



2010 Annual Examination

FORM I MATHEMATICS

Thursday 28th October 2010

QUESTION ONE (12 marks) Start a new page.

(a) Evaluate:

(i) $\frac{5}{7} \times \frac{3}{4}$

(ii) $\frac{1}{9} + \frac{2}{3}$

(iii) $6.28 + 0.053$

(b) Find:

(i) $-5 + 4$

(ii) $2 - 8$

(c) Simplify:

(i) $12x - 5x$

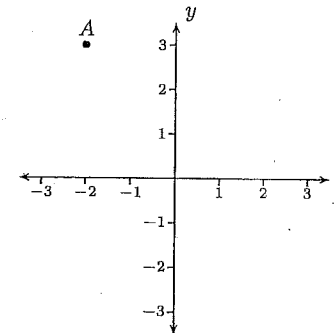
(ii) $y^{15} \div y^6$

(d) Solve:

(i) $4x = 24$

(ii) $\frac{y}{3} = -5$

(e)



Write down the coordinates of the point A in the diagram above.

(f) Find 5% of \$80.

(g) Find the perimeter of a square with side length 1.2 cm.

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.
- Start each question on a new page.

Structure of the paper

- Total marks — 120
- All ten questions may be attempted.
- All ten questions are of equal value.

Collection

- Write your name, class and master clearly on each page of your answers and on the tear-off sheet.
- Staple your answers in a single bundle.
- Bundle the tear-off sheet with the question it belongs to.
- Write your name and master on this question paper and submit it with your answers.

1BR/ADS: SO	1RMF/CJW: BR	1DBD/MW: MW
1JAG/CDS: JMR	1RBCH/JSH: FMW	1SD/PKR: TCW
1PGM/AHWD: LYL	1WTR/AGY: SJE	

Checklist

- Writing paper required.
- Candidature — 187 boys

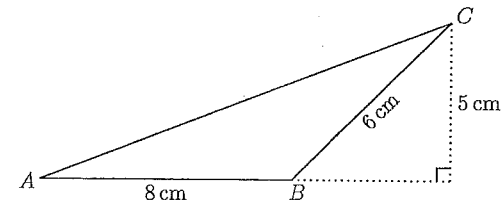
Examiner
FMW

QUESTION TWO (12 marks) Start a new page.

- (a) (i) List all the factors of 18.
 (ii) The first multiple of 4 is 4. Write down the twentieth multiple of 4.
- (b) Expand $x(3x + 4)$.
- (c) Express in decimal form:
 (i) 29%
 (ii) $\frac{5}{8}$
- (d) Find:
 (i) $42 \div 0.6$
 (ii) $1\frac{1}{8} \div \frac{5}{6}$
 (iii) $\frac{8}{15} - \frac{3}{4}$
- (e) Without doing the division, explain why we know that 33 738 is divisible by 6.

QUESTION THREE (12 marks) Start a new page.

- (a) Express the following numbers as percentages.
 (i) 0.043
 (ii) $2\frac{1}{5}$
- (b) Evaluate:
 (i) $-18 \div -3$
 (ii) $7 - (-11) \times 2$
- (c) Solve the following equations:
 (i) $7m - 5 = 9$
 (ii) $23 - 2x = 3x + 3$
- (d)



Find the area of triangle ABC in the diagram above.

- (e) Alex bought two egg and bacon rolls for \$4.25 each, a cappuccino for \$3.60 and a freshly squeezed orange juice which cost \$3.70. How much change did he receive from twenty dollars? Show your working.
- (f) What is half of one tenth?

QUESTION FOUR (12 marks) Start a new page.

- (a) (i) Copy and complete the following table using the rule $y = 4x - 1$.

x	-1	0	1	2
y				

- (ii) Plot the points resulting from the table above on a number plane.
 Note: Use a ruler to draw your axes and label each axis.

- (b) Simplify:

(i) $(h^5)^6$

(ii) $5x^3 - 2x - 8x^3 + 4x$

(iii) $\frac{p}{3} + \frac{6p}{7}$

(iv) $8y^3 \times 5y^4$

- (c) If $t = -2$ and $q = 4$, evaluate $t^3 - q$.

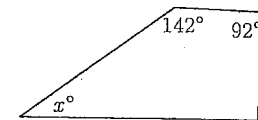
QUESTION FIVE (12 marks) Start a new page.

- (a) The whole numbers from 1 to 19 inclusive are written on cards and placed in a bag. One card is drawn at random. Find the probability that it is:

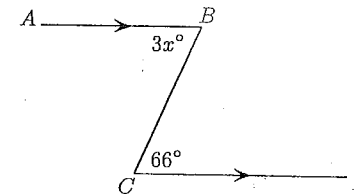
- (i) divisible by 3,
- (ii) not divisible by 3,
- (iii) a prime number.

- (b) Find the value of x in each diagram below, giving reasons:

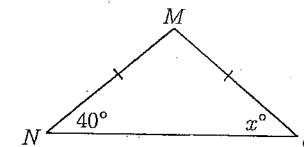
- (i)



- (ii)



- (iii)



- (c) Tear off the last sheet of this examination and do the constructions there. Bundle the sheet with the rest of Question 5.

QUESTION SIX (12 marks) Start a new page.

(a) Expand and simplify:

$$5(x + 3) + 6(x - 1)$$

(b) Given that $123 \times 456 = 56\,088$, evaluate:

(i) 1.23×45.6

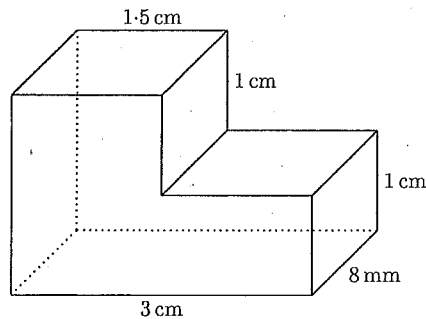
(ii) $56.088 \div 4.56$

(c) A number x is tripled and then increased by 7. The result is -2 .

(i) Form an equation to represent the information given.

(ii) Solve your equation to find the original number.

(d)



Find the volume of the prism sketched above. Show your working.

(e) How many square centimetres are contained in 4 square metres?

(f) CSI agents were keeping an eye on a house in Maine. They saw a male suspect enter the house at 0700 hours on Tuesday and leave at 1343 hours on Wednesday. A female suspect arrived at 2312 hours on Tuesday and left at 1450 hours on Wednesday.

(i) Convert 1343 hours to 12 hour time.

(ii) For how long were both suspects in the house together? Give your answer in hours and minutes.

QUESTION SEVEN (12 marks) Start a new page.

(a) Sam and Pam were in different classes at school. They both had a mathematics test. Sam's test was marked out of 30 and Pam's test was marked out of 40. Sam got 21 out of 30 and Pam got 29 out of 40. Who did better in their test? Show your working.

(b) Suppose $B = \{3, 5, 7\}$, $C = \{2, 3, 4, 5, 6, 7, 8\}$ and $D = \{4, 5, 6, 7, \dots, 13, 14\}$.

(i) State TRUE or FALSE for each of the following:

(α) $10 \in D$

(β) $C \subset B$

(γ) $|D| = 10$

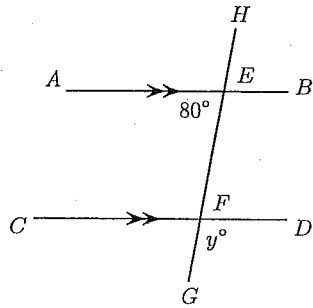
(ii) List all the subsets of B .

(c) A squirrel found a pile of nuts and ate $\frac{5}{21}$ of the nuts. There were 448 nuts left in the pile. How many nuts were there to start with? Show your working.

(d) Find the value of $\frac{36 - x}{-2x^2}$ when $x = -4$.

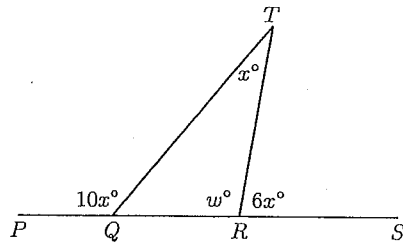
QUESTION EIGHT (12 marks) Start a new page.

(a)



Find the value of y in the diagram above, giving reasons.

(b)



Consider the diagram above.

- (i) Write an algebraic expression for w in terms of x . Give a geometrical reason.
 - (ii) Write an equation for x . Give a geometrical reason.
 - (iii) Solve your equation to find x .
- (c) Simplify:
- (i) $\frac{3x^3}{14y} \times \frac{7y^2}{9x^3}$
 - (ii) $35p^8q^6 \div (-5p^3q^5)$
 - (iii) $\frac{(4m^3)^2}{9m - m}$
- (d) This problem first appeared in a 15th century French book.

A carpenter agrees to work for 2 francs for each day he actually works and to forfeit 3 francs for each day he does not work. At the end of thirty days it turns out that he has to forfeit exactly the same amount as he receives. How many days does he work? Show your reasoning.

QUESTION NINE (12 marks) Start a new page.

(a) Consider the following rule:

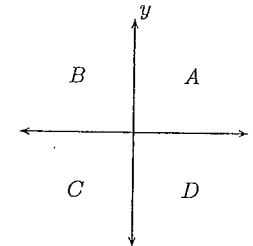
$$(1\frac{1}{2})^2 = (1 \times 2) + \frac{1}{4}$$

$$(2\frac{1}{2})^2 = (2 \times 3) + \frac{1}{4}$$

$$(3\frac{1}{2})^2 = (3 \times 4) + \frac{1}{4}$$

- (i) Write out the rule for $(4\frac{1}{2})^2$ and show that it works.
- (ii) Write out the rule for $(n + \frac{1}{2})^2$.

(b)



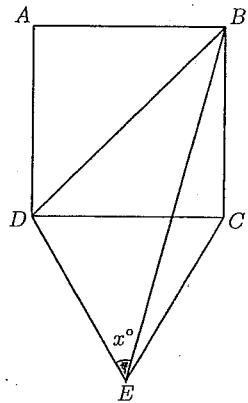
The diagram above shows the four quadrants of the number plane labelled A, B, C and D. Find a point in each quadrant which satisfies the rule $y^2 = x^2$.

- (c) For all numbers a and b , the operation $a\#b$ is defined by $a\#b = 2ab^2$.
- (i) Find x if $x\#2 = -40$.
 - (ii) Find $\sqrt{50\#3}$.
 - (iii) Find $m\#(n\#p)$.
- (d) (i) On half-a-page, draw a line l at least 5 cm in length. Mark two points X and Y at least 3 cm from l .
- (ii) Using ruler and compasses only, find the point A on l such that $XA = YA$. Your construction must be clear with construction arcs visible.

QUESTION TEN (12 marks) Start a new page.

- (a) (i) Express 56 as a product of its prime factors.
 (ii) The areas of the different faces of a rectangular prism are 10, 35 and 56 cm². Find its volume.

(b)



In the diagram above, $ABCD$ is a square and CDE is an equilateral triangle. Angle DEB is labelled x° . Find the value of x , giving reasons.

- (c) Given $x = -1$, $y = 2$ and $z = -3$, find the value of:

$$y + \frac{1}{x + y + \frac{x + y}{x + y + z}}$$

- (d) (i) Show that $22^2 - 26^2 = (22 - 26)(22 + 26)$.

(ii) Find:

$$1^2 - 3^2 + 5^2 - 7^2 + 9^2 - 11^2 + \dots + 101^2 - 103^2$$

END OF EXAMINATION

Tear-off pages follow ...

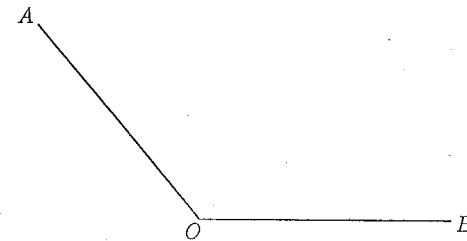
NAME: CLASS: MASTER:

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

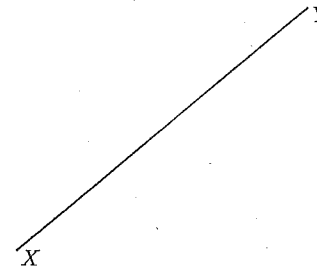
QUESTION FIVE

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

- (i) Bisect $\angle AOB$.



- (ii) Construct a 60° angle at the endpoint X of the interval XY below.



FORM 1 SOLUTIONS

① (a) $\frac{5}{7} \times \frac{3}{4} = \frac{15}{28}$ ✓

(ii) $\frac{1}{9} + \frac{2}{3} = \frac{1+6}{9}$
 $= \frac{7}{9}$ ✓

(iii)
$$\begin{array}{r} 6.280+ \\ 0.053 \\ \hline 6.333 \end{array}$$
 ✓

(b) (i) $-5+4 = -1$ ✓
(ii) $2-8 = -6$ ✓

(c) (i) $12x - 5x = 7x$ ✓
(ii) $y^{15} \div y^6 = y^9$ ✓

(d) (i) $4x = 24$
 $x = 6$ ✓

(ii) $\frac{y}{3} = -5$
 $y = -15$ ✓

(e) A $(-2, 3)$ ✓

(f) $\frac{5}{100} \times 80 = \4 ✓

(g) $P = 4 \times 1.2$
 $= 4.8 \text{ cm}$ ✓

② (a) (i) $18 : 1, 2, 3, 6, 9, 18$ ✓

(ii) 80 ✓

(b) $x(3x+4) = 3x^2 + 4x$ ✓

(c) (i) $29\% = 0.29$ ✓

(ii) $\frac{5}{8} = 0.625$ ✓

(d) (i) $42 \div 0.6 = 420 \div 6$
 $= 70$ ✓

(ii) $1\frac{1}{5} \div \frac{5}{6} = \frac{6}{5} \times \frac{6}{5}$ ✓

$= \frac{27}{20}$ ✓

(iii) $\frac{8}{15} - \frac{3}{4} = \frac{32-45}{60}$
 $= -\frac{13}{60}$ ✓

(e) last digit is even so it is divisible by 2 ✓

$3+3+7+3+8 = 24$

$24 \div 3 = 8$

sum of digits is divisible by 3 ✓

it is divisible by 6 ($2 \times 3 = 6$) ✓

③ (a) (i) $0.043 = 4.3\%$ ✓
 (ii) $2\frac{1}{5} = 220\%$ ✓

(b) (i) $-18 \div -3 = 6$ ✓

(ii) $7 - (-11) \times 2 = 7 - (-22)$
 $= 29$ ✓

(c) (i) $7m - 5 = 9$
 $7m = 14$
 $m = 2$ ✓

(ii) $23 - 2x = 3x + 3$
 $23 = 5x + 3$ ✓
 $20 = 5x$ ✓
 $x = 4$ ✓

(d) $A = \frac{1}{2} \times 8 \times 5$
 $= 20 \text{ cm}^2$ ✓✓

(e) $2 \times 4.25 = 8.50$ ✓
 change = \$4.20 ✓

$$\begin{array}{r} 8.50 \\ 3.60 \\ \underline{3.70} \\ \$ 15.80 \end{array}$$
 ✓

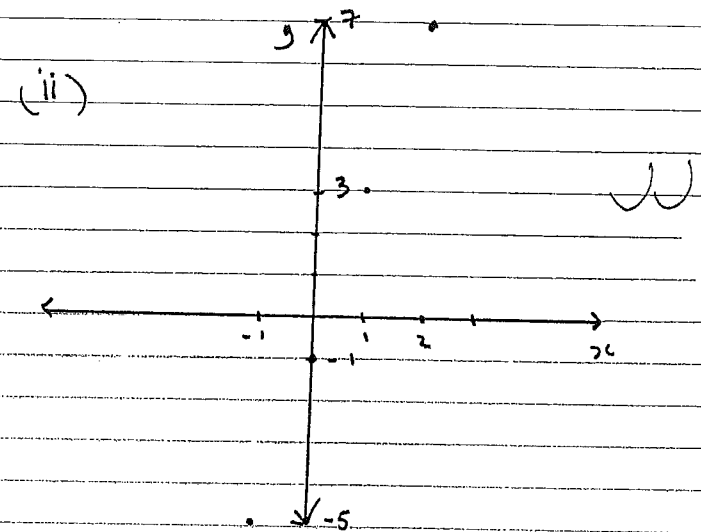
(f) $\frac{1}{2} \times \frac{1}{10} = \frac{1}{20}$ ✓

12

④ (a) (i)

x	-1	0	1	2
y	-5	-1	3	7

 $y = 4x - 1$ ✓



(b) (i) $(h^5)^6 = h^{30}$ ✓

(ii) $5x^3 - 2x - 8x^3 + 4x = -3x^3 + 2x$ ✓

(iii) $\frac{p}{3} + \frac{6p}{7} = \frac{7p + 18p}{21}$ ✓
 $= \frac{25p}{21}$ ✓

(iv) $8y^3 \times 5y^4 = 40y^7$ ✓

(c) $t^3 - 9 = (-2)^3 - 4$ ✓
 $= -8 - 4$ ✓
 $= -12$ ✓

12

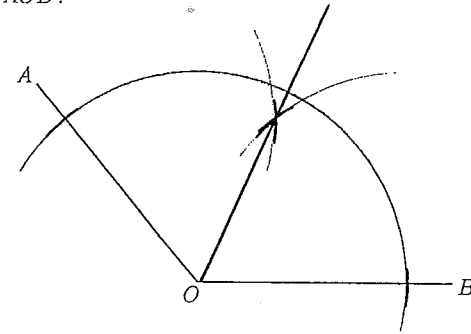
NAME: CLASS: MASTER:

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

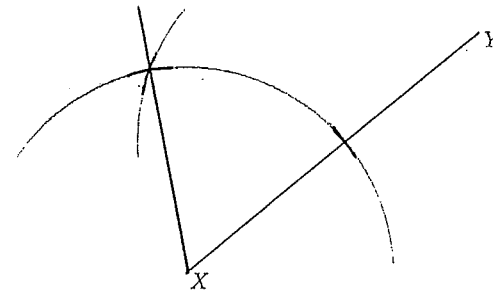
QUESTION FIVE

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

(i) Bisect $\angle AOB$.



(ii) Construct a 60° angle at the endpoint X of the interval XY below.



5 (a) (i) $P(E) = \frac{6}{19}$ ✓

(ii) $P(E) = \frac{13}{19}$ ✓

(iii) $P(E) = \frac{8}{19}$ ✓

(b) (i) $x + 142 + 92 + 90 = 360$ (angle sum of quadrilateral)
 $x + 324 = 360$
 $x = 36$ ✓

(ii) $3x = 66$ (alternate angles, $AB \parallel CD$)
 $x = 22$ ✓

(iii) $x = 40$ (angles opposite equal sides) ✓

(c) (i) ✓✓ (see next page)

(ii) ✓✓

~~12~~

6 (a) $5(x+3) + 6(x-1) = 5x+15 + 6x-6$ ✓
 $= 11x+9$ ✓

(b) (i) $1.23 \times 45.6 = 56.088$ ✓

(ii) $56.088 \div 4.56 = 5608.8 \div 456$
 $= 12.3$ ✓

(c) let the number be x

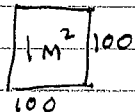
(i) $3x + 7 = -2$ ✓

(ii) $3x = -9$
 $x = -3$ ✓

the number is -3

(d) $V = 3 \times 2 \times 0.8 - 1.5 \times 1 \times 0.8$ ✓

$= 6 \times 0.8 - 1.5 \times 0.8$
 $= 4.8 - 1.2$
 $= 3.6 \text{ cm}^3$ ✓

(e)  $4 \times 100 \times 100 = 40000$ ✓

(f) (i) $1:43 \text{ pm}$ ✓

(ii) $2312 \text{ Tuesday} \rightarrow 1343 \text{ Wednesday}$

$48 \text{ min} + 12 \text{ h} + 1 \text{ h } 43 \text{ min}$
 $= 14 \text{ h } 31 \text{ min}$ ✓

7 (a) $\frac{21}{30} \times 100 = 70\%$ ✓

$\frac{29}{40} \times 100 = 145$
 $= 72\frac{1}{2}\%$ ✓

Pam performed better in the test

(b) (i) (A) True ✓

(B) False ✓

(C) False ✓

(ii) $\{3\}, \{5\}, \{7\}, \{3,5\}, \{3,7\}, \{5,7\},$
 $\{3,5,7\}, \emptyset$ ✓

(c) $\frac{16}{21}$ of nuts = 448

$\frac{1}{21}$ of nuts = $\frac{448}{16}$ ✓

total number = $\frac{448}{16} \times 21$
 $= 588$ ✓

(d) $\frac{36-x}{-2x^2} = \frac{36-(-4)}{-2 \times (-4)^2}$ ✓

$= \frac{40}{-32} = -\frac{5}{4}$ ✓

8 (a) $\angle CFE = 100^\circ$ (co-interior angles, $AB \parallel CD$) ✓
 $y = 100$ (vertically opposite angles) ✓

(b) (i) $w + 6x = 180$ (straight angle)
 $w = 180 - 6x$
 (or $w + x = 10x$ (exterior angle of triangle)) ✓

(ii) $10x = x + 180 - 6x$ (exterior angle of triangle) ✓
 (iii) $10x = 180 - 5x$
 $15x = 180$
 $x = 12$ ✓

(c) (i) $\frac{3x^2}{4y} \times \frac{7y^2}{9x^3} = \frac{y}{6}$ ✓
 (✓ for 2 correct answers)

(ii) $35p^8q^6 \div -5p^3q^5 = -7p^5q$ ✓

(iii) $\frac{(4m^3)^2}{9m-m} = \frac{16m^6}{8m}$ ✓
 $= 2m^5$ ✓

(d) let him work n days

$2n = (30-n) \times 3$
 $2n = 90 - 3n$
 $5n = 90$
 $n = 18$ ✓

12

he works 18 days

9 (a) $(4\frac{1}{2})^2 = (\frac{9}{2})^2$ $4 \times 5 + \frac{1}{4} = 20\frac{1}{4}$
 $= \frac{81}{4}$ ✓
 $= 20\frac{1}{4}$ ✓

(ii) $(n+\frac{1}{2})^2 = n(n+1) + \frac{1}{4}$ ✓

(b) any four that work

eg $(1, 1), (1, -1), (-1, 1), (-1, -1)$

note: $(0, 0)$ is not in one of the four quadrants

(c) (i) $x \neq 2 = 2x \times 2^2$
 $= 8x$

$8x = -40$
 $x = -5$ ✓

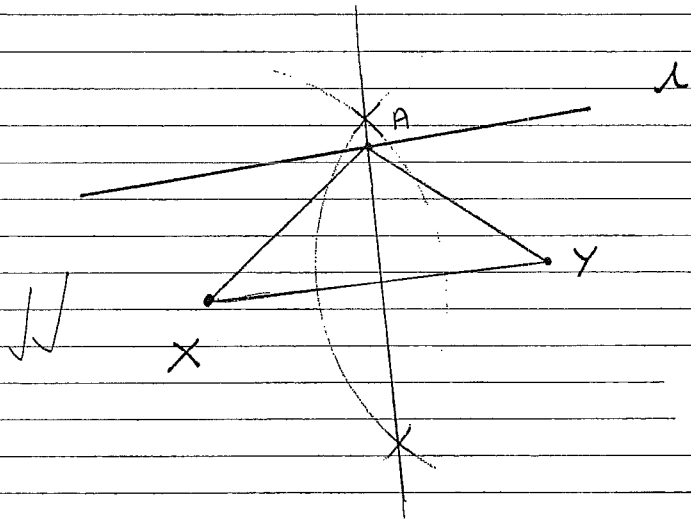
(ii) $\sqrt{50 \neq 3} = \sqrt{2 \times 50 \times 3^2}$ ✓
 $= \sqrt{900}$ ✓
 $= 30$ ✓

(iii) $m \neq (n \neq p) = m \neq (2np^2)$ ✓
 $= 2m(2np^2)$
 $= 2m(4n^2p^4)$
 $= 8m^2n^2p^4$ ✓

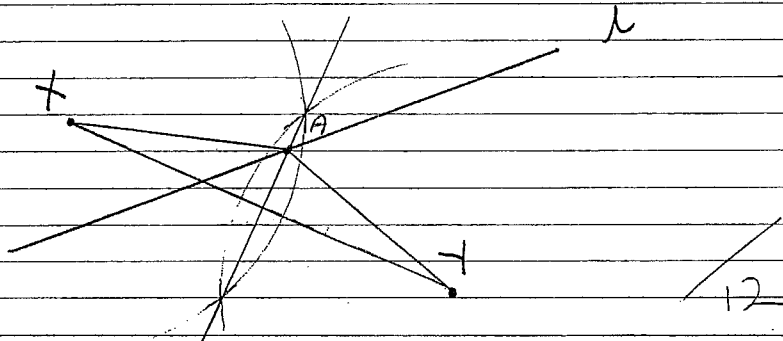
9 d) if we construct the perpendicular bisector of XY and let A be the point on l where the bisector meets l , then $\triangle AXY$ will be isosceles with $XA = YA$.

note: only need one case

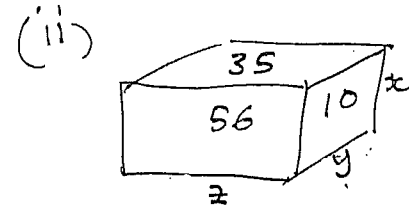
case 1: X and Y on the same side of l



case 2: X and Y on different sides of l



$$(10) (a) (i) 56 = 8x + 7 \\ = 2^3 \times 7$$



let the dimensions be x, y and z .

$$xy = 10$$

$$xz = 56$$

$$zy = 35$$

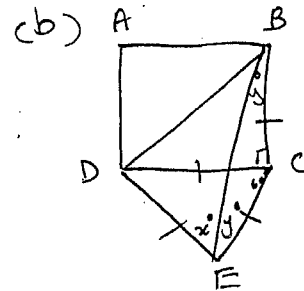
$$xy \times xz \times zy = 10 \times 56 \times 35$$

$$x^2 y^2 z^2 = 2 \times 5 \times 2^3 \times 7 \times 5 \times 7$$

$$= 2^4 \times 5^2 \times 7^2$$

$$xyz = 2^2 \times 5 \times 7$$

$$= 140 \text{ cm}^2$$



$\angle DCE = 60^\circ$ (angle of equilateral triangle)

let $\angle BEC = y$
 $\angle EBC = y$ (angles opposite equal sides)

$$2y + 90 + 60 = 180 \text{ (angle sum of } \triangle BEC)$$

$$2y = 30 \\ y = 15$$

$$x + 15 = 60 \text{ (angle of equilateral triangle)} \\ x = 45$$

$$(c) \frac{1}{y + \frac{y}{x+y + \frac{x+y}{x+y+z}}}$$

$$= \frac{1}{2 + \frac{2}{-1+2 + \frac{-1+2}{-1+2-3}}}$$

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

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

$$= \frac{1}{2 + \frac{2}{\frac{1}{2}}}$$

$$= \frac{1}{2 + 4}$$

$$= \frac{1}{6}$$

(Some correct simplification required)

$$(d) (i) 22^2 - 26^2 = 484 - 676 = -192$$

$$(22-26)(22+26) = -4 \times 48 = -192$$

$$(ii) 1^2 - 3^2 + 5^2 - 7^2 + 9^2 - 11^2 + \dots + 101^2 - 103^2$$

$$= (1-3)(1+3) + (5-7)(5+7) + (9-11)(9+11) + \dots + (101-103)(101+103)$$

$$= (-2) \times 4 + (-2) \times 12 + (-2) \times 20 + \dots + (-2) \times (204)$$

$$= (-2) \times (4 + 12 + 20 + \dots + 204)$$

$$= (-2) \times (4 + 204) \times 26 \div 2$$

$$= -208 \times 26$$

$$= -5408$$