



2008 Yearly Examination

**FORM I
MATHEMATICS**

Friday 31st October 2008

General Instructions

- Writing time — 1 hour 30 minutes
- Write using black or blue pen.
- Calculators are not to be used.
- All necessary working should be shown in every question.

Structure of the paper

- Total marks — 108
- All nine questions may be attempted.
- All nine questions are of equal value.

Collection

- Write your name, class and master clearly on the front and on the tear-off sheet.
- Bundle the tear-off sheet with the question it belongs to.

CPS/ADS: MLS/GJ
JAG/DJM: AMD
RDWL/LDR: JMR

DBD/CJW: AMD
JFC/PKR: MW
WTR/AGY: TCW/RCF

FHB/MW: MW
PGM/AHWD: LYL

Checklist

- Writing paper required.
- Candidature — 187 boys

Examiner
LYL

QUESTION ONE (12 marks) Start a new page.

(a) Evaluate:

- (i) $-5 + 2$
- (ii) $3 - (-9)$

(b) Calculate:

- (i) -1.5×10
- (ii) $-14 \div (-2)$

(c) Evaluate:

- (i) $\frac{1}{4} - \frac{3}{16}$
- (ii) $\frac{9}{5} \div \frac{3}{2}$

(d) Simplify:

- (i) $y \times y \times y$
- (ii) $-7y - 3y$

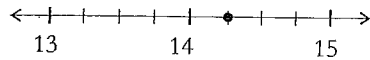
(e) Solve $x - 8 = 7$.

(f) Expand $4(6 - y)$.

(g) Find the value of $3x^2$, when $x = -2$.

QUESTION TWO (12 marks) Start a new page.

- (a) Kevin Rudd was born in 1957. What age will he turn on his birthday in 2009?
- (b) A certain type of cat is known to have 14 claws, 4 on each front leg and 3 on each back leg. If the RSPCA has 4 three-legged cats of this type and each one has a different leg missing, how many claws do they have altogether?
- (c)



Write down the value of the point marked on the number line above.

- (d) How many centimetres are there in 7 km?
- (e) What is 15% of 20?
- (f) Calculate:
- (i) $\$8.99 + \0.36
- (ii) $2.8 \div 7$
- (iii) 73.4×0.11
- (iv) $5.75 \div 0.5$

QUESTION THREE (12 marks) Start a new page.

- (a) From a regular pack of 52 cards, one card is drawn at random.
- (i) Find the probability that it is a king.
- (ii) Find the probability that it is not the queen of diamonds.

(b)

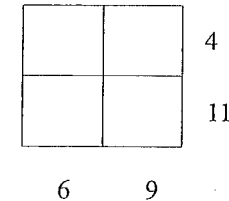
x	-2	-1	0	1
y				

- (i) Copy and complete the table of values above for the rule $y = 3x + 1$.
- (ii) Plot the points resulting from the table on a number plane. Use a ruler to draw your axes. Use 1 cm for 1 unit on both axes.

(c) Solve:

- (i) $4x = 32$
- (ii) $4x + 5 = 77$

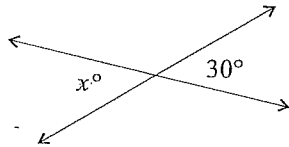
- (d) In the diagram below, fill in the squares with integers such that no integer is less than 1 and the sum of the integers in each row and column add up to the number at the end of that row or column. An integer may be used more than once. Draw diagrams to show the three possible ways to fill them.



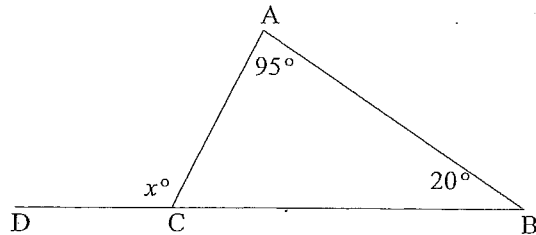
QUESTION FOUR (12 marks) Start a new page.

(a) Find the value of x in each diagram below, giving a reason for each answer.

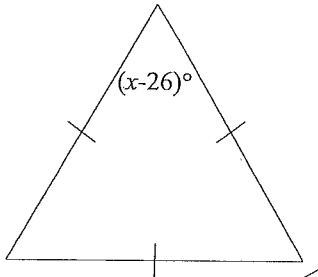
(i)



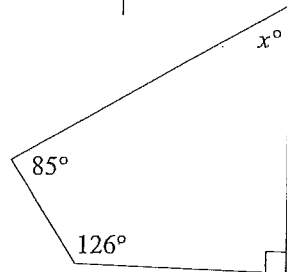
(ii)



(iii)



(iv)



(b) The set A is the set of primes between 0 and 15.

- (i) Write down one possible subset of A .
- (ii) Find $|A|$.

(c) A 30 g museli bar contains 2.49 g of carbohydrate. Find the percentage of carbohydrate in the museli bar.

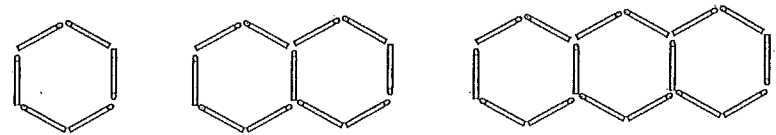
Exam continues overleaf ...

QUESTION FIVE (12 marks) Start a new page.

(a) A room has two 12 m by 3 m walls and two 15 m by 3 m walls.

- (i) Find the total area of the four walls.
- (ii) A painter wants to paint the walls of the room. If a 2 L tin of paint covers 50 m^2 , how many tins of paint will the painter need to buy?

(b)



The three diagrams above show a matchstick pattern, making one, two and three hexagons.

(i)

h	1	2	3	4
m				

Copy and complete the table above, showing the number of matches m required to build h hexagons.

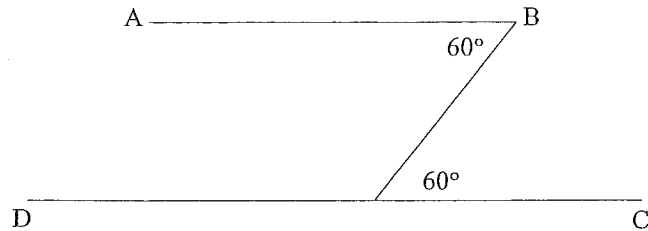
- (ii) (α) How many matches are required to add a hexagon to an existing diagram?
(β) How many more matches are needed for the first hexagon?
- (iii) Write down a formula for the number of matches required to make a diagram with h hexagons.
- (iv) How many matches would you need to build a diagram containing 30 hexagons?
- (v) How many hexagons make up a diagram containing 316 matches?
- (c) (i) Express $\frac{x}{3}$ and $\frac{x}{4}$ with a common denominator.

(ii) Find the fraction which lies exactly halfway between $\frac{x}{3}$ and $\frac{x}{4}$. Leave your answer in its simplest form.

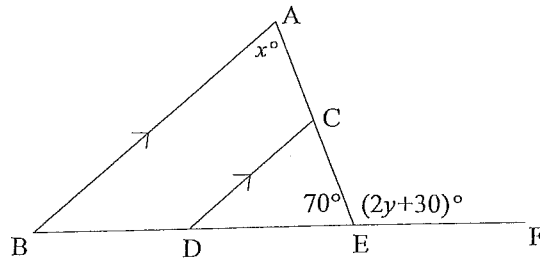
Exam continues next page ...

QUESTION SIX (12 marks) Start a new page.

- (a) Give a reason why $AB \parallel CD$ in the diagram below.



- (b) In the diagram below, $\triangle CDE$ is isosceles with $CD = DE$. Given that $AB \parallel CD$ and $\angle CED = 70^\circ$, find the value of x and y giving reasons for your answers.



- (c) Tear off the last sheet of this examination and do the constructions described there. Bundle the sheet with the rest of Question 6.

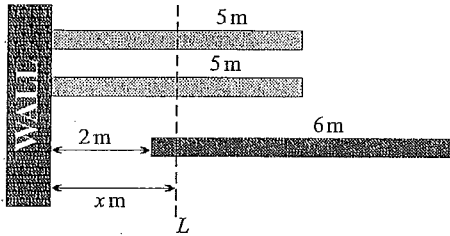
QUESTION SEVEN (12 marks) Start a new page.

- (a) If there are 16 basketball teams in a competition, how many games are needed to determine a winner if a team is eliminated upon losing a game?
- (b) Solve $5(p + 5) = 2(p - 6)$.
- (c) A rectangle is 4 cm longer than it is wide. Let the width of the rectangle be x cm. If the perimeter is 44 cm, form an equation and solve it to find the dimensions of the rectangle.
- (d) Kate's fitness programme involves walking for 6 minutes followed by running for 6 minutes then walking for 6 minutes and so on. She walks at a steady pace of 4 km/h and runs at a steady pace of 8 km/h.
- How far does Kate go in 1 hour?
 - Find her average speed in metres per second.
 - Kate paces herself in a similar way in a 21 kilometre half-marathon. She walks for 6 minutes, then runs for 6 minutes then walks for 6 minutes and so on. If she walks at a steady pace of 4 km/h, at what speed does she run if she finishes the marathon in exactly 3 hours?

QUESTION EIGHT (12 marks) Start a new page.

- (a) Simplify:
- (i) $(3x^3)^4$
- (ii) $\frac{72ab^4}{9ab^2}$
- (b) Calculate $8\frac{2}{3} - 2\frac{5}{6}$.
- (c) When the reciprocal is subtracted from a number, the result is $\frac{7}{12}$. Use guess and check, or any appropriate method to find the number, showing your reasoning.

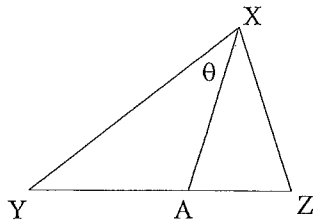
(d)



In the diagram above, three pieces of timber with lengths 5 m, 5 m and 6 m are placed in the parallel positions as indicated. A single cut is made along the line L perpendicular to the lengths of the timber so that the total length on each side of L is the same. Let x metres be the length of the top piece of timber to the left of L .

- (i) Explain why the length of the bottom piece of timber to the right of L is $(8 - x)$ metres.
- (ii) Form an equation and solve it to find the value of x .

(e)



In $\triangle XYZ$, $XY = YZ$ and A is a point on YZ such that XA bisects $\angle YXZ$. Furthermore, in $\triangle AXZ$, $XA = XZ$. Let $\angle AXY = \theta$.

- (i) Write down an expression for $\angle AXZ$, giving your reason.
- (ii) Write down an expression for $\angle XZY$, giving your reason.
- (iii) Hence calculate the sizes of the angles in $\triangle XYZ$.

QUESTION NINE (12 marks) Start a new page.

- (a) This year, 25 boys and 15 girls entered a national spelling bee competition. Prizes were awarded to 24% of the boys and 20% of the girls. What is the total percentage of entrants receiving prizes?
- (b) Calculate $4 - 5 + 6 - 7 + \dots - 99 + 100$.
- (c) Determine the number of digits in the product $5^9 \times 4^4$.
- (d) Tom is twice as old now as Sam was when Tom was as old as Sam is now. If the sum of their ages is 63, find their current ages. Show your working.
- (e) Harry brought a bag of lollies to School to share with 4 friends according to the following rule. He gave lollies to each friend in turn as he met them. If the friend had dark hair he gave half the lollies less half a lolly. If the friend had light hair he gave half the lollies plus half a lolly. After giving out the lollies, he had 3 left for himself.
- (i) How many lollies did he bring to School? Find all possible answers.
- (ii) If he meets at least 3 friends with light hair, how many lollies did he bring to School? Find all possible answers.

END OF EXAMINATION

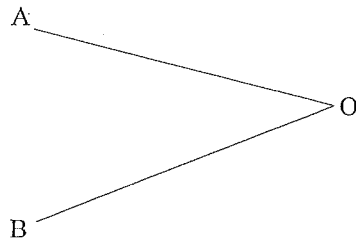
NAME: CLASS: MASTER:

DETACH THIS SHEET AND BUNDLE IT WITH THE REST OF QUESTION SIX.

QUESTION SIX

(b) Using a pencil, ruler and compasses only, complete the following constructions.
Do not erase any construction markings.

(i) Construct the angle bisector for the acute $\angle AOB$ below.



(ii) The interval PQ is shown below.

(α) Construct a right angle at P.

(β) Complete the diagram by constructing the $\triangle PQR$ in which $\angle P = 90^\circ$ and $PR = 4$ cm.

(γ) Using your protractor measure $\angle PQR$ and record your answer below to the nearest degree.



$\angle PQR =$ _____

Q1 (2 marks)

a) i) -3 ✓
 ii) $3 - (-9) = 3 + 9 = 12$ ✓

b) i) -15 ✓
 ii) 7 ✓

c) i) $\frac{1^4 - 3}{4 \times 4} = \frac{4}{16} - \frac{3}{16}$

ii) $\frac{9}{5} \div \frac{3}{2} = \frac{9^3}{5} \times \frac{2}{3}$
 $= \frac{6}{5}$ ✓

d) i) y^3 ✓
 ii) $-10y$ ✓

e) $x - 8 = 7$
 $x = 15$ ✓

f) $4(6 - y) = 24 - 4y$ ✓

g) $3 \times (-2)^2 = 3 \times 4 = 12$ ✓

(12)

Q2

a) 52 ✓
 b) 6 front legs
 6 back legs

$6 \times 4 = 24$ ✓
 $6 \times 3 = 18$ ✓
 Total claws = 42 ✓

c) 14.25 ✓
 d) $7 \text{ km} = 7000 \text{ m} = 700000 \text{ cm}$ ✓

e) $15\% \times 20 = \frac{15}{100} \times 20 = 3$ ✓

f) i) 8.99
 10.36
 $\$9.35$ ✓

ii) $2.8 \div 7 = 0.4$ ✓
 iii) $73.4 \times 0.11 = 734 \times \frac{11}{1000}$

$\frac{11}{734}$ ✓
 $\frac{7340}{8074}$ ✓

iv) $5.75 \div 0.5$
 $= 57.5 \div 5 = 11.5$ ✓

(12)

Q3

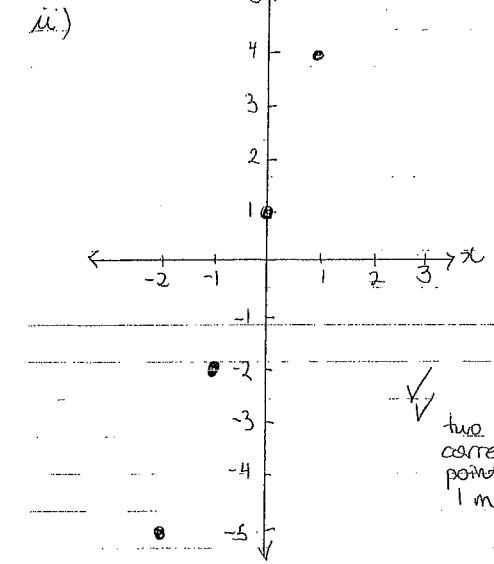
a) i) $P(\text{king}) = \frac{4}{52} = \frac{1}{13}$ ✓

ii) $P(\text{not queen of diamonds}) = 1 - P(\text{queen of diamonds}) = 1 - \frac{1}{52} = \frac{51}{52}$ ✓

b) i) $y = 3x + 1$

x	-2	-1	0	1
y	-5	-2	1	4

✓ two values 1 mark



✓ two correct points 1 mark

c) i) $4x = 32$
 $x = 8$ ✓

ii) $4x + 5 = 77$
 $4x = 72$
 $x = 18$ ✓

d)

2	2	4
4	7	11
6	9	

✓

3	1	4
3	8	11
6	9	

✓

1	3	4
5	6	11
6	9	

✓

(12)

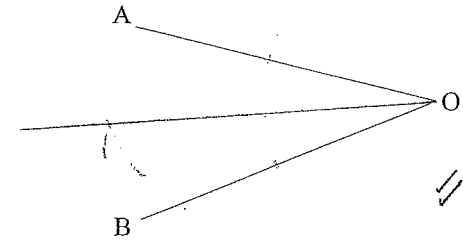
NAME: CLASS: MASTER:

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QUESTION SIX

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(i) Construct the angle bisector for the acute $\angle AOB$ below.

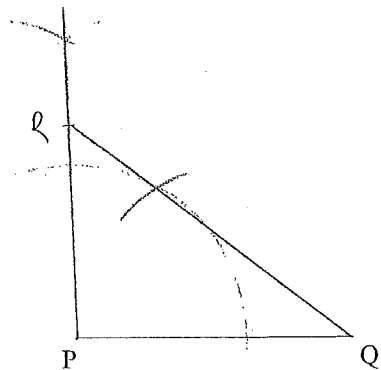


(ii) The interval PQ is shown below.

(a) Construct a right angle at P.

(b) Complete the diagram by constructing the $\triangle PQR$ in which $\angle P = 90^\circ$ and $PR = 4$ cm.

(c) Using your protractor measure $\angle PQR$ and record your answer below to the nearest degree.



$\angle PQR = 37^\circ \pm 2^\circ$ ✓

4 a) (i) $x^\circ = 30^\circ$ (vertically opposite angles) ✓

ii) $x^\circ = 95 + 20 = 115^\circ$ (exterior angle of Δ) ✓

iii) $x - 26 = 60$ (angle of equilateral Δ)
 $x = 86^\circ$ ✓

iv) $x + 90 + 126 + 85 = 360$
 $x + 301 = 360$
 $x = 59^\circ$ ✓

(angle sum of quadrilateral)

b) $A = \{2, 3, 5, 7, 11, 13\}$

i) various answers: sets containing 1-6 members, empty set.

ii) $|A| = 6$ ✓

c) $\frac{2 \cdot 49}{30} = \frac{24 \cdot 9}{300} \div 3$
 $= \frac{8 \cdot 3}{100}$
 $= 8.3\%$ ✓

(12)

Q5.

i) 12×3 wall area = 36
 15×3 wall area = 45 ✓

Total area = $2 \times 81 = 162 \text{ m}^2$ ✓

ii) $162 \div 50 = 3 \frac{12}{50}$ ✓

Need 4 cans of 2L paint.

b) i)

w	1	2	3	4
m	6	11	16	21

ii) $x = 5$ ✓

$\beta = 1$ ✓

iii) $m = 5w + 1$ ✓

iv) $h = 30$
 $m = 5 \times 30 + 1 = 150 + 1 = 151$ ✓

v) $316 = 5h + 1$
 $315 = 5h$
 $h = 63$ ✓

c) i) $\frac{x}{3} = \frac{4x}{12}$

$\frac{x}{4} = \frac{3x}{12}$ ✓

ii) Halfway $\frac{3 \cdot 5x}{12} = \frac{35x}{120} = \frac{7x}{24}$ ✓

(in simplest form)

(12)

Q6

a) $AB \parallel CD$ (alternate angles are equal) ✓

b) $\angle DCE = 70^\circ$ (base angles of isosceles)

$\angle BAC = 70^\circ$ (corresponding angles $AB \parallel CD$)

$2y + 30 = 70$ (straight angle)
 $2y = 40$
 $y = 20^\circ$ ✓

TEAR-OFF SHEET

c) i) angle bisector ✓

ii) α) right angle ✓

p.) Construct $\triangle PQR$ ✓

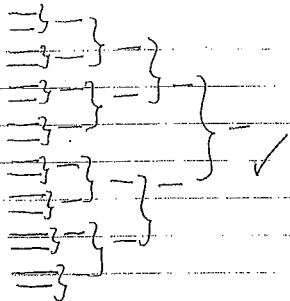
$PR = 4 \text{ cm}$ ✓

r.) $\angle PQR = 37^\circ \pm 2^\circ$ ✓

(12)

Q7

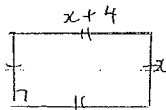
a) 15 games ✓ (1 mark correct working diagram)



b) $5(p+5) = 2(p-6)$
 $5p + 25 = 2p - 12$ ✓
 $3p = 37$
 $p = \frac{37}{3}$ ✓
 $= 12\frac{1}{3}$

(12)

c)



$P = (x+4) + x + (x+4) + x$
 $= 4x + 8$ ✓

$4x + 8 = 44$ ✓

$4x = 36$

$x = 9$

\therefore width is 9 cm ✓
 and length is 13 cm ✓

d) i) In 1h

Kate walks 2km in $\frac{1}{2}$ h
 4km in $\frac{1}{2}$ h

So covers 6km/h. ✓

ii) 6 km in 1 hour
 6000 m in 60 minutes
 100 m in 1 minute
 100 m in 60 seconds ✓
 $\frac{100}{60}$ m in 1 second ✓
 $1\frac{2}{3}$ metres per second

d) iii) At 6 km/h
 Kate would take $3\frac{1}{2}$ h
 to complete 21 km

If she ran 10 km/h ✓
 for the 6 minute runs
 her average speed
 would be 7 km/h
 which means she
 would complete
 21 km in 3h.

(12)

Q8

i) $(3x^3)^4 = 3^4(x^3)^4$
 $= 81x^{12}$ ✓

ii) $\frac{8^2}{9ab^4} = 8b^2$ ✓

b) $8\frac{2}{3} - 2\frac{5}{6} = 8\frac{4}{6} - 2\frac{5}{6}$
 $= 7\frac{10}{6} - 2\frac{5}{6}$ ✓
 $= 5\frac{5}{6}$ ✓

c) Let the number be x
 $x - \frac{1}{3x} = \frac{7}{12}$

guess and check

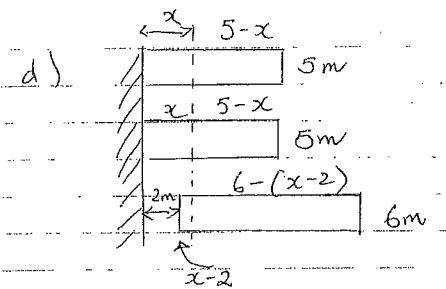
$x = 1$
 $1 - 1 = 0$

$x = 2$
 $2 - \frac{1}{2} = 1\frac{1}{2}$

$x = \frac{3}{2}$
 $\frac{3 \times 3}{2 \times 3} - \frac{2 \times 2}{3 \times 2} = \frac{9}{6} - \frac{4}{6}$
 $= \frac{5}{6}$

$x = \frac{4}{3}$
 $\frac{4 \times 4}{3 \times 3} - \frac{3 \times 3}{4} = \frac{16}{9} - \frac{9}{4}$
 $= \frac{7}{12}$

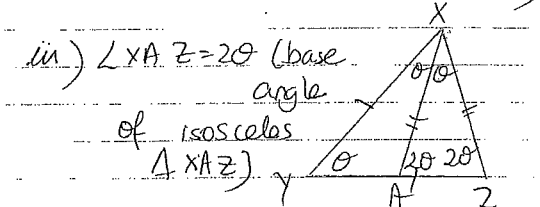
The number is $\frac{4}{3}$ ✓



i) The part of the 6m timber to the left of h is $x-2$ which means the part on the right of h must be $6 - (x-2) = 6 - x + 2 = 8 - x$ ✓

ii) Left Right ✓
 $x + x + x - 2 = 5 - x + 5 - x + 8 - x$
 $3x - 2 = 18 - 3x$
 $6x = 20$
 $x = 3\frac{1}{3}$ m ✓

e) i) $\angle AXZ = \theta$ ✓
 (XA bisects $\angle YXZ$)
 ii) In $\triangle XYZ$
 $\angle XZY = 2\theta$ (base angle ✓ of isosceles $\triangle XYZ$)



iii) $\angle XAZ = 2\theta$ (base angle of isosceles $\triangle XAZ$)
 $\angle XYA = \theta$ (exterior angle of $\triangle XYA$)
 $5\theta = 180^\circ$ (angle sum)
 $\theta = 36^\circ$
 $\angle XYA = 36^\circ$
 $\angle YXZ = \angle XZY = 72^\circ$ ✓

(12)

Q9

a) $24\% \times 25 = \frac{24}{100} \times 25$
 $= \frac{6}{1}$
 $20\% \times 15 = \frac{20}{100} \times 15$
 $= 3$

$\frac{18}{40} = \frac{9 \times 2}{20 \times 2} = \frac{45}{100}$
 Total percentage of entrants in 45%

b) $4(-5+6)(-7+8)(-9+10)\dots(-99+100)$
 $= 4 + 48 \times 1$
 $= 52$

c) $5^9 \times 4^4 = 5^9 \times (2^2)^4$
 $= 5^9 \times 2^8$
 $= (5 \times 2)^8 \times 5^1$
 $= 5 \times 10^8$

The product has 9 digits.

d) Let the current ages of Tom and Sam be t and s respectively.

Tom was as old as Sam $(t-s)$ years ago

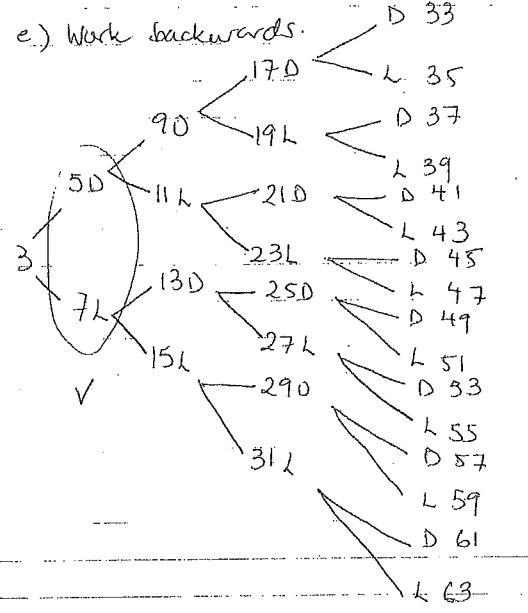
So Sam was $s - (t-s)$
 $= 2s - t$

Tom's age
 $t = 2(2s - t)$
 $= 4s - 2t$
 $3t = 4s$

Given $s+t = 63$
 $t = 63 - s$

So
 $3(63 - s) = 4s$
 $189 - 3s = 4s$
 $189 = 7s$
 $s = 27$

Sam is 27 years old
 and Tom is 36 years old.



Harry needs the odd numbers from 33 to 63 inclusive.

- ii) D H L L 47
- L D H L 55
- L L D L 59
- L L L L 63