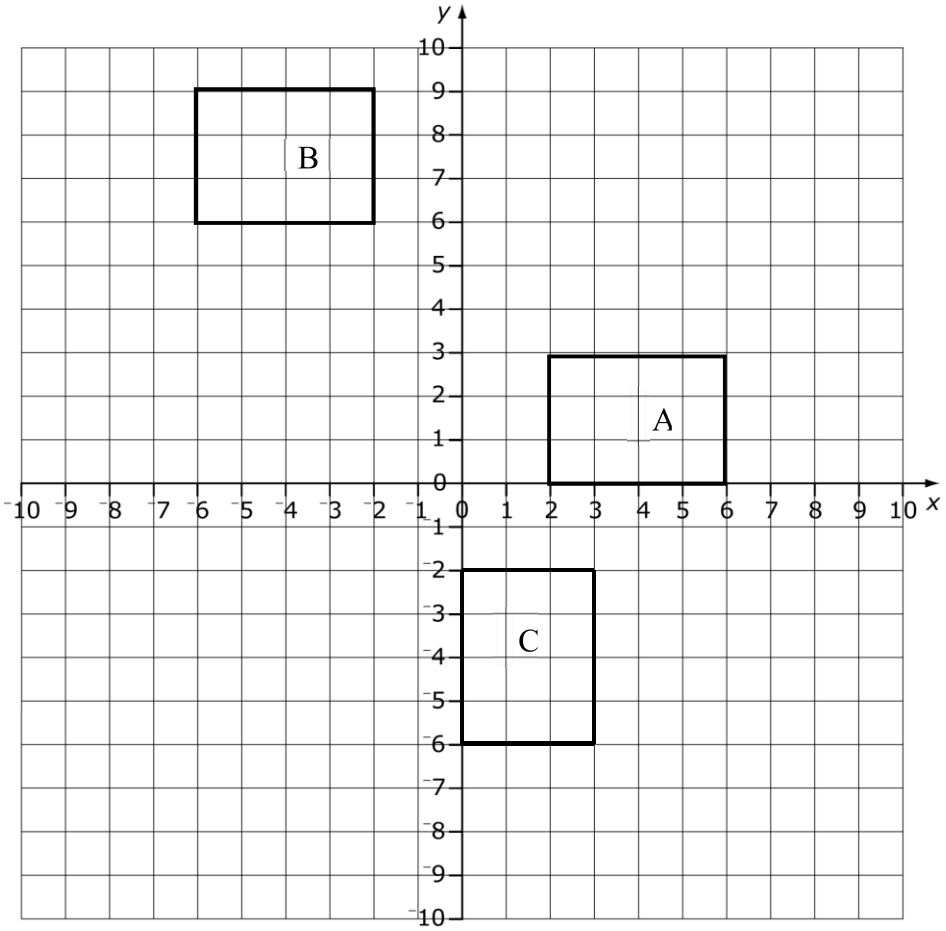
11



(i) Describe the single transformation that maps rectangle **A**:

(a) to rectangle B;

2 marks

(b) to rectangle C.

2 marks

(ii) Draw the image of rectangle A when it is enlarged by scale factor 2 about the point (8, 0) and label it D.

3 marks

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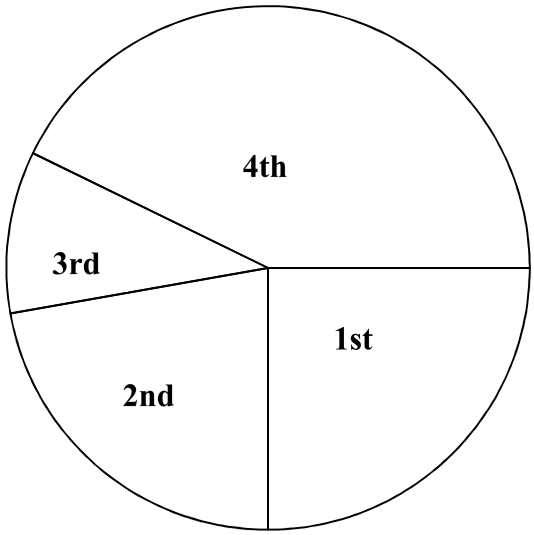
12 The Pie Chart drawn below shows the sales from a shop in each quarter of the year 2012. In the first quarter, the sales amounted to €6,750.

(i) What did the total sales amount to in all of 2012?



2 marks

(ii) Calculate the sales in the other three quarters of the year.

2nd quarter:

3rd quarter:

4th quarter:

6 marks

13 Keith invested €35,000 in a project rendering a yearly simple interest of 4%.

(i) How much interest did Keith earn in 8 years?

2 marks

(ii) After the 8 years have passed, Keith added a fraction of the total interest to the initial capital and earned €1,568 interest in the next year. What fraction of the interest did Keith re-invest?

4 marks

DO NOT WRITE ABOVE THIS LINE

14 Nathalie has the following recipe for an orange cake:

125 grams self-raising flour
100 grams castor sugar
65 grams butter
3 eggs
Juice and grated rind of one orange

The cost of flour is €0.25 per 100 grams and sugar costs €0.13 per 100 grams.
A 260 grams packet of butter costs €0.96.
Eggs cost €1.60 per dozen and oranges cost €0.25 each.

(i) Calculate the cost of making 4 orange cakes of the same size as the recipe.

5 marks

(ii) Nathalie takes the 4 cakes she made to a fund–raising activity. She cuts each cake into 8 pieces and sells each piece at €1. Find the profit made on the sale of these 4 cakes.

3 marks

DO NOT WRITE ABOVE THIS LINE

15

The picture shows the speedometer of a car with an outer scale showing miles per hour and an inner scale showing km per hour.

(i) Give an estimate for the current reading of the speed, in miles per hour.

1 mark

(ii) If approximately, every 5 miles make 8 km, what is the reading on the speedometer, in km per hour, when a speed limit of 60 miles per hour is reached?

2 marks

(iii) If the car is going at a speed of 60 km per hour, and its wheels are of diameter 40 cm:

(a) Find the distance, in m correct to 3 decimal places, that a wheel covers in one complete revolution

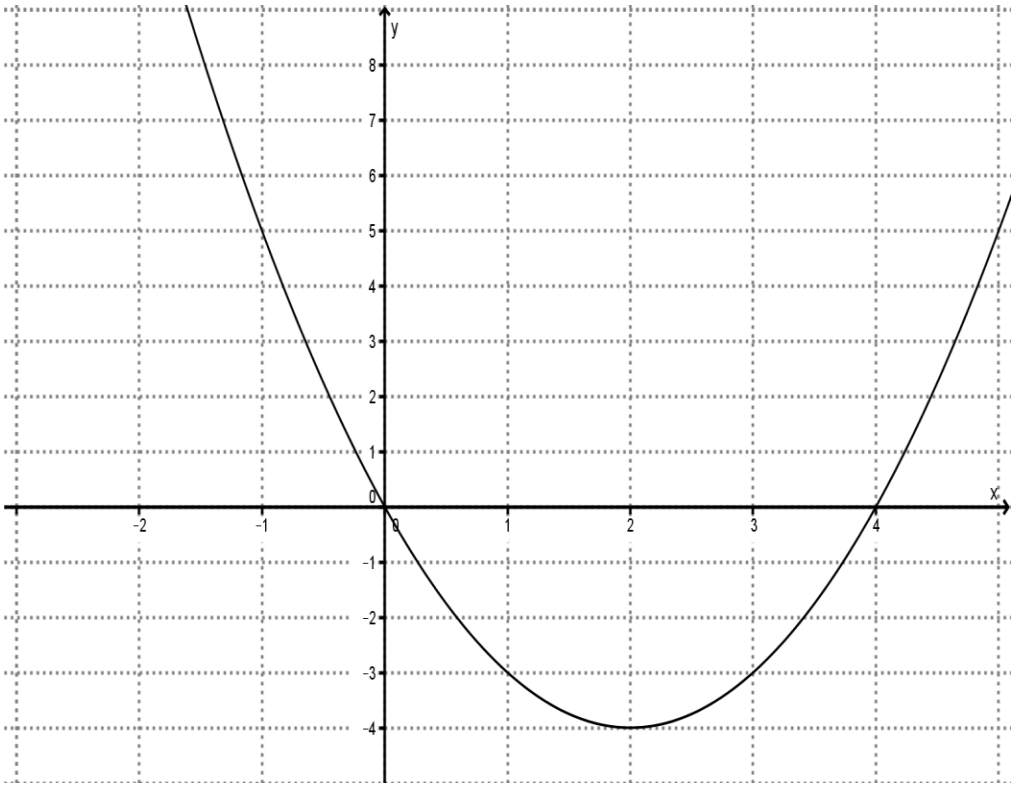
2 marks

(b) How many revolutions does the wheel make per minute? Give your answer to the nearest 10 revolutions.

2 marks

DO NOT WRITE ABOVE THIS LINE

16



Use the graph of the equation $y = x^2 - 4x$ plotted above to determine:

(i) the coordinates of the minimum point.

1 mark

(ii) the two solutions to the equation $x^2 - 4x = 0$?

1 mark

(iii) A straight line has equation $y = -2x + 3$. Complete the table provided for values of x between – 2 and 4 to find the corresponding values of y.

x	– 2	– 1	0	1	2	3	4
y			3				

2 marks

(a) Use the same set of axes above to draw the graph of the straight line.

2 marks

(b) Write down the points of intersection of the two graphs. Explain why their x - coordinates are the solutions to the equation $x^2 - 2x - 3 = 0$.

3 marks

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17 The time-table below shows the departure times of a new circular bus service operating from Rome to Assisi via Perugia and vice-versa.

Town	**Departure Times of Buses**			**Town**	**Departure Times**	
BUS	**A**	**B**	**C**	**BUS**	**D**	**E**
Rome	07:15	08:15	14:00	**Assisi**	13:45	16:30
Perugia	9:30	10:40	16:15	**Perugia**	14:30	17:30
Assisi	10:00	11:10	16:45	**Rome**	16:55	20:05

(i) Thomas takes the bus departing at 8:15 from Rome. How long does the bus take to reach Perugia?

1 mark

(ii) He stops at Perugia to do some sight-seeing and then catches the bus departing at 16:15 from Perugia to Assisi. How much time does he spend in Perugia?

2 marks

(iii) After spending a night in Assisi, Thomas travels back to Rome, choosing the shorter route. Is this route D or E? How many minutes does he save by choosing this route?

3 marks

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18 Tanya walks x km at 5 km/hour. She then, cycles $3x$ km at 10 km/hour. If she takes 2 hours 20 minutes to cover all the $4x$ kilometres, form an equation and solve it to find the value of x.

5 marks

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19 P, Q and R are three points on a map representing three towns such that P is 25 km due north of Q and R is 18 km due East of Q.

(i) Draw a rough diagram of triangle PQR, representing the three towns.

1 mark

(ii) Calculate the distance PR in km, correct to one decimal place.

2 marks

(iii) Find angle PRQ to the nearest degree.

2 marks

(iv) S is a point on PR such that QS is perpendicular to PR. Calculate the distance SR, in km correct to one decimal place.

3 marks

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20 In this question you are to use ruler and compasses only.

Draw a circle of radius 6 cm, with the horizontal diameter AB.
Draw chord AC of length 10 cm in the upper semicircle.
At A, construct angle DAC making 60° with AC and cutting the circle at D in the lower semicircle.
Join D to the centre of the circle and produce the line to cut AC at E.
Measure AE.

6 marks

END OF EXAMINATION