SYDNEY BOYS HIGH SCHOOL
MOORE PARK, SURRY HILLS

Year 9

Yearly Examination 2013

Advanced Mathematics

General Instructions

- Working time – 90 minutes
- Write using black or blue pen.
- Approved calculators may be used.
- All necessary working MUST be shown in every question if full marks are to be awarded.
- If more space is required, clearly write the number of the QUESTION on one of the back pages and answer it there. Indicate that you have done so.
- Clearly indicate your class by placing an X, next to your class
- All answers should be presented in simplest exact form, unless otherwise directed.
- Marks may not be awarded for untidy or badly arranged work.

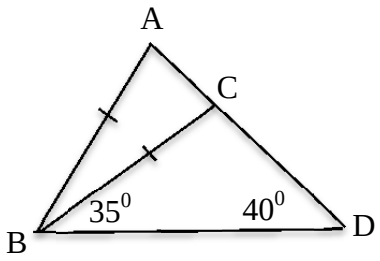
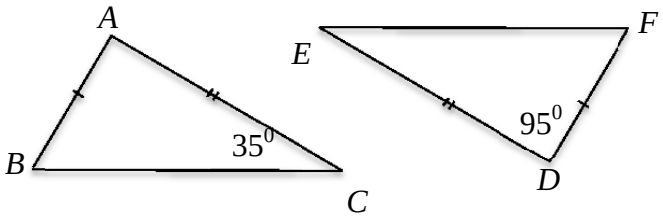
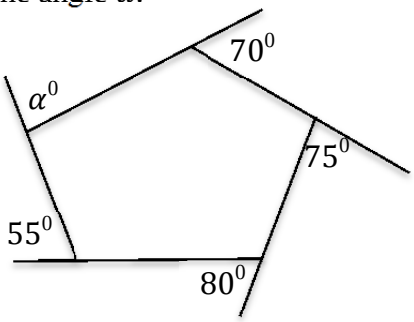
Examiner: *R.Boros*

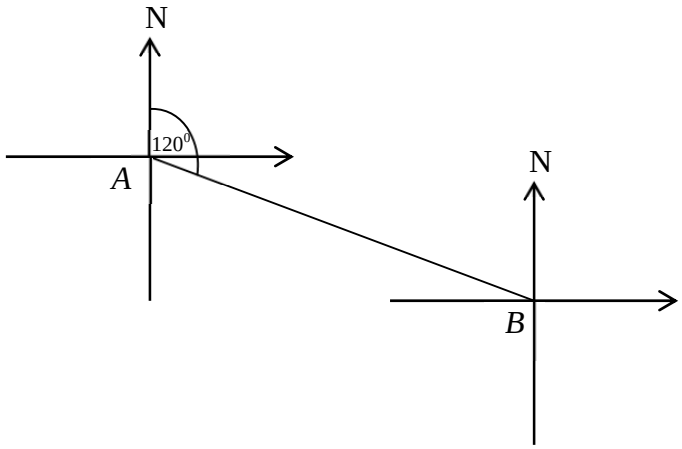
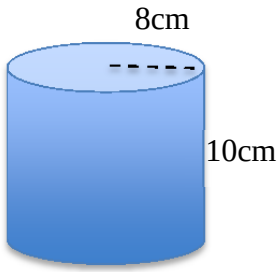
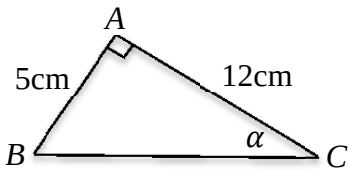
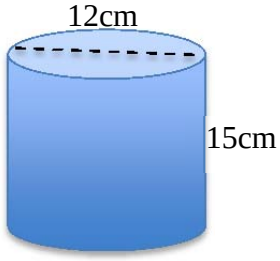
NAME: ……..

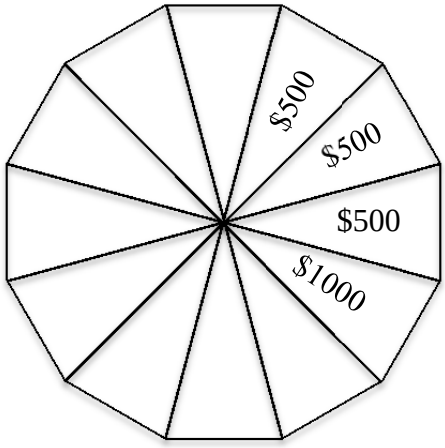
Class	Teacher	
9 A	Ms Kilmore	
9 B	Ms Chen, Mr Elliott	
9 C	Ms Millar	
9 D	Ms Nesbitt Ms Likourezos	
9 E	Mr Hespe	
9 F	Mr McQuillan	
9 G	Mr Fuller	

Question	Mark
1	**/20**
2	**/20**
3	**/20**
4	**/20**
5	**/11**
6	**/15**
7	**/12**
Total	**/118**

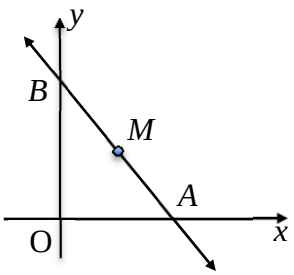
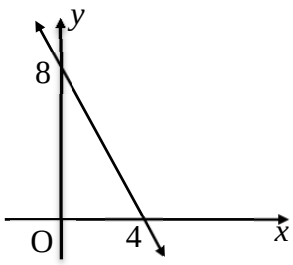
Question 1. (20 marks)

		Answers	
(a)	In the diagram at right, ΔABC is isosceles, such that $AB=CB$. Given the other data in the diagram, find $\angle ABC$. 		**1**
(b)	The two triangles shown are congruent. Find the size of $\angle ABC$. 		**1**
(c)	Find the size of the angle α. 		**2**
(d)	Circle the correct letter. The expression $\frac{6}{\sqrt[3]{x^2}}$ may be written as: (A) $6x^{-\frac{2}{3}}$ (B) $6x^{\frac{2}{3}}$ (C) $6x^{\frac{3}{2}}$ (D) $6x^{-\frac{3}{2}}$		**1**
(e)	Andrew made the following statements: I: 6.8×10^{-20} is greater than 1.2×10^{-10} II: 120 million can be written as 1.2×10^{8} Circle the correct letter. Andrew was correct in: (A) I only (B) II only (C) both I and II (D) neither I nor II		**1**
(f)	Expand and simplify the following expression: $\left(2\sqrt{3}-3\right)^2$		**2**

(g)	Simplify $\frac{(2x^4)^3 \times 4x^4}{8x^8}$		**2**
(h)	Find the true bearing of A from B. 		**1**
(i)	Find the surface area of this closed can, in terms of π. 		**2**
(j)	Find the value of α, correct to the nearest minute. 		**2**
(k)	Find the volume of this closed can correct to the nearest cubic centimetre. 		**2**

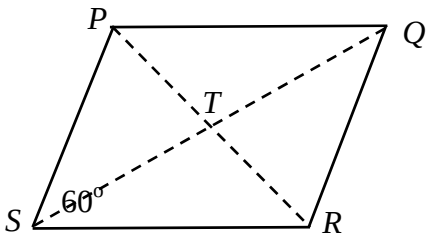
(l)	Angelo starts to design a spinner in which a player can win either \$500 or \$1000. Complete the design so that the probability of winning \$500 is 3 times the probability of winning \$1000.		**1**
(m)	Belinda is to choose two balls without replacement from a bag containing thirty balls numbered 1 to 30. If the number on the first ball is 2, find the probability that the number on the second ball is less than 20, and a multiple of 3.		**2**

Question 2. (20 Marks)

(a)	Solve for x, and graph the solution on a real number line: $5 - 2x > 7$		**2**
(b)	Write down one factor of $6x^2 - 17x + 12$.		**2**
(c)	The line containing the points A, M and B is $y = -3x + 12$. Given M is the midpoint of AB, find the coordinates of M. 		**2**
(d)	What is the value of the gradient of the line in this diagram? 		**1**
(e)	Simplify as a single fraction: $\frac{2}{x+1} - \frac{1}{x-1}$		**2**
(f)	Make q the subject of the equation: $q(p + 2) = 3q + p$		**2**
(g)	Simplify: $\frac{4x^2+8x+3}{2x+1} \times \frac{1}{4x+6}$		**2**
(h)	Find the slope of the line $2x + 3y = 12$.		**1**
(i)	Calculate the exact distance from $A(-3, 2)$ to $B(4,1)$.		**2**

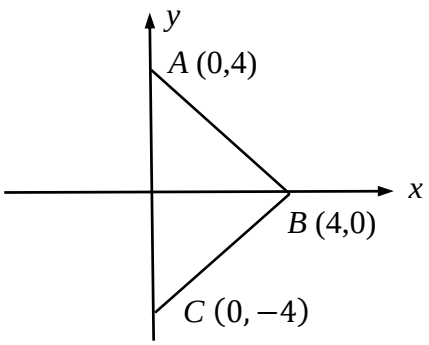
(j)	Find, correct to 3 significant figures: $(8.53 \times 10^3)^2$		**2**
(k)	Expand and simplify: $3(1-5x)(2+3x)$		**2**

Question 3. (20 Marks)

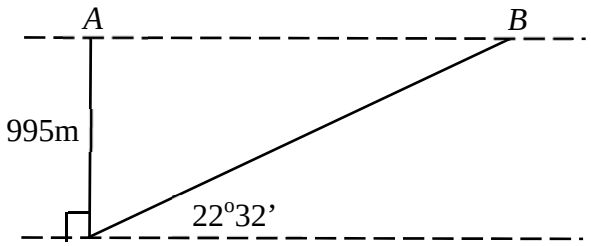
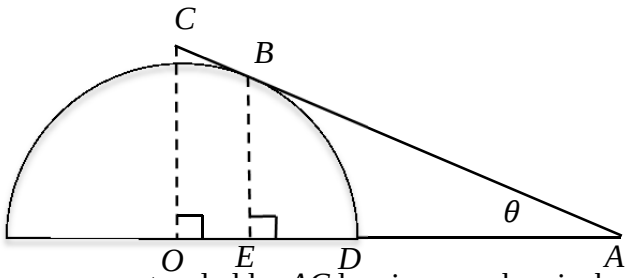
(a)	Factorise completely: (i) $x^2 + 8x - 9$ (ii) $a(b + c) + b + c$	(i) (ii)	**2**
(b)	(i) Find the angle sum of a regular nonagon (9 sides). (ii) Hence find the size of each interior angle.	(i) (ii)	**2**
(c)	Show that the point (3, -1) lies on the line $3x - y = 10$		**1**
(d)	*PQRS* is a rhombus. *PQ* = 8 cm, and $\angle PSR = 60^\circ$. Find the length of *PT*. 		**3**
(e)	Solve for *x*: (i) $2(x + 1) - 1 = 8$ (ii) $\frac{2x+1}{x-1} = \frac{1}{2}$	(i) (ii)	**3**
(f)	Simplify the following expression, leaving your answer in index form: $\frac{2^{x+2} \times 8}{2^{2x} \times 2^{x+1}}$		**3**

(g)	Simplify: $\frac{x^3y^{-2}}{x^{-4}y}$		**2**
(h)	Solve for x: $\sqrt{x} = \sqrt{75} - \sqrt{12}$		**2**
(i)	Find p and q if $\frac{6+\sqrt{3}}{\sqrt{3}} = p + q\sqrt{3}$		**2**

Question 4. (20 Marks)

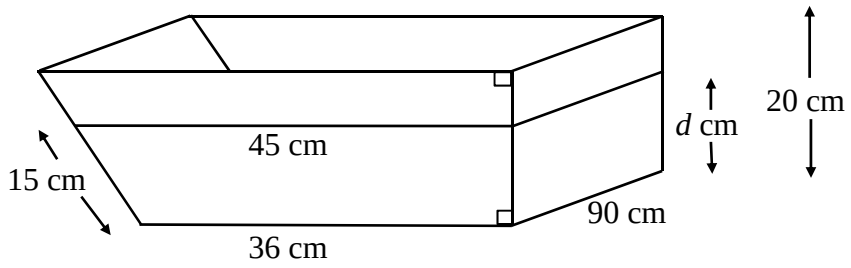
	 Given the diagram above:		**20**
(a)	Find the length of *AC*.		
(b)	Show that ΔABC is isosceles.		
(c)	Show that ΔABC is a right-angled triangle.		
(d)	Find the midpoint *M* of interval *AB*.		
(e)	Find the gradient of *OM*.		
(f)	Show that the line which passes through the midpoints of *AC* and *AB* is parallel to *BC*.		
(g)	Find the equation of the line *OM*, and write it in general form.		
(h)	What is the gradient of the *x*-axis?		

Question 5. (11 Marks)

(a)	A plane is flying at an altitude (height) of 995m. An observer on the ground first observes the plane when it is directly overhead at *A*. Forty seconds later, the angle of elevation of the plane, at *B*, from the observer is $20^{\circ}32'$.  		
	(i) Through what distance did the plane fly in 40 seconds correct to the nearest minute?		**3**
	(ii) Calculate the speed of the plane in km/h correct to 3 significant figures.		**2**
(b)	 The diagram represents a ladder *AC* leaning on a hemispherical tank filled with water. $AB = 7.6m, ED = 2.3m, OE = 3.63m, EB = 4.67m$		
	(i) Find θ, the angle that the ladder makes with the ground at *A*, correct to the nearest minute.		**2**
	(ii) Find *AD*, the distance between the foot of the ladder and the hemispherical tank, correct to the nearest centimetre.		**2**
	(iii) Find *AC*, the total length of the ladder, correct to the nearest centimetre.		**2**

Question 6. (15 Marks)

(a)



The diagram shows a tank, in the form of a trapezoidal prism, filled with milk to a depth of *d* cm.

(i) Show that the depth *d* of the milk in the tank is 12cm. **2**

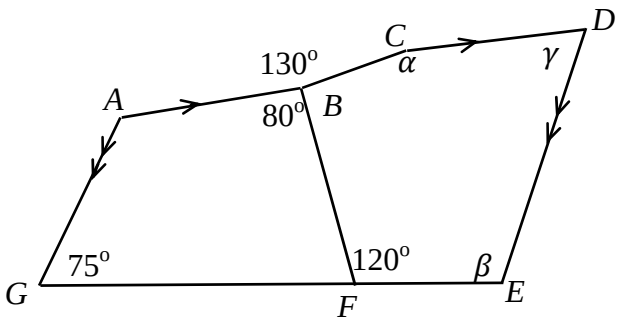
(ii) Find the amount of milk in the tank (now) in litres. **3**
You may use $1\ L = 1000\ cm^3$.

(iii) The milk in the tank now represents $\frac{3}{5}$ of the total capacity of the tank. If milk is added to the tank at a rate of 3.6 litres every minute, how long does it take to fill the tank? **4**

(b) In the diagram at right, *AB*||*CD* and *GA*||*ED*.

$\angle ABC = 130^\circ$, $\angle ABF = 80^\circ$, $\angle AGF = 75^\circ$, and $\angle BFE = 120^\circ$.

The figure is NOT to scale.



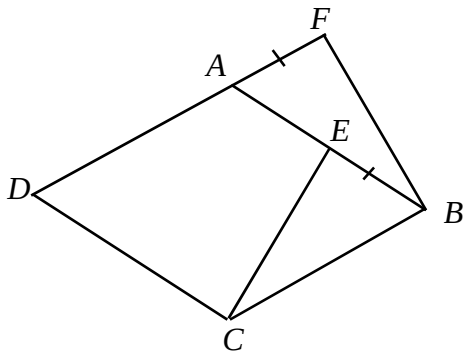
Without supplying reasons:

(i) Find the value of α $(\angle BCD)$. **2**

(ii) Find the value of β $(\angle FED)$. **2**

(iii) Find the value of γ $(\angle CDE)$. **2**

Question 7. (12 Marks)

(a)	*ABCD* is a rhombus and *AF* = *EB*. Provide a full proof to parts (i), (ii), and (iii).  		
	(i) Prove that $\Delta ABF \equiv \Delta BCE$.		**4**
	(ii) Show why *CE* = *BF*.		**1**
	(iii) Show that $\angle ECB = \angle FBA$.		**1**
(b)	How much water has to be added to 1 litre of a 5% ethanol-water solution (volume for volume) to produce a 4% ethanol-water solution? Show all working.		**3**
(c)	Given $5^1 + 5^2 + 5^3 + 5^4 + 5^5 + 5^6 + 5^7 + 5^8 + 5^9 + 5^{10}$, show by continued factoring that the above expression could be represented as $30 + 156 \times 125 \times 626$. Show all working.		**3**

This is the end of the paper.

Use this space if you wish to **REWRITE** any answers

Clearly *indicate* the **QUESTION** number.

Question	

Use this space if you wish to **REWRITE** any answers

Clearly *indicate* the **QUESTION** number.

Question	

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Question	