



SYDNEY BOYS HIGH SCHOOL
MOORE PARK, SURRY HILLS

Year 9

Yearly Examination 2006

Mathematics

General Instructions

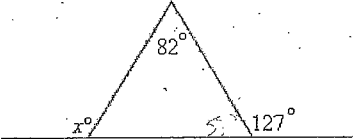
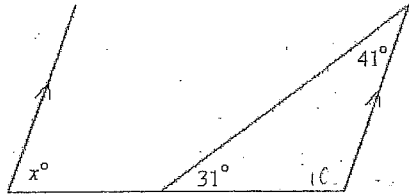
- Working time – 90 minutes
- Write using black or blue pen.
- Approved calculators may be used.
- All necessary working **MUST** be shown in every question if full marks are to be awarded.
- Marks may not be awarded for untidy or badly arranged work.
- If more space is required, clearly write the number 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

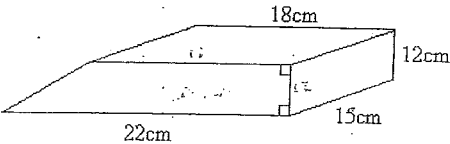
Examiner: P. Bigelow

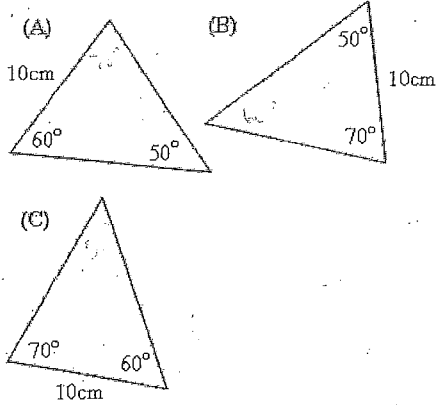
NAME:

Class	Teacher	
9 A	Mr Boros	
9 B	Ms Evans	
9 C	Ms Nesbitt	
9 D	Mr Hespe	
9 E	Mr Gainford	
9 F	Ms Ward	

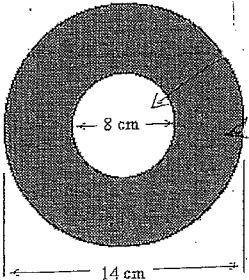
Question	Mark
1	/17
2	/17
3	/19
4	/19
5	/19
6	/19
Total	/110

Question One (17 Marks)	Answers	Marks
(a) Simplify (i) $3a + b - a$ (ii) $\frac{4a}{9} + \frac{5a}{9}$ (iii) $\frac{4x}{3y} \times \frac{6y}{x}$		3
(b) Find x in the following (i)  (ii) 		2
(c) Express 0.0065 in scientific notation.		1
(d) Use a calculator to evaluate $\frac{49.6}{19.8 - 7.9}$ correct to 3 significant figures.		1
(e) Simplify $\frac{\sqrt{48}}{6}$		1

(f)	Simplify $3a^0 + (4a)^0$		1
(g)	Evaluate $125^{\frac{4}{3}}$		1
(h)	Given $\sqrt{y} = 5\sqrt{6}$ find the value of y .		1
(i)	Between which two consecutive integers does $\sqrt{301}$ lie?		1
(j)	Find $\sin 7^\circ$ (correct to two decimal places).		1
(k)	$\frac{1}{\sqrt[3]{x^4}} = x^a$, write down the value of a .		1
(l)	If $(2, c)$ lies on the line $4x - y + 7 = 0$ find the value of c .		1
(m)	Calculate the volume of the following prism. 		2

Question Two (17 Marks)		Answers	Marks
(a)	A regular polygon has an exterior angle of 15° . How many sides does it have?		1
(b)	State which of the triangles are congruent and the congruence test used. 		2
(c)	Simplify $(3x^2)^3 \times (2x^3)^2$		2
(d)	Expand and simplify: (i) $(2a+1)(a-6)$ (ii) $[4x - (x-1)]^2$		4
(e)	Solve (i) $\frac{y}{3} - 1 = 7$		1
	(ii) $\frac{4}{a+2} = 7$		1

(f)	Solve $3 - a \leq 5 - 3a$		1
(g)	Given the points A(3, 0), B(-1, 6) and C(-2, 5) Find: (i) the mid-point of AB. (ii) the gradient of BC. (iii) the length of the interval AC.		3
(h)	Find x correct to the nearest degree if $\cos x = 0.212$.		1
(i)	If $\frac{a}{b} = -1$ write down the value of $a + b$.		1

Question Three (19 Marks)		Answers	Marks
(a)	Which is the best buy? (A) 20g for \$7.20 (B) 25g for \$8.50		1
(b)	Simplify $3\sqrt{8} - \sqrt{18}$.		1
(c)	Expand and simplify: $(\sqrt{7} + \sqrt{2})(2\sqrt{7} - \sqrt{2})$		2
(d)	An exercise machine was reduced by 15% and sold for \$632.40. What was the original price?		2
(e)	The 26 letters of the alphabet are written on cards and placed in a box. If one card is picked at random from the box, what is the probability that the letter will be: (i) Y (ii) C or D (iii) a vowel (iv) a letter in the word SYDNEY		4
(f)	Calculate the shaded area (correct to two decimal places). 		2

(g) Find the value of the pronumeral (correct to one decimal place).

(h) The students in Year 9 English were given a rating of 0 to 5 in a writing task. The results were.

~~4~~ 5 ~~4~~ ~~3~~ ~~0~~ ~~3~~ ~~4~~ 5 ~~3~~ ~~2~~
~~3~~ ~~2~~ ~~3~~ ~~2~~ ~~4~~ ~~2~~ ~~2~~ ~~4~~ ~~4~~ ~~3~~
~~1~~ ~~0~~ ~~2~~ ~~1~~ ~~3~~ ~~2~~ ~~3~~ ~~2~~ ~~3~~ ~~4~~

(i) Complete the table

Rating (x)	Tally	Frequency (f)	f × x	Cumulative frequency (c.f.)
0				
1				
2				
3				
4				
5				

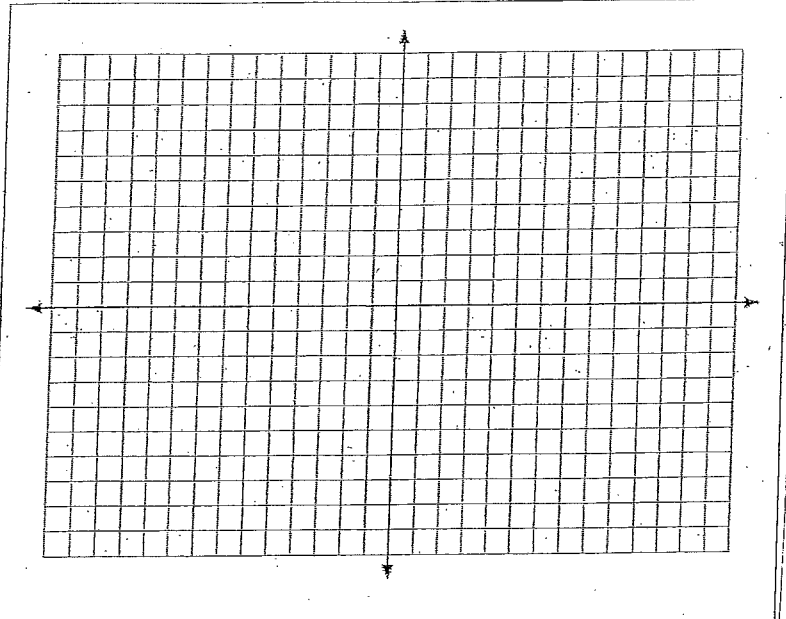
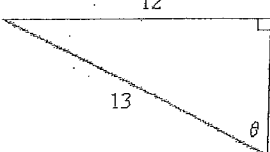
(ii) Use the table to find the

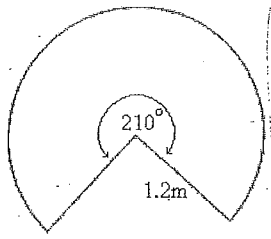
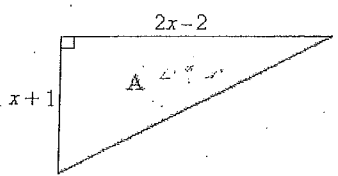
(1) Mode

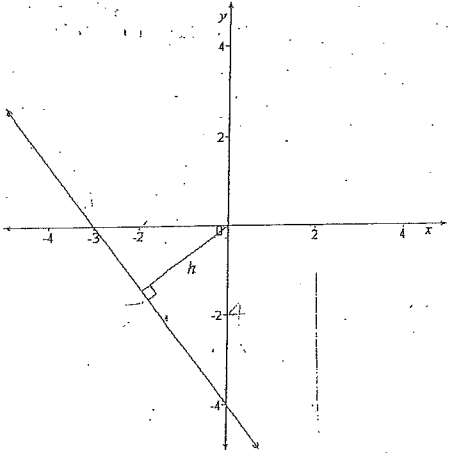
(2) Median

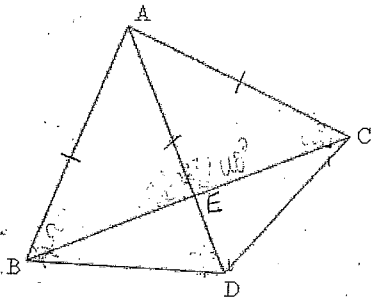
(3) Mean

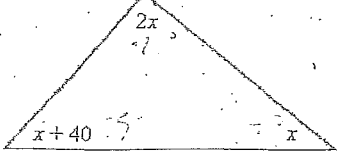
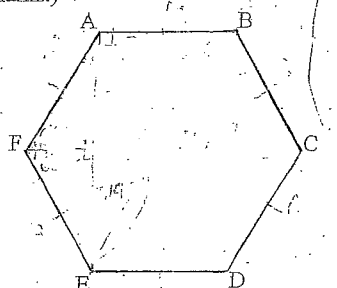
Question Four (19 Marks)		Answers	Marks
(a)	Given $T = a + (n-1)d$, express d as the subject of the formula.		1
(b)	Calculate the total surface area (correct to one decimal place) of a solid cylinder of height 12cm and base diameter 10cm.		2
(c)	Solve the following pair of equations: $5a + 2b = 28$ $3a + 5b = 51$		2
(d)	Factorise the following (i) $16 - 9x^2$ (ii) $x^2 - x - 20$ (iii) $ab - a + b - 1$ (iv) $6y^2 + 35y - 6$		4
(e)	Write down the gradient of the line $2x + 4y + 7 = 0$.		1
(f)	Find the equation of the line passing through the points (3, 1) and (-1, 4). (express your answer in general form).		2

(g)	Express $\frac{\sqrt{7}-\sqrt{3}}{\sqrt{7}+\sqrt{3}}$ with a rational denominator in simplest form.	2
(h)	If $x^{\frac{5}{3}} = 32$, find x .	1
(i)	<p>Sketch the region defined by the intersection of $y < 2x + 1$ and $5x + 4y \leq 20$.</p> 	2
(j)	<p>Find θ correct to the nearest minute.</p> 	2

Question Five (19 Marks)	Answers	Marks
<p>(a) Find the perimeter of this shape (correct to two decimal places).</p> 		2
<p>(b) A construction worker earns \$39.20 per hour for a 38 hour week, plus a site allowance of \$37.80 per week.</p> <p>Each week the employer deducts \$534.60 in tax and 4.5% of the gross wage is paid into a superannuation fund.</p> <p>(i) How much is paid into the superannuation fund each week?</p> <p>(ii) Calculate the workers net weekly pay.</p>		4
<p>(c) (i) Find an expression for the area A of the triangle.</p>  <p>(ii) Find x if $A = 48\text{cm}^2$</p>		3
<p>(d) Simplify $\frac{2x+1}{4} - \frac{x-1}{6}$</p>		2

(e)	A box contains 4 blue and 5 yellow balls. How many blue balls must be added to the box such that the probability of choosing a blue ball from the box is $\frac{9}{10}$?	2
(f)	One vat holds 600 litres more than another. When the smaller vat is two thirds full, it holds as much as the larger when half full. What is the capacity of each vat?	2
(g)	Find the equation of the line which has an x-intercept of -3 and is perpendicular to $y = \frac{1}{2}x + 7$.	2
(h)	Find the value of h . 	2

Question Six (19 Marks)		Answers	Marks												
(a)	Paula's gross annual salary is \$56 540. Her tax advisor approved the following deductions. <ul style="list-style-type: none"> 40% of the cost of a new computer, purchased for \$2 390. <i>950</i> \$410 for stationery. \$725 for work related expenses. \$475 for union fees. <p>(i) What is the total of Paula's deductions?</p> <p>(ii) What is her taxable income?</p>		2												
Tax rates 2006-07 <table border="1" style="margin: auto;"> <thead> <tr> <th>Taxable Income</th> <th>Tax on this income</th> </tr> </thead> <tbody> <tr> <td>\$0 - \$6 000</td> <td>Nil</td> </tr> <tr> <td>\$6 001 - \$25 000</td> <td>15c for each \$1 over \$6 000</td> </tr> <tr> <td>\$25 001 - \$75 000</td> <td>\$2 850 plus 30c for each \$1 over \$25 000</td> </tr> <tr> <td>\$75 001 - \$150 000</td> <td>\$17 850 plus 40c for each \$1 over \$75 000</td> </tr> <tr> <td>Over \$150 000</td> <td>\$47 850 plus 45c for each \$1 over \$150 000</td> </tr> </tbody> </table>				Taxable Income	Tax on this income	\$0 - \$6 000	Nil	\$6 001 - \$25 000	15c for each \$1 over \$6 000	\$25 001 - \$75 000	\$2 850 plus 30c for each \$1 over \$25 000	\$75 001 - \$150 000	\$17 850 plus 40c for each \$1 over \$75 000	Over \$150 000	\$47 850 plus 45c for each \$1 over \$150 000
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(iii)	Use the table to calculate the tax payable of this income.		3												
(iv)	A medicare levy is calculated at 1.5% of taxable income. Calculate the amount that Paula is charged.														
(b)	$\angle ABD = \angle ADB$ and $\angle ADC = \angle ACD$. Prove that $\angle ABC = \angle ACB$. 		3												

(c)	<p>In the diagram find, in degrees, the measure of the largest angle.</p> 	2
(d)	<p>The diagram represents a regular hexagon with perimeter 54cm. Find the length of BE. (You must justify your answer to gain marks.)</p> 	2
(e)	<p>Simplify $\frac{x^2 + 5x - 14}{5x^2 - 20} \div \frac{x^2 - 49}{x^2 + 4x + 4}$</p>	2
(f)	<p>If $X = 5^a + 5^{-a}$ and $Y = 5^a - 5^{-a}$ evaluate $X^2 - Y^2$.</p>	2
(g)	<p>The sides of a triangle are 6, 8 and x. Find the range of values of x so that the triangle will be acute-angled.</p>	3



SYDNEY BOYS HIGH SCHOOL
MOORE PARK, SURRY HILLS

Year 9

Yearly Examination 2006

SOLUTIONS
- MASTER COPY

Mathematics

General Instructions

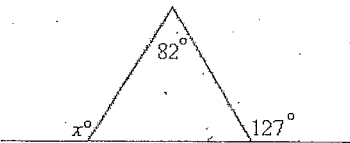
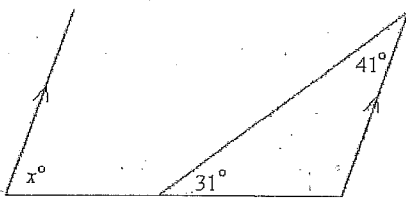
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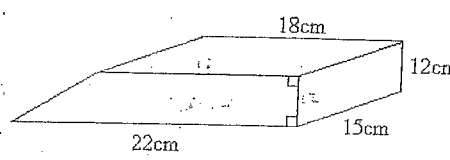
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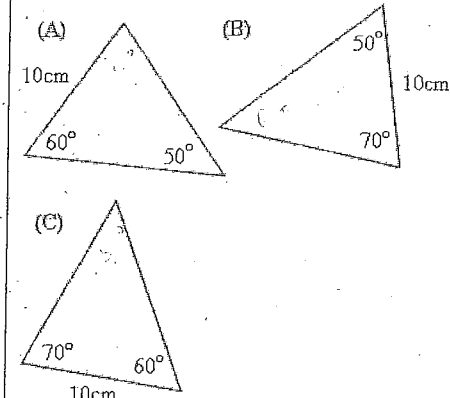
NAME:

Class	Teacher	
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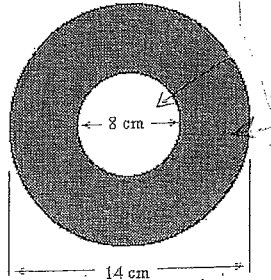
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Total	/110

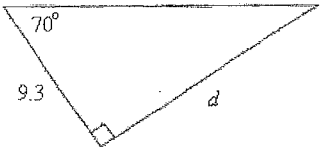
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(b) Find x in the following (i)  (ii) 	$x^\circ = 135^\circ$ $x^\circ = 72^\circ$	2
(c) Express 0.0065 in scientific notation.	6.5×10^{-3}	1
(d) Use a calculator to evaluate $\frac{49.6}{19.8 - 7.9}$ correct to 3 significant figures.	4.175	1
(e) Simplify $\frac{\sqrt{48}}{6}$	$\frac{2\sqrt{3}}{3}$	1

(f)	Simplify $3a^0 + (4a)^0$	4	1
(g)	Evaluate $125^{\frac{4}{3}}$	625	1
(h)	Given $\sqrt{y} = 5\sqrt{6}$ find the value of y .	150	1
(i)	Between which two consecutive integers does $\sqrt{301}$ lie?	17, 18	1
(j)	Find $\sin 7^\circ$ (correct to two decimal places).	0.12	1
(k)	$\frac{1}{\sqrt[3]{x^4}} = x^a$, write down the value of a .	$-\frac{4}{3}$	1
(l)	If $(2, c)$ lies on the line $4x - y + 7 = 0$ find the value of c .	$y = 15$	1
(m)	Calculate the volume of the following prism. 	3600 cm^3	2

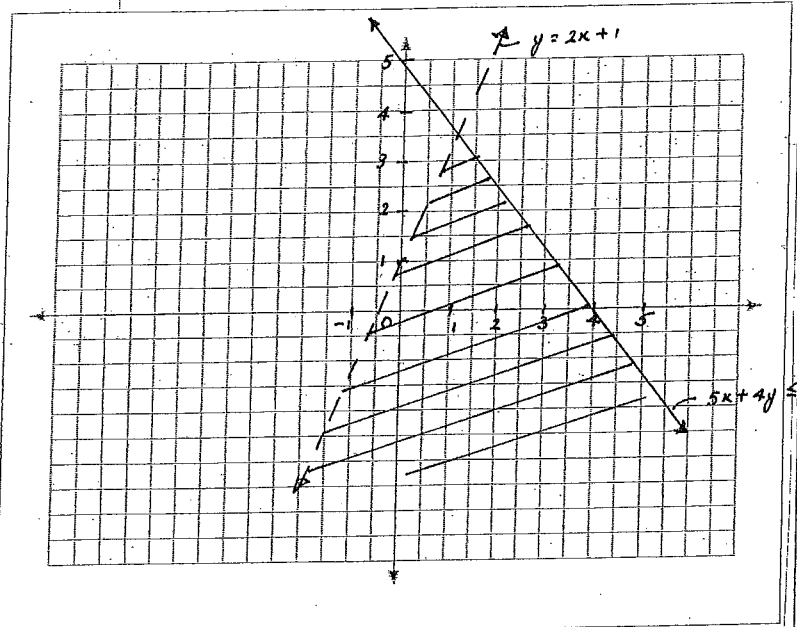
Question Two (17 Marks)		Answers	Marks
(a)	A regular polygon has an exterior angle of 15° . How many sides does it have?	24 sides	1
(b)	State which of the triangles are congruent and the congruence test used. 	A + C (A.A.S test)	2
(c)	Simplify $(3x^2)^3 \times (2x^3)^2$	$108x^{12}$	2
(d)	Expand and simplify: (i) $(2a+1)(a-6)$ (ii) $[4x - (x-1)]^2$	$2a^2 - 11a - 6$ $9x^2 + 6x + 1$	4
(e)	Solve (i) $\frac{y}{3} - 1 = 7$	$y = 24$	1
	(ii) $\frac{4}{a+2} = 7$	$a = -1\frac{3}{7}$	1

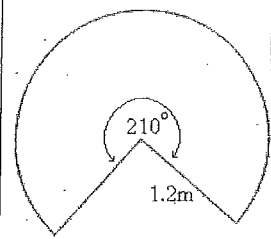
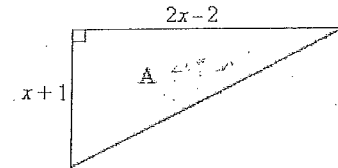
(f)	Solve $3 - a \leq 5 - 3a$	$a \leq 1$	1
(g)	Given the points A(3, 0), B(-1, 6) and C(-2, 5) Find: (i) the mid-point of AB. (ii) the gradient of BC. (iii) the length of the interval AC.	$(1, 3)$ $m_{BC} = 1$ $5\sqrt{2}$	3
(h)	Find x correct to the nearest degree if $\cos x = 0.212$.	78°	1
(i)	If $\frac{a}{b} = -1$ write down the value of $a + b$.	$a + b = 0$	1

Question Three (19 Marks)		Answers	Marks
(a)	Which is the best buy? (A) 20g for \$7.20 (B) 25g for \$8.50	B	1
(b)	Simplify $3\sqrt{8} - \sqrt{18}$.	$3\sqrt{2}$	1
(c)	Expand and simplify: $(\sqrt{7} + \sqrt{2})(2\sqrt{7} - \sqrt{2})$	$12 + \sqrt{14}$	2
(d)	An exercise machine was reduced by 15% and sold for \$632.40. What was the original price?	\$ 744	2
(e)	The 26 letters of the alphabet are written on cards and placed in a box. If one card is picked at random from the box, what is the probability that the letter will be: (i) Y (ii) C or D (iii) a vowel (iv) a letter in the word SYDNEY	$1 : 26$ $1 : 13$ $5 : 26$ $5 : 26$	4
(f)	Calculate the shaded area (correct to two decimal places). 	103.67	2

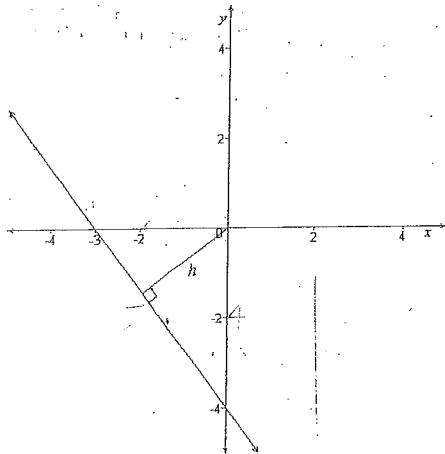
(g)	Find the value of the pronumeral (correct to one decimal place). 	25.6	2																																			
(h)	The students in Year 9 English were given a rating of 0 to 5 in a writing task. The results were. 5 5 3 3 3 5 3 2 3 2 3 2 4 2 2 4 3 1 0 2 1 3 2 3 2 4		2																																			
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Question Four (19 Marks)		Answers	Marks
(a)	Given $T = a + (n-1)d$, express d as the subject of the formula.	$d = \frac{T-a}{n-1}$	1
(b)	Calculate the total surface area (correct to one decimal place) of a solid cylinder of height 12cm and base diameter 10cm.	534.1 cm² (to 1dp)	2
(c)	Solve the following pair of equations: $5a + 2b = 28$ $3a + 5b = 51$	$a = 2$ $b = 9$	2
(d)	Factorise the following (i) $16 - 9x^2$ (ii) $x^2 - x - 20$ (iii) $ab - a + b - 1$ (iv) $6y^2 + 35y - 6$	$(4-3x)(4+3x)$ $(x-5)(x+4)$ $(a+1)(b-1)$ $(6y-1)(y+6)$	4
(e)	Write down the gradient of the line $2x + 4y + 7 = 0$.	$-\frac{1}{2}$	1
(f)	Find the equation of the line passing through the points (3, 1) and (-1, 4). (express your answer in general form).	$3x + 4y - 12 = 0$	2

(g)	Express $\frac{\sqrt{7}-\sqrt{3}}{\sqrt{7}+\sqrt{3}}$ with a rational denominator in simplest form.	$\frac{5-\sqrt{21}}{2}$	2
(h)	If $x^{\frac{5}{3}} = 32$, find x .	8	1
(i)	Sketch the region defined by the intersection of $y < 2x+1$ and $5x+4y \leq 20$.		2
(j)	Find θ correct to the nearest minute.	$67^{\circ} 23'$	2

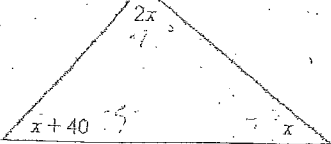
Question Five (19 Marks)	Answers	Marks
(a) Find the perimeter of this shape (correct to two decimal places). 	6.80 m	2
(b) A construction worker earns \$39.20 per hour for a 38 hour week, plus a site allowance of \$37.80 per week. Each week the employer deducts \$534.60 in tax and 4.5% of the gross wage is paid into a superannuation fund. (i) How much is paid into the superannuation fund each week? (ii) Calculate the workers net weekly pay.	<p>\$68.73</p> <p>\$948.12</p>	4
(c) (i) Find an expression for the area A of the triangle.  (ii) Find x if A = 48cm ²	<p>$A = x^2 - 1$</p> <p>$x = 7$</p>	3
(d) Simplify $\frac{2x+1}{4} - \frac{x-1}{6}$.	$\frac{4x+5}{12}$	2

(e)	A box contains 4 blue and 5 yellow balls. How many blue balls must be added to the box such that the probability of choosing a blue ball from the box is $\frac{9}{10}$?	41	2
(f)	One vat holds 600 litres more than another. When the smaller vat is two thirds full, it holds as much as the larger when half full. What is the capacity of each vat?	Small = 1800 Large = 2400	2
(g)	Find the equation of the line which has an x-intercept of -3 and is perpendicular to $y = \frac{1}{2}x + 7$.	$2x + y + 6 = 0$	2
(h)	Find the value of h .	$2\frac{2}{5}$	2



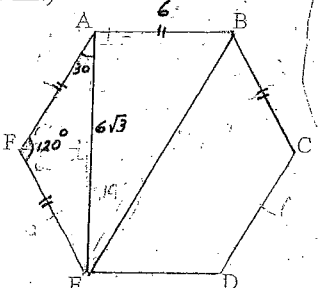
Question Six (19 Marks)		Answers	Marks												
(a)	Paula's gross annual salary is \$56 540. Her tax advisor approved the following deductions. <ul style="list-style-type: none"> 40% of the cost of a new computer, purchased for \$2 390. 950 \$410 for stationery. \$725 for work related expenses. \$475 for union fees. <p>(i) What is the total of Paula's deductions?</p> <p>(ii) What is her taxable income?</p>	\$ 2 566 \$ 53 974	2												
Tax rates 2006-07 <table border="1" style="margin: auto;"> <thead> <tr> <th>Taxable Income</th> <th>Tax on this income</th> </tr> </thead> <tbody> <tr> <td>\$0 - \$6 000</td> <td>Nil</td> </tr> <tr> <td>\$6 001 - \$25 000</td> <td>15c for each \$1 over \$6 000</td> </tr> <tr> <td>\$25 001 - \$75 000</td> <td>\$2 850 plus 30c for each \$1 over \$25 000</td> </tr> <tr> <td>\$75 001 - \$150 000</td> <td>\$17 850 plus 40c for each \$1 over \$75 000</td> </tr> <tr> <td>Over \$150 000</td> <td>\$47 850 plus 45c for each \$1 over \$150 000</td> </tr> </tbody> </table>				Taxable Income	Tax on this income	\$0 - \$6 000	Nil	\$6 001 - \$25 000	15c for each \$1 over \$6 000	\$25 001 - \$75 000	\$2 850 plus 30c for each \$1 over \$25 000	\$75 001 - \$150 000	\$17 850 plus 40c for each \$1 over \$75 000	Over \$150 000	\$47 850 plus 45c for each \$1 over \$150 000
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(iii)	Use the table to calculate the tax payable of this income.	\$ 11 542.20	3												
(iv)	A medicare levy is calculated at 1.5% of taxable income. Calculate the amount that Paula is charged.	\$ 809.61													
(b)	$\angle ABD = \angle ADB$ and $\angle ADC = \angle ACD$. Prove that $\angle ABC = \angle ACB$.	<p>Show that $\triangle ABC$ is isosceles!</p>	3												

(c) In the diagram find, in degrees, the measure of the largest angle.



75°

(d) The diagram represents a regular hexagon with perimeter 54cm. Find the length of BE. (You must justify your answer to gain marks.)



$BE^2 = 6^2 + (6\sqrt{3})^2$
 $= 36 + 108$
 $= 144$
 $\therefore BE = 12 \text{ cm}$

(e) Simplify $\frac{x^2 + 5x - 14}{5x^2 - 20} \div \frac{x^2 - 49}{x^2 + 4x + 4}$

$= \frac{(x+7)(x-2)}{5(x+2)(x-2)} \times \frac{(x+2)^2}{(x-7)(x+7)}$

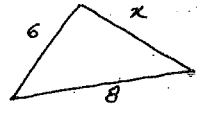
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(f) If $X = 5^a + 5^{-a}$ and $Y = 5^a - 5^{-a}$ evaluate $X^2 - Y^2$.

$= (X+Y)(X-Y)$
 $= (2 \cdot 5^a)(2 \cdot 5^{-a})$
 $= 4 \cdot 5^0$

4

(g) The sides of a triangle are 6, 8 and x. Find the range of values of x so that the triangle will be acute-angled.



$x + 6 > 8 \quad \cap \quad x + 8 > 6$
 $x > 2 \quad \cap \quad x > -2$
 $\cap \quad 6 + 8 > x$
 $\therefore \underline{2 < x < 14}$