



SYDNEY BOYS HIGH SCHOOL
MOORE PARK, SURRY HILLS

2008

Year 9
Yearly Examination

Mathematics

General Instructions

- Working time - 90 minutes
- Write using black or blue pen
- Board Approved calculators may be used.
- All necessary working should be shown in every question if full marks are to be awarded.
- Marks may not be awarded for messy or badly arranged work.
- Attempt all questions.
- Clearly indicate your class by placing an X next to your class.
- All answers are to be given in simplified exact form unless otherwise stated.

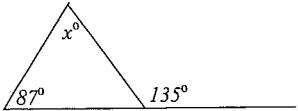
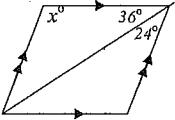
NAME _____

Examiner: *A. Ward*

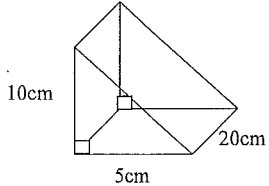
Class	Teacher	Tick
9A	Mr McQuillan	
9B	Ms Roessler	
9C	Ms Nesbitt	
9D	Mr Fuller	
9E	Mr Hesse	
9F	Mr Gainford	
9G	Ms Evans	

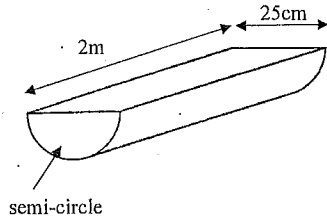
Question	Marks
1	/15
2	/15
3	/15
4	/15
5	/15
6	/15
7	/15
TOTAL	/105

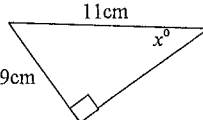
Question One (15 Marks)		Answers	Marks
a)	Solve $3x + 2 = 7$		1
b)	Calculate $36^2 + \frac{72}{6}$		1
c)	Find 112 % of 27.		1
d)	Expand $2(3a + 4)$		1
e)	Write 0.85 as a fraction in simplest form.		1
f)	Factorise $2xa - 6a$		1
g)	Write as a single fraction in simplest form: $\frac{2t}{7} - \frac{2t}{21}$		1
h)	Calculate m if $\sqrt{525} = m\sqrt{21}$		1
i)	Write in scientific notation. i.) 6.90572 ii.) 0.00960572		1 1
j)	Simplify: i.) $6x + 7 - (5x - 4)$ ii.) $\frac{7m}{14} + \frac{m}{2}$ iii.) $10t^2 + 2t^7$		1 1 1

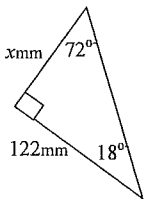
k)	Determine the value of x : i.)  ii.) 		1
End of Question One			1

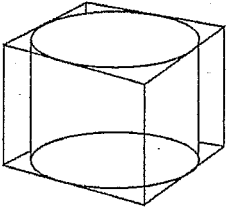
Question Two (15 Marks)	Answers	Marks
a) If $x = -4$ and $y = 6$ evaluate: $\frac{xy}{x+y}$		2
b) Solve $n+4 = 6n-3$		1
c) Evaluate $\left(\frac{7^2}{5^4}\right)^{\frac{1}{2}}$		1
d) Expand and simplify: $(3x-2)(3x+2)$		2
e) Simplify the following $\sqrt{75} + \sqrt{108}$		2
f) Find $\tan 32^\circ$ correct to 3 significant figures.		1

g)	Calculate the volume of the following: 		1
h)	Simplify $4x^0 + (4x)^0$		1
i)	Which of the following are irrational numbers: $\pi, 0.\dot{1}, \sqrt{4}, \sqrt{626}, 9^{-2}$		1
j)	A cylindrical tank has a base diameter of 20m and height 40m. Find its capacity in litres.		2
k)	Make y the subject of the formula $H = \sqrt{\frac{ay}{5}}$		1
End of Question Two			

Question Three (15 Marks)	Answers	Marks
a) Solve: $\frac{3}{x} + \frac{4}{2x} = 24$		2
b) Find the surface area of the following solid, including the top, in m^2 . Leave answer in terms of π . 		2
c) If a bag has 3 red, 4 blue and 5 green balls. What is the probability that, if a ball is chosen at random, John would choose: i.) A blue ball ii.) A red or green ball		1 1

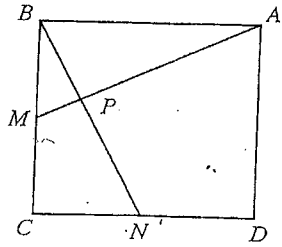
d)	Find the value of x to the nearest degree. 	2												
e)	Find the gradient of the straight line joining the two points (1,7) and (-1,-7).	1												
f)	Factorise $x^2 + 4x - 60$.	1												
g)	Find the mean, median and mode for the following frequency distribution table. <table border="1" data-bbox="212 869 548 957"> <tr> <td>x</td> <td>35</td> <td>36</td> <td>37</td> <td>38</td> <td>39</td> </tr> <tr> <td>f</td> <td>8</td> <td>7</td> <td>4</td> <td>9</td> <td>2</td> </tr> </table>	x	35	36	37	38	39	f	8	7	4	9	2	3
x	35	36	37	38	39									
f	8	7	4	9	2									
h)	Expand and simplify: $2y(y+2) - 3y(4-3y)$	2												
End of Question Three														

Question Four (15 Marks)	Answers	Marks
a) What is the midpoint of the interval joining the points (51,-12) and (-36,11)		1
b) Find the internal angle sum of a hexagon.		1
c) A poker die has faces A, K, Q, J, 10 and 9. It is rolled once. Determine the probability of getting a number face up.		1
d) Factorise $9x^2 - 121$.		1
e) Find the value of x correct to 2 decimal places. 		2
f) Express in general form $3y - 6 = 2x$.		1
g) Express with a rational denominator; $\frac{1}{4\sqrt{7}}$.		1

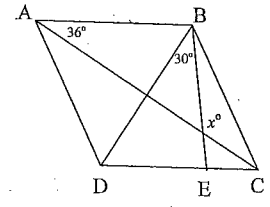
<p>h) A cylindrical tin of diameter 2cm and height 2cm fits tightly inside a cube with side measurements 2cm.</p> <p>i.) Find the volume of the cylinder</p> <p>ii.) Find the volume of the cube</p> <p>iii.) Express the volume of the cylinder as a percentage of the volume of the cube.</p> 		3
<p>i) Find the effect on the range when a set of scores has</p> <p>i.) 3 added to each score.</p> <p>ii.) each score halved.</p>		1 1
<p>j) Make n the subject of:</p> $A = \frac{(n-1)}{n+1}$		2
End of Question Four		

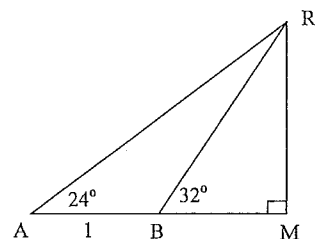
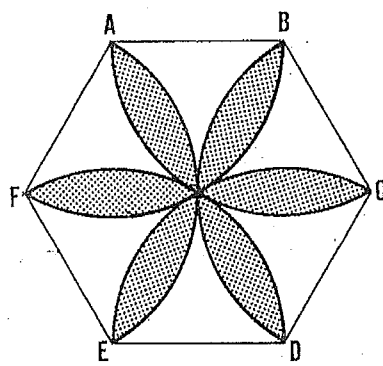
Question Five (15 Marks)		Answers	Marks
a)	What is the distance between the points (-2,5) and (3,7).		1
b)	Simplify: $\frac{x^2 - 2x}{x^2 - 4}$		2
c)	Solve the inequality: i.) $2(2-x) \geq \frac{1}{3}(9-3x)$ ii.) Graph the solution on a number line.		2 1
d)	Make b the subject of the formula: $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$		2

e)	Two dice are thrown. What is the probability of getting a sum of more than 7, when the upper most faces are added together.	2
f)	Find 2 numbers such that if 18 is added to the first number it becomes twice the second number and if 6 is added to the second number it becomes three times the first number.	3
g)	Find a and b if $(x-a)^2 = x^2 - 6x + b$.	2
End of Question Five		

Question Six (15 Marks)		Answers	Marks
a)	Determine, without a calculator, which is greater 4^{100} or 6^{75} (show full working).		2
b)	Find the y intercept of the straight line: $\frac{x}{4} + \frac{y}{8} = 10$		1
c)	<p>ABCD is a square; M and N are the midpoints of BC and CD respectively.</p>  <p>i.) Prove that triangles ABM and BCN are congruent.</p> <p>ii.) Prove that AM and BN are perpendicular.</p>		2 3

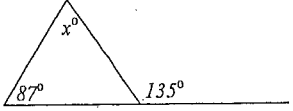
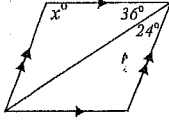
d)	Factorise $12x^2 - 5x - 2$	2
e)	Determine a if $2x + 5y = 11$ and $ax - 3y = 9$ are perpendicular.	2
f)	Express with a rational denominator: $\frac{\sqrt{5}}{2\sqrt{3} + \sqrt{2}}$	3
End of Question Six		

Question 7 (15 Marks)		Answers	Marks
a)	Simplify: $\frac{7}{x^2 - 7x + 10} - \frac{2}{x^2 - 5x}$		3
b)	Given the points $X(-1,3)$ and $Y(-4,1)$, find the equation of the perpendicular bisector of XY .		3
c)	<p>$ABCD$ is a rhombus. $\angle DBE = 30^\circ$ and $\angle BAC = 36^\circ$. Determine the value of x. (Reasons not required).</p> 		2

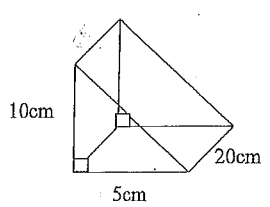

<p>d)</p>  <p>In the above diagram AB is 1 unit and the angles are as marked.</p> <p>i.) Prove that $RM = \frac{\tan 24^\circ \tan 32^\circ}{\tan 32^\circ - \tan 24^\circ}$</p> <p>ii.) Find RM correct to 2 decimal places.</p>		<p>3</p> <p>1</p>
<p>e) The regular hexagon ABCDEF has sides 1cm. Find the shaded area (answer in terms of π)</p> 		<p>3</p>
<p>End of Question Seven</p>		

<p>End Of Examination</p>		
<p>Additional Space for Answers</p>		<p>Marks</p>
<p>Question Number</p>	<p>Put "see back" at original question.</p>	

Question One (15 Marks)	Answers	Marks
a) Solve $3x+2=7$	$3x=5$ $x=5/3$	1
b) Calculate $36^2 + \frac{72}{6}$	$1296 + 12$ 1308	1
c) Find 112% of 27.	1.12×27 30.24	1
d) Expand $2(3a+4)$	$6a + 8$	1
e) Write 0.85 as a fraction in simplest form.	$17/20$	1
f) Factorise $2xa-6a$	$2a(x-3)$	1
g) Write as a single fraction in simplest form: $\frac{2t}{7} - \frac{2t}{21}$	$\frac{6t}{21} - \frac{2t}{21}$ $\frac{4t}{21}$	1
h) Calculate m if $\sqrt{525} = m\sqrt{21}$	$m=5$	1
i) Write in scientific notation. i.) 6.90572	6.90572×10^0	1
ii.) 0.00960572	9.60572×10^{-3}	1
j) Simplify: i.) $6x+7-(5x-4)$	$6x+7-5x+4$ $x+11$	1
ii.) $\frac{7m}{14} + \frac{m}{2}$	$\frac{7m}{14} \times \frac{2}{m}$ 1	1
iii.) $10t^2 + 2t^7$	$\frac{510t^2}{2t^5}$ $\frac{5}{t^5}$	1

k) Determine the value of x :			
i.)		$x = 135 - 87$ $x = 48^\circ$	1
ii.)		$x = 180 - (36 + 24)$ $= 180 - 60$ $= 120^\circ$	1
End of Question One			

Question Two (15 Marks)		Answers	Marks
a)	If $x = -4$ and $y = 6$ evaluate: $\frac{xy}{x+y} = \frac{-4 \times 6}{-4 + 6}$ $= \frac{-24}{2}$	-12	2
b)	Solve $n + 4 = 6n - 3$ $7 = 5n$	$n = \frac{7}{5}$	1
c)	Evaluate $\left(\frac{7^2}{5^4}\right)^{\frac{1}{2}}$	$\frac{7}{5^2} = \frac{7}{25}$	1
d)	Expand and simplify: $(3x-2)(3x+2)$ $= 9x^2 - 4$	$9x^2 - 4$	2
e)	Simplify the following $\sqrt{75} + \sqrt{108}$ $5\sqrt{3} + 6\sqrt{3}$	$11\sqrt{3}$	2
f)	Find $\tan 32^\circ$ correct to 3 significant figures.	0.625	1

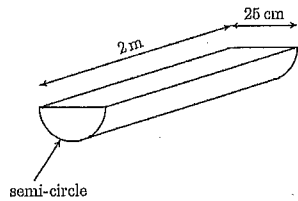
g)	Calculate the volume of the following: 	$V = \frac{1}{2} \times 10 \times 5 \times 20$ $= 500 \text{ cm}^3$	1
h)	Simplify $4x^0 + (4x)^0$ $= 4 + 1$	5	1
i)	Which of the following are irrational numbers: $\pi, 0.1, \sqrt{4}, \sqrt{626}, 9^{-2}$	$\pi, \sqrt{626}$	1
j)	A cylindrical tank has a base diameter of 20m and height 40m. Find its capacity in litres. 	$V = \pi r^2 h$ $= \pi (10)^2 \times 40$ $= 40000\pi \text{ m}^3$ $(\approx 6283 \text{ L}) = 40000000 \text{ L}$ $(\approx 12566370 \text{ L})$	2
k)	Make y the subject of the formula $H = \sqrt{\frac{ay}{5}}$ $H^2 = \frac{ay}{5}$ $ay = 5H^2$ $y = \frac{5H^2}{a}$	$y = \frac{5H^2}{a}$	1
End of Question Two			

2008 Year 9 Advanced Mathematics Yearly:
Solutions— Question 3

3. (a) Solve $\frac{3}{x} + \frac{4}{2x} = 24$.

Solution: $6 + 4 = 48x$,
 $x = \frac{10}{48}$,
 $= \frac{5}{24}$.

(b) Find the surface area of the following solid, including the top, in m^2 . Leave answer in terms of π .



Solution:
Top = $0.25 \times 2 m^2$,
Ends = $2 \times \frac{1}{2} \times \pi \times 0.125^2 m^2$,
Curved = $2 \times \pi \times 0.125 m^2$,
Total = $0.5 + 0.015625\pi + 0.25\pi m^2$,
 $= 0.5 + 0.265625\pi m^2$, or
 $= \frac{1}{2} + \frac{17\pi}{64} m^2$.

(c) A bag has 3 red, 4 blue and 5 green balls. What is the probability that, if a ball is chosen at random, John would choose:

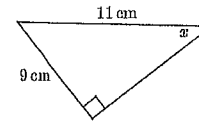
(i) A blue ball

Solution: $\frac{4}{12} = \frac{1}{3}$

(ii) A red or green ball

Solution: $\frac{3+5}{12} = \frac{2}{3}$

(d) Find the value of x to the nearest degree.



Solution: $\sin x = \frac{9}{11}$,
 $x \approx 55^\circ$.

(e) Find the gradient of the straight line joining the two points (1, 7) and (-1, -7).

Solution: $\frac{7 - -7}{1 - -1} = \frac{14}{2}$,
 $= 7$.

(f) Factorise $x^2 + 4x - 60$.

Solution: $(x + 10)(x - 6)$

(g) Find the mean, median and mode for the following frequency distribution table.

x	35	36	37	38	39
f	8	7	4	9	2

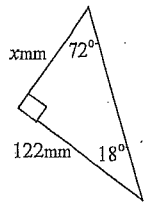
Solution: Mean = $\frac{1100}{30}$,
 $= 36\frac{2}{3}$,
Median = $\frac{36 + 37}{2}$,
 $= 36\frac{1}{2}$,
Mode = 38.

(h) Expand and simplify:

$2y(y + 2) - 3y(4 - 3y)$

Solution:
 $2y^2 + 4y - 12y + 9y^2 = 11y^2 - 8y$.

Question Four (15 Marks)	Answers	Marks
a) What is the midpoint of the interval joining the points (51,-12) and (-36,11)	$\left(\frac{51+(-36)}{2}, \frac{(-12)+11}{2}\right)$ $= \left(\frac{15}{2}, -\frac{1}{2}\right)$	1
b) Find the internal angle sum of a hexagon.	$(n-2)180$ $= 4 \times 180$ $= 720^\circ$	1
c) A poke die has faces A, K, Q, J, 10 and 9. It is rolled once. Determine the probability of getting a number face up.	$\frac{2}{6} = \frac{1}{3}$	1
d) Factorise $9x^2 - 121$.	$(3x - 11)(3x + 11)$	1
e) Find the value of x correct to 2 decimal places.	$\tan 18 = \frac{x}{122}$ $x = 122 \tan 18$ $x = 39.64 \text{ mm}$	2
f) Express in general form $3y - 6 = 2x$.	$2x - 3y + 6 = 0$	1
g) Express with a rational denominator; $\frac{1}{4\sqrt{7}} \cdot x \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{7}}{28}$		1



h) A cylindrical tin of diameter 2cm and height 2cm fits tightly inside a cube with side measurements 2cm.	<p>i.) Find the volume of the cylinder</p> <p>ii.) Find the volume of the cube</p> <p>iii.) Express the volume of the cylinder as a percentage of the volume of the cube.</p>	$V = \pi r^2 h$ $= \pi(1)^2(2)$ $= 2\pi$ $V = x^3$ $= (2)^3$ $= 8$ $\frac{2\pi}{8} \times 100\%$ $= 25\pi\%$	3
i) Find the effect on the range when a set of scores has	<p>i.) 3 added to each score.</p> <p>ii.) each score halved.</p>	<p>let lowest score be x highest score be y.</p> <p>orig. range = $y - x$</p> <p>i) range = $(y+3) - (x+3)$ $= y - x$ \therefore No change</p> <p>ii) range = $\frac{y}{2} - \frac{x}{2}$ $= \frac{1}{2}(y - x)$ \therefore Halved</p>	1 1
j) Make n the subject of:	$A = \frac{(n-1)}{n+1}$	$A(n+1) = n-1$ $An + A = n-1$ $An - n = -1 - A$ $n(A-1) = -1 - A$ $n = \frac{-1 - A}{A-1}$ $n = \frac{A+1}{1-A}$	2
End of Question Four			

Question Five (15 Marks)	Answers	Marks
a) What is the distance between the points (-2,5) and (3,7).	$\sqrt{5^2 + 2^2}$ 13	1
b) Simplify: $\frac{x^2 - 2x}{x^2 - 4} \cdot \frac{x(x-2)}{(x-2)(x+2)}$	$\frac{x}{x+2}$	2
c) Solve the inequality: i) $2(2-x) \geq \frac{1}{3}(9-3x)$ $4-2x \geq 3-x$ $-x \geq -1$ $x \leq 1$		1
ii) Graph the solution on a number line.		2
d) Make b the subject of the formula: $x = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$ $2ax = -b + \sqrt{b^2 - 4ac}$ $2ax + b = \sqrt{b^2 - 4ac}$ $4a^2x^2 + 4abx + b^2 = b^2 - 4ac$ $4a^2x^2 + b^2 = -4ac$ $b^2x = -4ac$ $b = \frac{-4ac}{x}$		2

e) Two dice are thrown. What is the probability of getting a sum of more than 7, when the upper most faces are added together.

$$\frac{15}{36} = \frac{5}{12}$$

f) Find 2 numbers such that if 18 is added to the first number it becomes twice the second number and if 6 is added to the second number it becomes three times the first number.

$$\begin{aligned} x + 18 &= 2y \quad \text{①} \\ 3x &= y + 6 \quad \text{②} \\ 3x &= 6y - 54 \quad \text{③} \\ 0 &= 5y - 60 \quad \text{④} \\ 12 &= y \end{aligned}$$

$$\text{① } x + 18 = 24$$

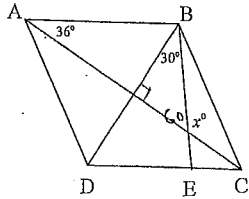
$$\begin{cases} x = 6 \\ y = 12 \end{cases}$$

g) Find a and b if $(x-a)^2 = x^2 - 6x + b$.

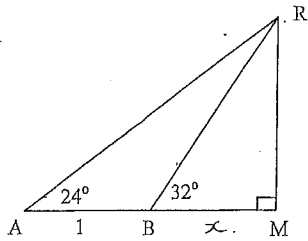
$$\begin{aligned} x^2 - 6x + b &= \text{perfect square} \\ \therefore b &= 9 \\ (x-a)^2 &= (x-3)^2 \\ a &= 3 \end{aligned}$$

Question Six (15 Marks)	Answers	Marks
a) Determine, without a calculator, which is greater 4^{100} or 6^{75} (show full working).	$(4^{100})^{\frac{1}{4}} = 4^4$ $(6^{75})^{\frac{1}{3}} = 6^3$ $4^4 > 6^3 \therefore 4^{100}$	2
b) Find the y intercept of the straight line: $\frac{x}{4} + \frac{y}{8} = 10$	$x = 0$ $y = 80$	1
c) ABCD is a square; M and N are the midpoints of BC and CD respectively. i) Prove that triangles ABM and BCN are congruent. ii) Prove that AM and BN are perpendicular.	$AB = BC$ (given) $BM = CN$ (") $\angle BCN = \angle ABM$ (rt + $\angle s$) $\therefore \triangle ABM \cong \triangle BCN$ (SAS) From (i) $\angle CBN = \angle BAM$ $\angle BNC = \angle AMB$ In $\triangle BCN$, $\angle B + \angle N = 90^\circ$ \therefore In $\triangle BMP$, $\angle B + \angle M = 90^\circ$ $\therefore \angle BPM = 90^\circ$ So $AM \perp BN$	2 3

<p>d) Factorise $12x^2 - 5x - 2$</p> $\frac{(12x-8)(12x+3)}{4 \times 3} = (3x-2)(4x+1)$		2
<p>e) Determine a if $2x+5y=11$ and $ax-3y=9$ are perpendicular.</p> $m_1 = -\frac{2}{5}$ <p>so $m_2 = \frac{5}{2}$</p>	$ax - 9 = 3y$ $y = \frac{a}{3}x - 3$ $\frac{a}{3} = \frac{5}{2}$ $a = 7\frac{1}{2}$	2
<p>f) Express with a rational denominator:</p> $\frac{\sqrt{5}}{2\sqrt{3}+\sqrt{2}} \times \frac{2\sqrt{3}-\sqrt{2}}{2\sqrt{3}-\sqrt{2}} = \frac{2\sqrt{15}-\sqrt{10}}{12-2}$ $= \frac{2\sqrt{15}-\sqrt{10}}{10}$		3
<p>End of Question Six</p>		

Question 7 (15 Marks)	Answers	Marks
<p>a) Simplify:</p> $\frac{7}{x^2-7x+10} - \frac{2}{x^2-5x}$ $\frac{7}{(x-2)(x-5)} - \frac{2}{x(x-5)}$ $\frac{7x - 2x + 4}{x(x-5)(x-2)}$	$\frac{5x+4}{x(x-5)(x-2)}$	3
<p>b) Given the points $X(-1,3)$ and $Y(-4,1)$, find the equation of the perpendicular bisector of XY.</p> $MP = \left(-\frac{5}{2}, 2\right)$ $m = \frac{-2}{-5} = \frac{2}{5}$	$y - 2 = -\frac{3}{2}\left(x + \frac{5}{2}\right)$ $2y - 4 = -3x - \frac{15}{2}$ $4y - 8 = -6x - 15$ $6x + 4y + 7 = 0$ $y = -\frac{3}{2}x - \frac{7}{4}$	3
<p>c) ABCD is a rhombus. $\angle DBE = 30^\circ$ and $\angle BAC = 36^\circ$. Determine the value of x. (Reasons not required).</p> 	120°	2

d)



In the above diagram AB is 1 unit and the angles are as marked.

- i.) Prove that $RM = \frac{\tan 24^\circ \tan 32^\circ}{\tan 32^\circ - \tan 24^\circ}$
- ii.) Find RM correct to 2 decimal places.

$$\tan 32 = \frac{RM}{x}$$

$$x = \frac{RM}{\tan 32}$$

$$\tan 24 = \frac{RM}{1+x}$$

$$1+x = \frac{RM}{\tan 24}$$

$$1 + \frac{RM}{\tan 32} = \frac{RM}{\tan 24}$$

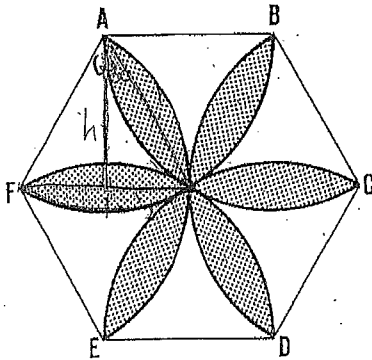
$$1 = RM \left(\frac{1}{\tan 24} - \frac{1}{\tan 32} \right)$$

$$1 = RM \left(\frac{\tan 32 - \tan 24}{\tan 24 \tan 32} \right)$$

$$RM = \frac{\tan 24 \tan 32}{\tan 32 - \tan 24}$$

$$RM = 1.55$$

- e) The regular hexagon ABCDEF has sides 1cm. Find the shaded area (answer in terms of π)



$$h = \sqrt{1 - \frac{1}{4}}$$

$$= \frac{\sqrt{3}}{2}$$

3

Area of triangle = $\frac{\sqrt{3}}{4}$

Area of sector = $\frac{\pi}{6}$

Area of half petal = $\frac{\pi}{6} - \frac{\sqrt{3}}{4}$

Area of shaded = $12 \left(\frac{\pi}{6} - \frac{\sqrt{3}}{4} \right)$

End of Question Seven

$$= 2\pi - 3\sqrt{3}$$