SYDNEY BOYS HIGH SCHOOL
MOORE PARK, SURRY HILLS

Year 9

Yearly Examination 2009

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: *A.M.Gainford*

NAME: .....

Class	Teacher	
9 A	Mr Kourtesis	
9 B	Ms Nesbitt	
9 C	Ms Ward	
9 D	Ms Roessler	
9 E	Mr McQuillan	
9 F	Mr Boros	
9 G	Mr Hespe	

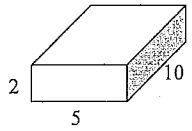
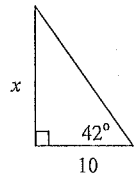
Question	Mark
1	/18
2	/18
3	/18
4	/18
5	/18
6	/18
7	/18
Total	/126

Question 1. (18 marks)

		Answers
(a) [2]	Find, correct to 4 decimal places: (i) $\sin 46°22'$ (ii) $\tan 84°12'$	(i) (ii)
(b) [1]	Express $0\cdot0064045$ in scientific notation, correct to four significant figures.	
(c) [2]	Arrange this set of numbers in order, smallest to largest: $\left\{\frac{11}{7}, \frac{\pi}{2}, \sqrt{3}, (0\cdot66667)^{-1}\right\}$	
(d) [2]	In each case find the acute angle θ correct to the nearest minute: (i) $\cos\theta = 0\cdot9$ (ii) $\tan\theta = 2.5$	(i) (ii)
(e) [2]	Express $\sqrt{45}-\sqrt{20}$ as a simple surd.	
(f) [2]	Simplify the following expression: $\frac{6(xy^2)^4}{(3x^3y)^2}$	
(g) [2]	Express in simplest surd form (i) $2\sqrt{75}-3\sqrt{48}$ (ii) $\frac{6\sqrt{2}\times\sqrt{6}}{4\sqrt{3}}$	(i) (ii)
(h) [2]	Expand and simplify $(3x-2)-2(x+2)$.	
(i) [1]	At a Sydney Swans match in Sydney there were five men to every two women. If 31 514 fans attended, how many men were there?	

		Answers
(j) [2]	Solve for x: $4(x+2)-3(x-1)=23$	

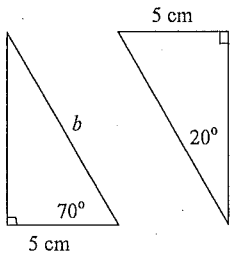
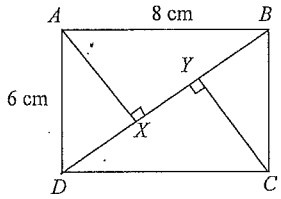
Question 2. (18 marks)

(a) [3]	A letter is chosen at random from the word *KATOOMBA*. What is the probability that the letter is: (i) A (ii) a consonant (iii) Z	(i) (ii) (iii)
(b) [3]	Factorise completely: (i) $9ab^2-6a^2b$ (ii) $4y^2-36$	(i) (ii)
(c) [4]	Find the volume and surface area of the closed rectangular prism, where measurements are in centimetres. 	Volume = SA =
(d) [4]	Factorise (i) x^2-6x+8 (ii) $8x^2+18x-5$	(i) (ii)
(e) [2]	Find x, correct to 3 decimal places. 	

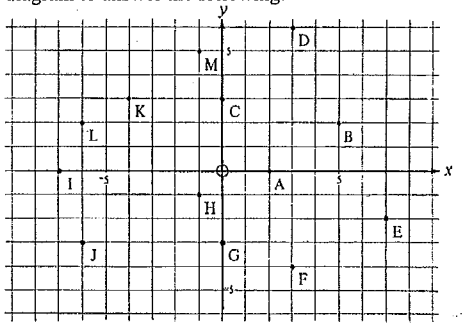
		Answers
(f) [2]	A certain quad scull races at 18 km/hr. (i) How far will it go in 2 minutes? (ii) How long, to the nearest second, will it take to race 1100 m?	(i) (ii)

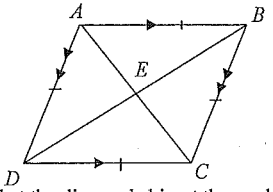
Question 3 (18 Marks)

(a) [4]	Two ordinary dice (6 faces) are rolled, and the uppermost faces noted. (i) Use a grid or table to show all possible outcomes. (ii) What is the probability of a double? (iii) What is the probability that the sum is 7 or 11?	(i) (ii) (iii)
(b) [3]	Consider the line with equation $2x-5y+10=0$ (i) State the gradient of the line. (ii) State the y-intercept of the line. (iii) State the x-intercept of the line.	(i) (ii) (iii)

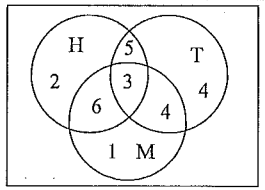
		Answers
(c)	 (i) State which test you would use to show that these two triangles are congruent. (ii) Find the value of the pronumeral, correct to 2 decimal places. [3]	(i) (ii)
(d)	*ABCD* is a rectangle with sides 6 cm and 8 cm. *AX* and *CY* are drawn perpendicular to *BD*. Find the length of *XY*.  [3]	
(e)	A card is drawn at random from a regular pack of 52 playing cards. State the probability that it is: (i) Red (ii) a spade (iii) a king (iv) a red ace (v) either a seven or a black queen [5]	(i) (ii) (iii) (iv) (v)

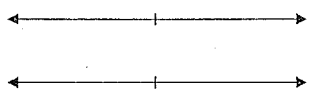
Question 4 (18 Marks)

		Answers
(a)	Use the diagram to answer the following:  (i) Find the gradient of *HD*. (ii) Find the gradient of *FH*. (iii) Find the gradient of *HM*. (iv) Find the length of *AK* (as a surd). (v) Find the mid point of *LF* (vi). Write the equation of the line *FH*. [6]	(i) (ii) (iii) (iv) (v) (vi)
(b)	Anita is five times as old as her son Bill. In fifteen years time Anita will only be twice as old as Bill. Find their present ages. [2]	
(c)	Factorise the following expression completely: $x^2 - y^2 + 5x - 5y$ [2]	

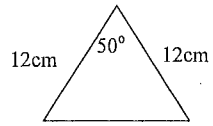
		Answers
(d) [5]	The diagram below is a rhombus.  (i) Prove that the diagonals bisect the angles at the vertices. (ii) Hence, show that the diagonals are perpendicular. Give clear reasons for each step.	(i) (ii)
(e) [2]	Solve $\frac{2a+3}{2}-\frac{a-2}{3}=\frac{a-1}{4}$	
(e) [1]	Make x the subject of the formula $y=\frac{x+1}{x-1}$.	

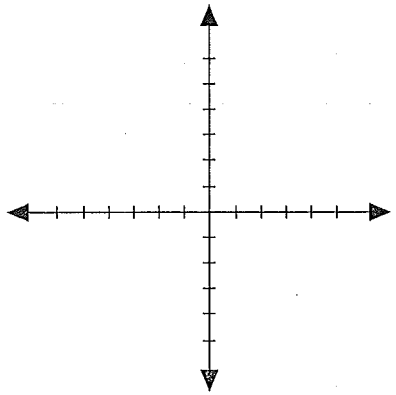
Question 5 (18 Marks)

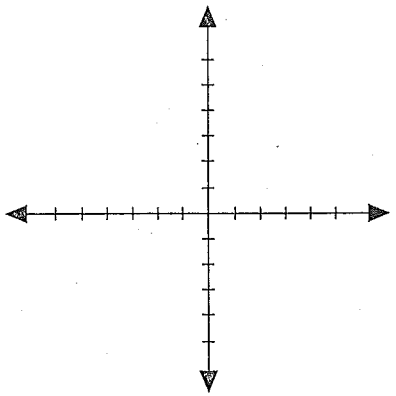
		Answers
(a) [2]	Simplify, and express with rational denominator: $\frac{1}{\sqrt{5}-\sqrt{3}}-\frac{1}{\sqrt{7}+\sqrt{5}}$	
(b) [4]	The Venn diagram shows the papers (Herald, Tele, Mx) read by a class of 30 boys. A boy is chosen at random. State the probability that: (i) He reads the Herald (ii) He reads the Tele and Mx, but not the Herald (iii) He reads exactly two papers (iv) He reads no paper  	(i) (ii) (iii) (iv)
(c) [2]	A canoeist paddles due west for 1.5 km, then turns due south and covers a further 800 m. How far (to the nearest metre) and in what direction (true bearing, nearest degree) must she travel to return directly to her starting point?	Distance Bearing
(d) [2]	Calculate the area of a right-angled triangle with hypotenuse 8 cm, and an angle of 50°, correct to 2 decimal places.	
(e) [2]	Solve this set of equations simultaneously: $\left.\begin{aligned}3x-y&=11\\x+y&=1\end{aligned}\right\}$	$x=$ $y=$
(f) [2]	From a lighthouse 70 m above sea level a ship is sighted 1.2 km out to sea. What is the angle of depression from the lighthouse to the ship? (Answer to the nearest minute.)	

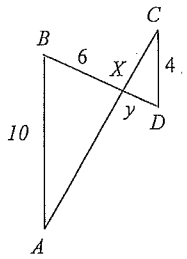
		Answers
(g) [2]	Simplify $\frac{x^2+2x-8}{x^2+8x+16}$.	
(h) [2]	Sketch the solution set of the inequations on separate number lines. (i) $2x-3<5$ (ii) $-2(3-2x)\leq 4$	

Question 6 (18 Marks)

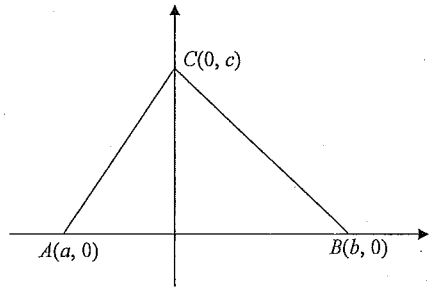
(a) [2]	The bases of two ladders are the same distance from the base of a vertical wall. The longer ladder is 15 m long, and makes an angle of 58° with the ground. If the shorter ladder is 12.6 m long, what angle does it make with the ground? (Nearest degree)	
(b) [4]	Find the general form equations of the lines: (i) Parallel to the line $3x+4y-2=0$ and passing through the point (-3, 4). (ii) Perpendicular to the line $3x+y=4$ and with x-intercept at -3.	(i) (ii)
(c) [2]	By the use of an appropriate construction, calculate the area of this triangle, correct to one decimal place. 	

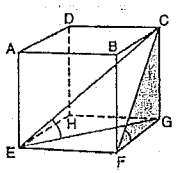
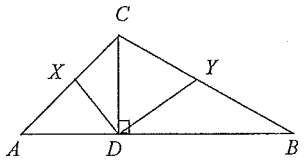
		Answers
(d) [1]	A British 50 pence piece is based on a regular heptagon (7 sides). Find the size of the internal angles.	
(e) [2]	On the number plane below sketch the lines $3x-2y=6$ and $y=-\frac{1}{2}x+3$. 	
(f) [2]	Use either the elimination method or the substitution method to solve the following system of simultaneous equations: $\left.\begin{aligned}7x+3y-4=0\\5x+2y-3=0\end{aligned}\right\}$	

		Answers
(g)	Sketch on the number plane the region where the inequalities $x-y\le 2$ and $3x+y\ge 3$ hold simultaneously.	
[2]		

(h)		(i) Given that $AB \parallel CD$, prove that $\Delta ABX \parallel\!\parallel\!\parallel \Delta CDX$ (giving reasons). (ii) Hence find the value of y. (Measurements are in centimeters).
[3]		

Question 7 (18 Marks)

		Answers
(a)		
	The diagram represents any triangle. An altitude of a triangle passes through a vertex and is perpendicular to the opposite side, produced if necessary.	
	(i) Sketch the altitudes BM (M lies on AC) and AN (N lies on BC).	
	(ii) Write down the gradients of BM and AN.	(ii)
	(iii) State the equations of the lines BM and AN.	(iii)
	(iv) Find the co-ordinates of the point of intersection of the altitudes BM and AN.	(iv)
[10]	(v) What geometric result is proved by the above?	(v)

		Answers
(b)	The figure is a cube of side 6 cm.  (i) Find the length of the body diagonal CE. (Correct to 2 d.p.) (ii) Find the angle CEG to the nearest minute. [4]	(i) (ii)
(c)	 ABC is any triangle, CD is an altitude, and X and Y are the midpoints of AC and BC respectively. Prove $DXCY$ is a kite. [4]	

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	

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

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

Question	

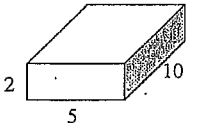
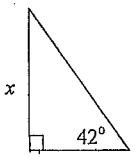
SBHS - Yr 9 Yrly 2009 Solutions

Question 1. (18 marks)

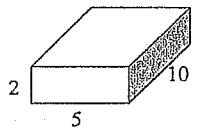
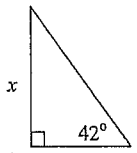
		Answers
(a) [2]	Find, correct to 4 decimal places: (i) $\sin 46°22'$ (ii) $\tan 84°12'$	(i) 0·7238 (ii) 9·8448
(b) [1]	Express $0\cdot0064045$ in scientific notation, correct to four significant figures.	$6\cdot405\times10^{-3}$
(c) [2]	Arrange this set of numbers in order, smallest to largest: $\left\{\frac{11}{7}, \frac{\pi}{2}, \sqrt{3}, (0\cdot66667)^{-1}\right\}$ 1·57143, 1·5708, 1·732, 1·499...	0.6667^{-1} $\pi/2$ $11/7$ $\sqrt{3}$
(d) [2]	In each case find the acute angle θ correct to the nearest minute: (i) $\cos\theta = 0\cdot9$ (ii) $\tan\theta = 2.5$	(i) 25°51' (ii) 68°12'
(e) [2]	Express $\sqrt{45}-\sqrt{20}$ as a simple surd. $\sqrt{9\times5}-\sqrt{4\times5} = 3\sqrt{5}-2\sqrt{5} =$	$\sqrt{5}$
(f) [2]	Simplify the following expression: $\frac{6(xy^2)^4}{(3x^3y)^2}$ $\frac{6x^4y^8}{9x^6y^2} =$	$\frac{2y^6}{3x^2}$
(g) [2]	Express in simplest surd form (i) $2\sqrt{75}-3\sqrt{48} = 2\times5\sqrt{3}-3\times4\sqrt{3} = 10\sqrt{3}-12\sqrt{3} =$ (ii) $\frac{6\sqrt{2}\times\sqrt{6}}{4\sqrt{3}} = \frac{3\sqrt{2}\times\sqrt{2}}{2} =$	(i) $-2\sqrt{3}$ (ii) 3
(h) [2]	Expand and simplify $(3x-2)-2(x+2)$. $3x-2-2x-4 =$	$x-6$
(i) [1]	At a Sydney Swans match in Sydney there were five men to every two women. If 31 514 fans attended, how many men were there? $\frac{31514}{7}\times5 =$	22 510

		Answers
(j) [2]	Solve for x: $4(x+2)-3(x-1)=23$ $4x+8-3x+3=23$ $x+11=23$	$x=12$

Question 2. (18 marks)

(a) [3]	A letter is chosen at random from the word *KATOOMBA*. What is the probability that the letter is: (i) *A* (ii) a consonant (iii) *Z*	(i) (ii) (iii)
(b) [3]	Factorise completely: (i) $9ab^2-6a^2b$ (ii) $4y^2-36$	(i) (ii)
(c) [4]	Find the volume and surface area of the closed rectangular prism, where measurements are in centimetres. 	Volume = SA =
(d) [4]	Factorise (i) x^2-6x+8 (ii) $8x^2+18x-5$	(i) (ii)
(e) [2]	Find x, correct to 3 decimal places. 	

Question 2. (18 marks)

(a) [3]	A letter is chosen at random from the word *KATOOMBA*. What is the probability that the letter is: (i) *A* (ii) a consonant (iii) *Z*	(i) $\frac{2}{8}=\frac{1}{4}$ (1) (ii) $\frac{4}{8}=\frac{1}{2}$ (1) (iii) $\frac{0}{8}=0$ (1)
(b) [3]	Factorise completely: (i) $9ab^2-6a^2b = 3ab(3b-2a)$ (1) (ii) $4y^2-36 = 4(y^2-9)=4(y-3)(y+3)$ (2)	(i) (ii)
(c) [4]	Find the volume and surface area of the closed rectangular prism, where measurements are in centimetres. 	Volume = 100 cm^3 (2) SA = $2\times2\times5+2\times5\times10+2\times2\times10 = 160\text{ cm}^2$ (1)
(d) [4]	Factorise (i) $x^2-6x+8 = (x-4)(x-2)$ (2) (ii) $8x^2+18x-5 = \frac{(8x+20)(8x-2)}{4(2x+5)\cdot2(4x-1)}$ (2) -40, $+18$	(i) (ii)
(e) [2]	Find x, correct to 3 decimal places. 	$\tan 42^\circ = \frac{x}{10}$ $x = 10\tan 42$ $x = 9.004$ 3DP (2)

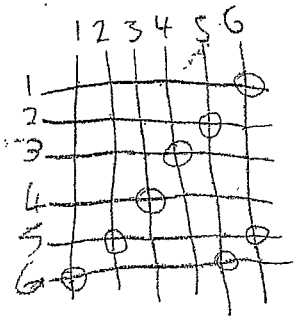
18 km = 60 mins

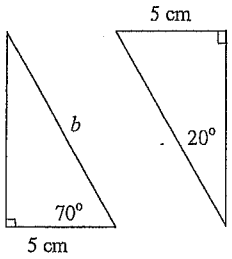
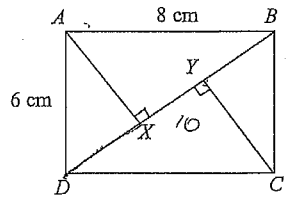
$\frac{18}{30}$ km = 2 mins

(f) [2]	A certain quad scull races at 18 km/hr. (i) How far will it go in 2 minutes? (ii) How long, to the nearest second, will it take to race 1100 m? 1 km = $\frac{60}{18}$ mins	**Answers** (i) $\frac{3}{5}$ km (0.6 km, 600 m) (1) (ii) 220 seconds or 3 mins 40 seconds (1)

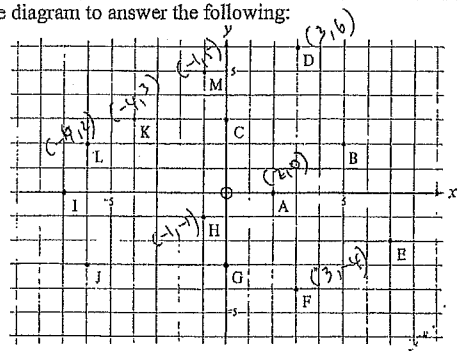
(f) [2]	A certain quad scull races at 18 km/hr. (i) How far will it go in 2 minutes? (ii) How long, to the nearest second, will it take to race 1100 m?	**Answers** (i) (ii)

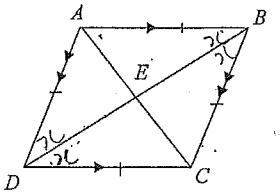
Question 3 (18 Marks)

(a) [4]	Two ordinary dice (6 faces) are rolled, and the uppermost faces noted. (i) Use a grid or table to show all possible outcomes. (ii) What is the probability of a double? (iii) What is the probability that the sum is 7 or 11?	(i)  (ii) $\frac{1}{6}$ (iii) $\frac{8}{36}=\frac{2}{9}$
(b) [3]	Consider the line with equation $2x-5y+10=0$ (i) State the gradient of the line. (ii) State the y-intercept of the line. (iii) State the x-intercept of the line.	$-5y = 2x+10$ $y = \frac{2x}{5}+2$. (i) $\frac{2}{5}=0.4$ (ii) 2 (iii) -5.

		Answers
(c) [3]	 (i) State which test you would use to show that these two triangles are congruent. (ii) Find the value of the pronumeral, correct to 2 decimal places.	(i) AAS. (ii) $\cos 70 = \frac{5}{b}$ $b = \frac{5}{\cos 70}$ $b = 14.62$
(d) [3]	$ABCD$ is a rectangle with sides 6 cm and 8 cm. AX and CY are drawn perpendicular to BD. Find the length of XY. 	$\frac{1}{2} \times 8 \times 6 = \frac{1}{2} \times 10 \times AX$ $AX = \frac{24}{5}$ $DX^2 = 6^2 - (\frac{24}{5})^2$ $DX = \frac{18}{5}$ $XY = \frac{14}{5} = 2.8$
(e) [5]	A card is drawn at random from a regular pack of 52 playing cards. State the probability that it is: (i) Red (ii) a spade (iii) a king (iv) a red ace (v) either a seven or a black queen	(i) $\frac{1}{2}$ (ii) $\frac{1}{4}$ (iii) $\frac{1}{13}$ (iv) $\frac{1}{26}$ (v) $\frac{3}{26}$

Question 4 (18 Marks)

		Answers
(a) [6]	Use the diagram to answer the following:  (i) Find the gradient of HD. (ii) Find the gradient of FH. (iii) Find the gradient of HM. (iv) Find the length of AK (as a surd). (v) Find the mid point of LF (vi). Write the equation of the line FH.	(i) $\frac{7}{4}$ (ii) $-\frac{3}{4}$ (iii) undefined (iv) $3\sqrt{5}$ (v) $(-\frac{3}{2}, -1)$ (vi) $\frac{y+4}{x+1} = \frac{-3}{4}$ $3x+3 = -4y-4$ $3x+4y+7=0$ or $y = \frac{-3}{4}x - \frac{7}{4}$
(b) [2]	Anita is five times as old as her son Bill. In fifteen years time Anita will only be twice as old as Bill. Find their present ages. Let Bill's age be x, Anita $= 5x$ $5x+15 = 2x+30$ $x = 5$	25, 5
(c) [2]	Factorise the following expression completely: $x^2 - y^2 + 5x - 5y$	$(x+y)(x-y) + 5(x-y) = (x+y+5)(x-y)$

		Answers
(d)	The diagram below is a rhombus.  (i) Prove that the diagonals bisect the angles at the vertices. (ii) Hence, show that the diagonals are perpendicular. Give clear reasons for each step. [5]	(i) From (i) we have Four congruent △s (ii) ∠AEB + ∠BEC + ∠CED + ∠DEA = 360° (angles at a pt) ∴ diagonals are ⊥
(e)	Solve $\frac{2a+3}{2} - \frac{a-2}{3} = \frac{a-1}{4}$ $6(2a+3) - 4(a-2) = 3a-3$ $12a + 18 - 4a + 8 = 3a - 3$ [2]	$5a = -29$ $a = -\frac{29}{5}$
(e)	Make x the subject of the formula $y = \frac{x+1}{x-1}$. $xy - y - x - 1 = 0$ $x - xy = -y - 1$ [1]	$x(1-y) = -y-1$ $x = \frac{-y-1}{1-y}$ $= \frac{y+1}{y-1}$

4(d) let ∠ABD = x

∠ADB = x (isos △)

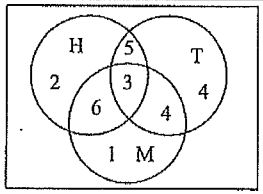
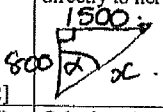
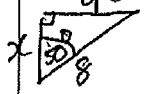
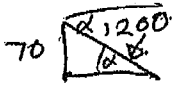
∠BDC = ∠ABD (eq alt ∠s, AB ∥ DC)

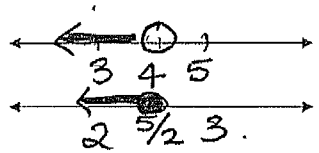
= x

and ∠DBC = ∠ADB = x (eq alt ∠s, AB ∥ DC)

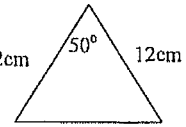
Similarly for ∠DAB and ∠DCB. ∴ the diagonals bisect ∠s at

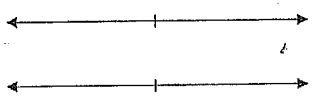
Question 5 (18 Marks)

		Answers
(a) [2]	Simplify, and express with rational denominator: $\frac{1}{\sqrt{5}-\sqrt{3}}-\frac{1}{\sqrt{7}+\sqrt{5}}$ $= \left(\frac{1}{\sqrt{5}-\sqrt{3}}\times\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}+\sqrt{3}}\right)-\left(\frac{1}{\sqrt{7}+\sqrt{5}}\times\frac{\sqrt{7}-\sqrt{5}}{\sqrt{7}-\sqrt{5}}\right)$ $= \frac{2\sqrt{5}+\sqrt{3}-\sqrt{7}}{2}$	
(b) [4]	The Venn diagram shows the papers (Herald, Tele, Mx) read by a class of 30 boys. A boy is chosen at random. State the probability that: (i) He reads the Herald (ii) He reads the Tele and Mx, but not the Herald (iii) He reads exactly two papers (iv) He reads no paper 	(i) $\frac{16}{30}=\frac{8}{15}$. (ii) $\frac{4}{30}=\frac{2}{15}$. (iii) $15/30=1/2$. (iv) $5/30=1/6$
(c) [2]	A canoeist paddles due west for 1.5 km, then turns due south and covers a further 800 m. How far (to the nearest metre) and in what direction (true bearing, nearest degree) must she travel to return directly to her starting point?  $x=\sqrt{800^2+1500^2}=1700$ $\tan\alpha=\frac{1500}{800}\therefore\alpha=62^\circ$	Distance 1700m. Bearing 062°T.
(d) [2]	Calculate the area of a right-angled triangle with hypotenuse 8 cm, and an angle of 50°, correct to 2 decimal places.  $x=8\cos50$ $y=8\sin50$. $A=\frac{1}{2}xy=\frac{1}{2}(8\cos50)(8\sin50)$	15.76cm².
(e) [2]	Solve this set of equations simultaneously: $3x-y=11$ $x+y=1$ $y=1-x$. $3x-(1-x)=11$. $4x=12$ $x=3$ $y=-2$.	$x=3$ $y=-2$.
(f) [2]	From a lighthouse 70 m above sea level a ship is sighted 1.2 km out to sea. What is the angle of depression from the lighthouse to the ship? (Answer to the nearest minute.)  $\tan\alpha=\frac{70}{1200}=3^\circ20'$  $\sin\alpha=\frac{70}{1200}=3^\circ21'$	

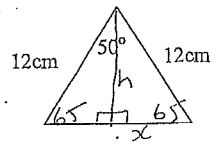
		Answers
(g) [2]	Simplify $\frac{x^2+2x-8}{x^2+8x+16}$. $=\frac{(x-2)(x+4)}{(x+4)(x+4)}=?$	$\frac{x-2}{x+4}$
(h) [2]	Sketch the solution set of the inequations on separate number lines. (i) $2x-3<5$, $2x<8$, $x<4$. (ii) $-2(3-2x)\le4$ $3-2x\ge2$ $-2x\ge-5$ $x\le5/2$ 	

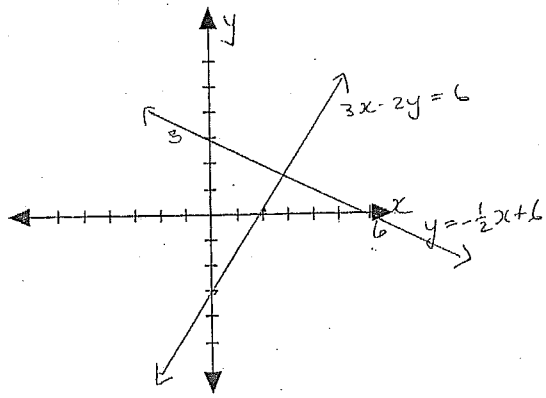
Question 6 (18 Marks)

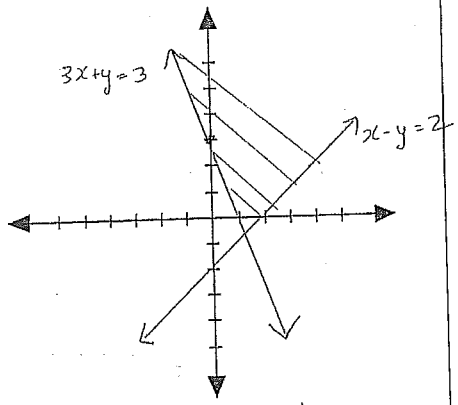
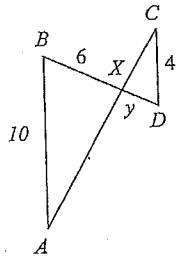
(a) [2]	The bases of two ladders are the same distance from the base of a vertical wall. The longer ladder is 15 m long, and makes an angle of 58° with the ground. If the shorter ladder is 12.6 m long, what angle does it make with the ground? (Nearest degree)	
(b) [4]	Find the general form equations of the lines: (i) Parallel to the line $3x+4y-2=0$ and passing through the point (-3, 4). (ii) Perpendicular to the line $3x+y=4$ and with x-intercept at -3.	(i) (ii)
(c) [2]	By the use of an appropriate construction, calculate the area of this triangle, correct to one decimal place. 	

		Answers
(g) [2]	Simplify $\frac{x^2+2x-8}{x^2+8x+16}$.	
(h) [2]	Sketch the solution set of the inequations on separate number lines. (i) $2x-3<5$ (ii) $-2(3-2x)\leq 4$	

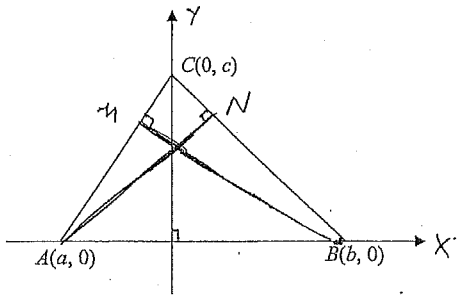
Question 6 (18 Marks)

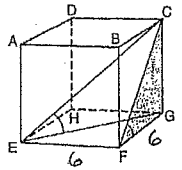
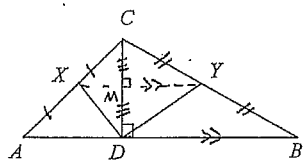
(a) [2]	The bases of two ladders are the same distance from the base of a vertical wall. The longer ladder is 15 m long, and makes an angle of 58° with the ground. If the shorter ladder is 12.6 m long, what angle does it make with the ground? (Nearest degree) $\cos 58 = \frac{x}{15}$ $x = 15\cos 58 = 7.95$ $\theta = \cos^{-1}\frac{7.95}{12.6}$ $= 50.8°$	 51°
(b) [4]	Find the general form equations of the lines: (i) Parallel to the line $3x+4y-2=0$ and passing through the point (-3, 4). $m_1 = m_2 = -\frac{3}{4}$ $y-4 = -\frac{3}{4}(x+3)$ (ii) Perpendicular to the line $3x+y=4$ and with x-intercept at -3. $m_1 = -3$ $m_2 = \frac{1}{3}$ $y = \frac{1}{3}(x+3)$	(i) $3x+4y-7=0$ (ii) $x-3y+3=0$
(c) [2]	By the use of an appropriate construction, calculate the area of this triangle, correct to one decimal place. $\sin 65 = \frac{h}{12}$ $h = 12\sin 65 = 10.88$ $\cos 65 = \frac{x}{12}$ $x = 5.07$	 $A = 5.07 \times 10.87$ $= 55.18$ $= 55.2$ cm (1 d.p.)

		Answers
(d) [1]	A British 50 pence piece is based on a regular heptagon (7 sides). Find the size of the internal angles. 7 sides – 5 triangles $\angle$ sum $5 \times 180 = 900$ each angle $900 \div 7$	$128\frac{4}{7}°$
(e) [2]	On the number plane below sketch the lines $3x-2y=6$ and $y=-\frac{1}{2}x+3$. 	
(f) [2]	Use either the elimination method or the substitution method to solve the following system of simultaneous equations: ① $7x+3y-4=0$ ② $5x+2y-3=0$ ① ×2 $14x+6y-8=0$ ② ×3 $15x+6y-9=0$ ② −① $x=1$ $=0$ $x=1$ ① $7x+3y-4=0$ $y=-1$	$(1, -1)$

		Answers
(g)	Sketch on the number plane the region where the inequalities $x-y\le 2$ and $3x+y\ge 3$ hold simultaneously. 	
[2]		
(h)		(i) Given that $AB \parallel CD$, prove that $\Delta ABX \equiv \Delta CDX$ (giving reasons). In $\triangle$s BXA + CXD $\angle BXA = \angle CXD$ (vert. op) $\angle ABD = \angle BDC$ (Alt $\angle$s BA $\parallel$ CD) $\therefore \triangle BXA \equiv CXD$ (equiangular)
[3]		(ii) Hence find the value of y. (Measurements are in centimeters). $\frac{y}{4} = \frac{6}{10}$ $10y = 24$ $y = 2.4$ cm

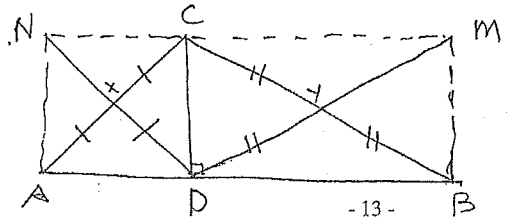
Question 7 (18 Marks)

		Answers
(a)	 The diagram represents any triangle. An altitude of a triangle passes through a vertex and is perpendicular to the opposite side, produced if necessary.	
	(i) Sketch the altitudes BM (M lies on AC) and AN (N lies on BC).	(i) (1)
	(ii) Write down the gradients of BM and AN. $m_{AC} = -\frac{c}{a} \Rightarrow m_{BM} = \frac{a}{c}$ $m_{BC} = -\frac{c}{b} \Rightarrow m_{AN} = \frac{b}{c}$	(ii) (3)
	(iii) State the equations of the lines BM and AN. $BM: y = \frac{a}{c}(x-b)$ $AN: y = \frac{b}{c}(x-a)$	(iii) (2)
	(iv) Find the co-ordinates of the point of intersection of the altitudes BM and AN. $\frac{a}{c}(x-b) = \frac{b}{c}(x-a)$ $ax - ab = bx - ab$ $x = 0$ $y = -\frac{ab}{c}$	(iv) (3)
[10]	(v) What geometric result is proved by the above? The altitudes of a triangle are concurrent.	(v) (1)

		Answers
(b)	The figure is a cube of side 6 cm. 	
	(i) Find the length of the body diagonal *CE*. (Correct to 2 d.p.) $EA = \sqrt{72} = 6\sqrt{2}$ $(EA)^2 + 6^2 = (EC)^2 \Rightarrow EC = \sqrt{108} \doteq 10.39$	(i) (2)
	(ii) Find the angle *CEG* to the nearest minute. $\tan C\hat{E}G = \frac{6}{6\sqrt{2}} = \frac{1}{\sqrt{2}} \Rightarrow C\hat{E}G = 35°16'$ or $\sin C\hat{E}G = \frac{6}{\sqrt{108}} \Rightarrow C\hat{E}G =$	(ii) (2)
[4]		
(c)	*ABC* is any triangle, *CD* is an altitude, and *X* and *Y* are the midpoints of *AC* and *BC* respectively.  Prove *DXCY* is a kite. (many ways)	
[4]	$XY \parallel AB$ (line joining midpts of two adjacent sides of a Δ is $\parallel$ the third side). $\Delta CXY \sim\sim \Delta CAB$ (ratio of sides about included angles) $\Rightarrow CY : CB = 1:2$ $\therefore CM : CD = 1:2$ ie $CM = DM$ $C\hat{D}Y = C\hat{D}B = 90°$ (corresp. angles $XY \parallel AB$) $\therefore$ diagonals of quad. DXCY are perpendicular (DXCY is a kite)	

This is the end of the paper.

(5) A kite is a quadrilateral with both pairs of adjacent sides equal.



BDCM Rect.
$CY = YB$
Since $CB = DM$ (diag).
$CY = YD$
Similarly $CX = XD$