Candidate Name: _____ ( ) Class 2 ____

ANGLICAN HIGH SCHOOL
Mid-year Examination
Secondary Two
MATHEMATICS D
Part 1

Thursday 10 May 2007 45 minutes

INSTRUCTIONS TO CANDIDATES

Answer **all** questions.

Write your answers in the spaces provided on the question paper.

If working is needed for any question it must be shown and written in **pen** below that question. Omission of essential working will result in loss of marks.

NEITHER ELECTRONIC CALCULATORS NOR MATHEMATICAL TABLES MAY BE USED IN THIS PAPER.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this part is 30.

This paper will be collected by the teacher at the end of 45 minutes.

Assessment noted by:

_____

Name of Parent/Guardian

_____

Signature of Parent/Guardian

Date: _____

For Examiner's Use

This question paper consists of 5 printed pages, including this page.

Part 1 (30 marks)
Answer the following questions in the space provided.

1) Evaluate the following, leaving your answers in standard form.

(a) $(3.2\times10^{5})^{2}$.

(b) $48\times10^{3}\div(1.2\times10^{-4})$.

(c) $10^{-6}-10^{-8}$.

Answer (a) _____ [1]

(b) _____ [2]

(c) _____ [2]

2) A length of 5 cm on a map represents an actual distance of 20 km.

(a) Calculate the length of a river on the map which has an actual length of 73.6 km.

(b) Calculate the actual area, of a basketball court which is represented by 8.5 cm^2 on the map.

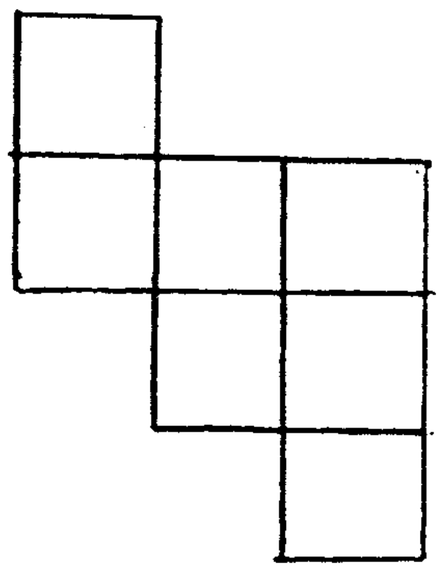
Answer (a) _____ *cm* [2]

(b) _____ *km^2* [2]

3) The diagram shows a figure made up of 7 **identical** squares.

(a) State the order of rotational symmetry of the figure.

(b) Add **one** more square to the figure so that it will have **only** one line of symmetry. Indicate the line of symmetry. [2]



*Answer (a) Order*_____ [1]

4) The variable y varies inversely as square root of $x+13$ and when $x=3$, $y=4$.

(a) Express y in terms of x.

(b) Find the value of x when $y=2$.

Answer (a) _____ [2]

(b) $x=$ _____ [2]

5i) Factorise completely the expression below

$$x^2 + 10x + 21$$

(ii) Hence, by using a suitable value for x, express 221 as the product of two prime numbers.

Answer (i) _____ [1]

(ii) _____ [1]

6) Simplify the following terms, giving your answers in the lowest term

(a) $\dfrac{7y(x+y)}{56(x^2-y^2)}$

(b) $\dfrac{5m^3n^2}{7nq^5} \div \dfrac{15(mn)^4}{3mn} \times \dfrac{4qm}{3n^7}$

Answer (a) _____ [2]

(b) _____ [3]

7) Make a the subject of the given formulae

$$\frac{1}{a} - \frac{1}{c} = \frac{b}{d}$$

Answer _____ [3]

8) Solve the simultaneous equations:

$$3x + 2y = 8 \text{ and}$$
$$x - 3y = -23$$

Answer $x=$ _____, y= _____ [4]

-- END OF PART 1 --

Candidate Name _____ ( ) Class 2 _____

ANGLICAN HIGH SCHOOL
Mid-year Examination
Secondary Two
MATHEMATICS D
Part 2

Thursday 10 May 2007 1 hour 15 minutes

Additional Materials: 5 Writing papers

INSTRUCTIONS TO CANDIDATES

Answer all questions in Section A and any 1 question in Section B.
Write your answers and working on the separate writing paper provided.
Show all your working on the same page as the rest of your answers.
Omission of essential working will result in loss of marks.
CALCULATORS MAY BE USED IN THIS PAPER.

Attach this cover page to the first page of your answer scripts.
Circle the question in Section B you have attempted.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [ ] at the end of each question or part question.

The total of the marks for this part is 50.

For Examiner's Use		
Section A	Q1	
	Q2	
	Q3	
	Q4	
	Q5	
	Q6	
	Q7	
	Q8	
	Q9	
Section B	Q10 or 11	
Total		

Assessment noted by:

_____
Name of Parent/Guardian

_____
Signature of Parent/Guardian

Date: _____

This question paper consists of 5 printed pages, including this page.

Part 2 Section A (42 marks)
Answer all the questions in this section

1) Expand and simplify the following:

(a) $a(b+c)+5c(b-a)$ [1]

(b) $(p-2q)^2-4p(p+q)$ [2]

---

2) Factorize the following:

(a) $5d^3+35d^2e$ [1]

(b) $x^2y^2+x^2-y^2-1$ [3]

(c) $16-p^4$ [2]

---

3) The selling price of a sofa set is \$2770. Alessia decides to buy it on hire purchase. She pays a 30% down payment for it. The outstanding balance plus the 5% per annum compound interest for 18 months was to be paid in 18 monthly instalments.

(a) Calculate the monthly instalment, correct to the nearest cent. [3]

(b) What is the percentage difference of the hire purchase price and the original price. [2]

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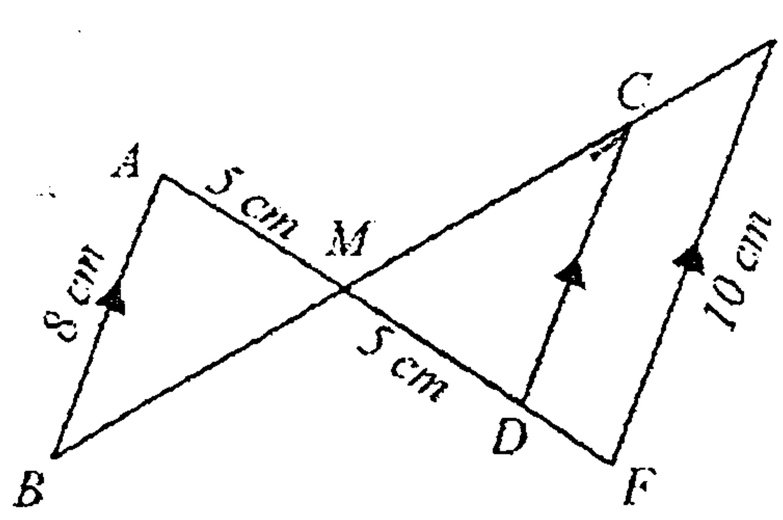
4) In the diagram shown, $AB \parallel CD \parallel EF$, $AB = 8$ cm, $AM = MD = 5$ cm and $EF = 10$ cm.



(a) Prove that $\Delta AMB \equiv \Delta DMC$ [2]

(b) Hence, or otherwise, find the length of DF. [2]

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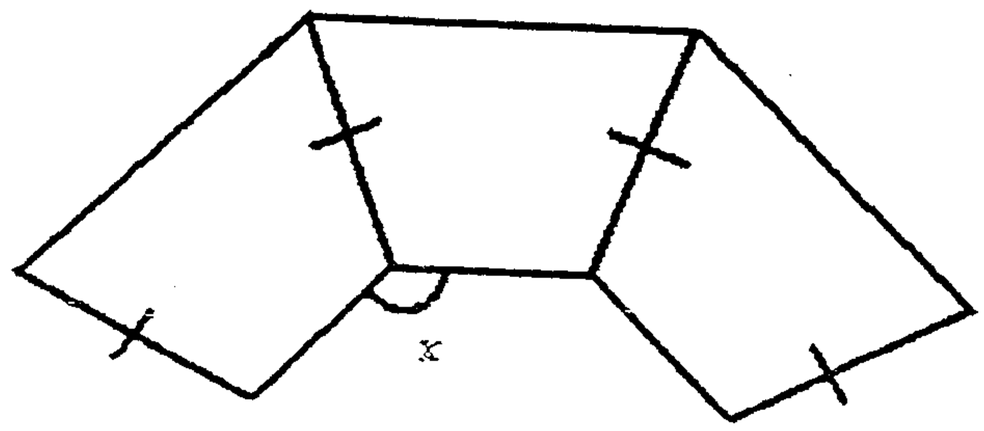
5) The diagram shows three quadrilaterals. The angle, $x = 144°$ and the two slanted sides of each quadrilateral are equal in length as shown in the diagram.



Additional similar quadrilaterals are then added to these three quadrilaterals in the same manner to form a closed ring, surrounding a regular polygon. How many **more** quadrilaterals are needed to complete the ring? (Answer obtained by drawing is not accepted.)

[3]

6a) Expand and simplify the expression below

$$(x-3)^2-(x-4)^2.$$

[2]

b) Using the result from (a), evaluate the value of

$$597^2-596^2$$

[1]

---

7) Solve the following equations:

(a) $x-\dfrac{2x-8}{4}=\dfrac{x-3}{5}$

[2]

(b) $\dfrac{5}{x+4}=3+\dfrac{2}{x-2}$

[4]

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8) Eugene Wee bought a basket of durians for \$600. He paid \$$x$ for each durian.

(a) Write down an expression in terms of x for the number of durians he bought. [1]

(b) As 10 durians were rotten, he decided to sell each of the remaining durians at a profit of \$1.20. Write down an expression in terms of x for the sum of money he would receive if all the remaining durians were sold. [1]

(c) He sold all the durians and made a profit of \$90. Use this information to write down an equation involving x and show that it simplifies to $5x^2 + 51x - 360 = 0$. [3]

(d) Solve the equation and find the cost price of each durian. [2]

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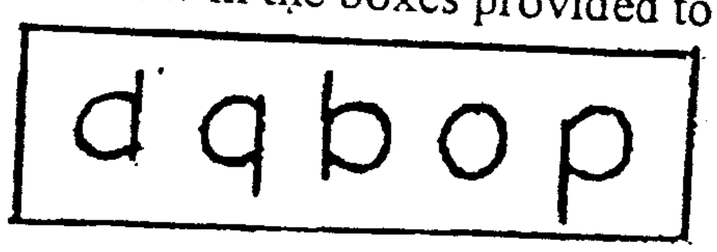
9) The 'tens' digit of a two-digit number is four times the 'units' digit. When the digits are reversed, the number is decreased by 54. By letting the 'tens' digit be x and the 'units' digit be y, find the number. [5]

--- END OF SECTION A ---

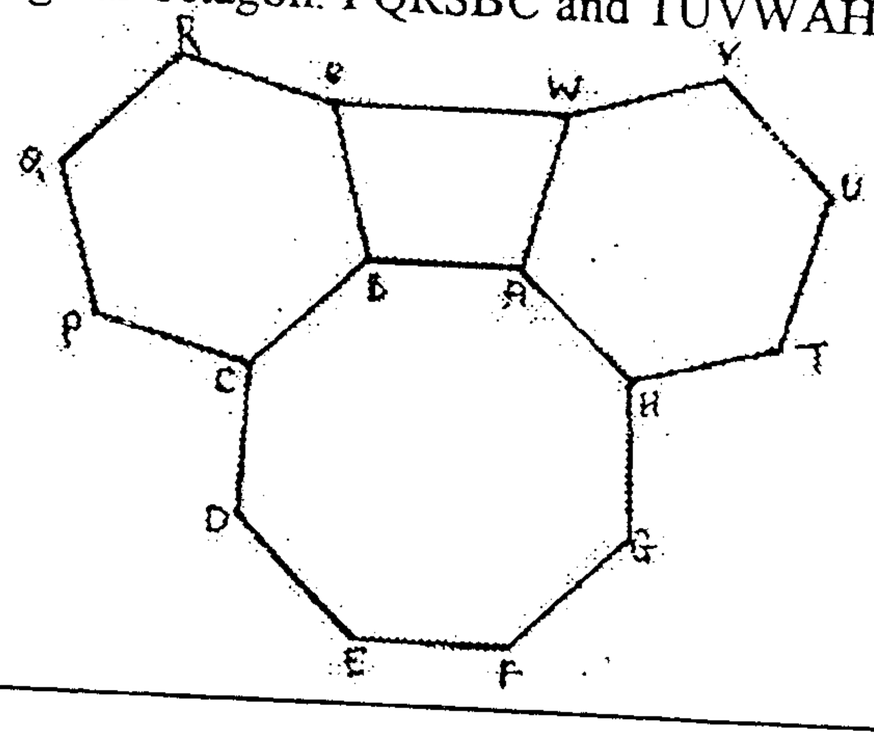
Part 2 Section B (8 marks)
Answer any 1 question only.

10a) Rewrite the letters shown below in the boxes provided to form a pattern having rotational symmetry.



[1]

10b) In the diagram, ABCDEFGH is a regular octagon. PQRSBC and TUVWAH are regular hexagons. Find



(i) reflex $\angle ABS$ [2]

(ii) obtuse $\angle RBH$ [3]

(iii) acute $\angle BSW$ [2]

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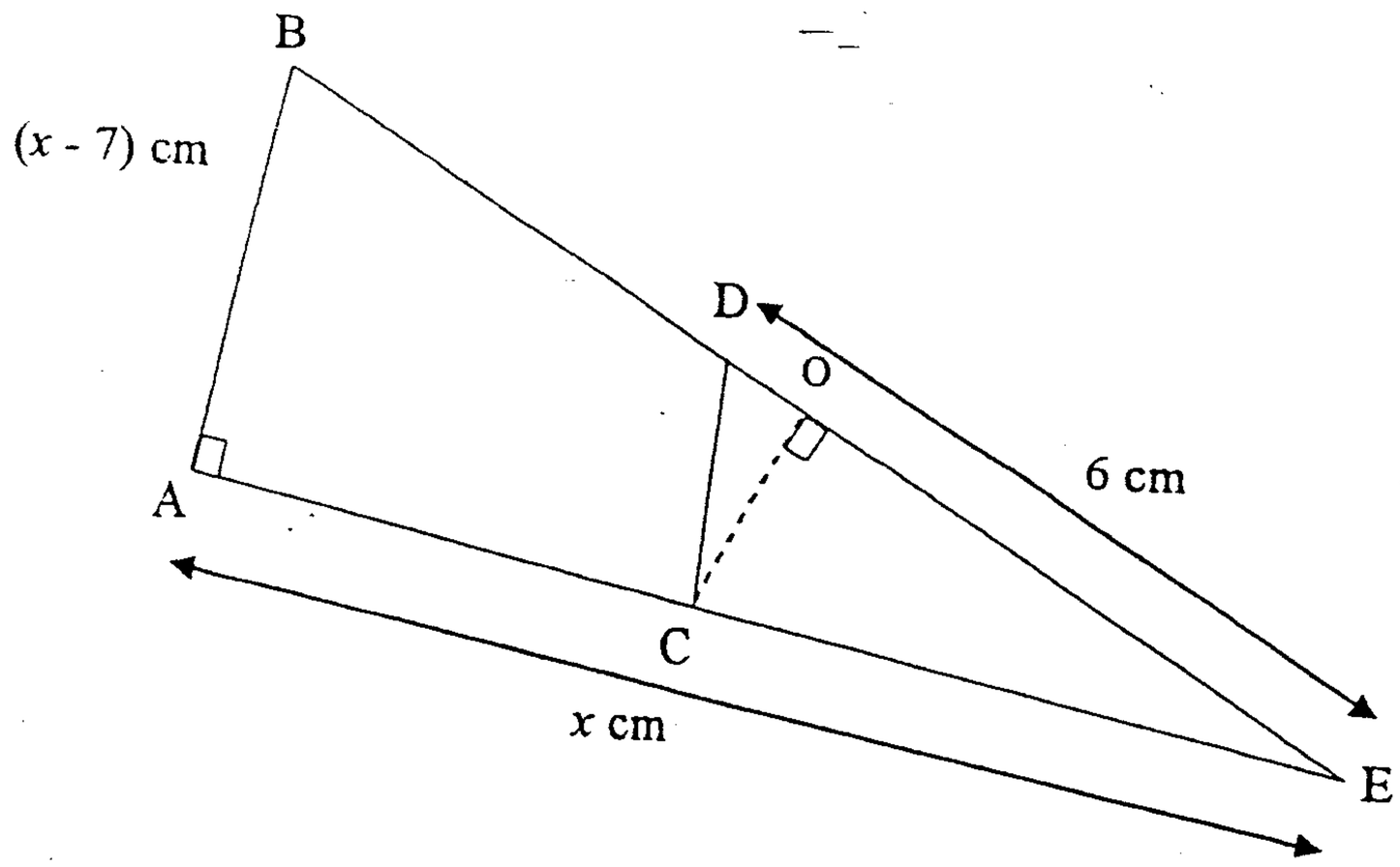
11) In the diagram below, ABE is a right-angled triangle with $AB = (x - 7)$ cm, $AE = x$ cm and $DE = 6$ cm.



(a) Given that the length of $CO = \frac{1}{2}$ of length AB. Find in terms of x, the length of CO. [1]

(b) If the area of $ABCD = 22.5$ cm^2, form an equation in x and show that it reduces to $x^2 - 10x - 24 = 0$. [3]

(c) Solve the equation in part (b) and find x. [2]

(d) Find the length CO and the area CDE. [2]

--- END OF PAPER ---

Answers for Sec 2 Exam Papers

Paper 1

1(a) $(3.2\times10^5)^2 = 3.2 \times 10^5 \times 3.2 \times 10^5$
$= 10.24 \times 10^{5+5}$
$= 10.24 \times 10^{10}$
$= \mathbf{1.024 \times 10^{11}}$

1(b) $48\times10^3 \div (1.2\times10^{-4}) = 40 \times 10^{3-(-4)}$
$= 40 \times 10^{3+4}$
$= 40 \times 10^7$
$= \mathbf{4.0 \times 10^8}$

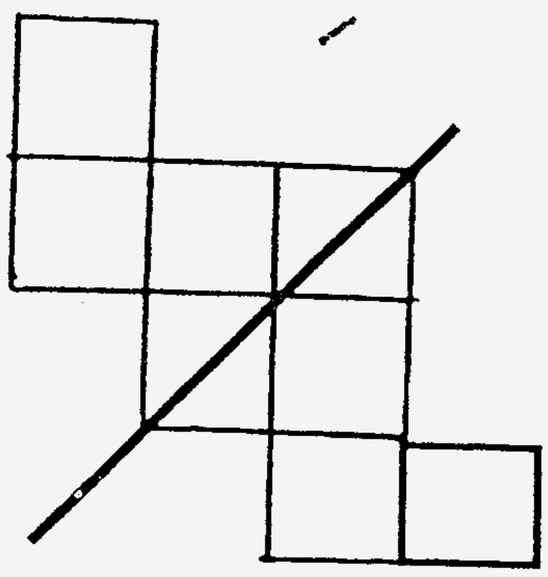
1(c) $10^{-6} - 10^{-8} = 1 \times 10^{-6} - 1 \times 10^{-8}$
$= 100 \times 10^{-8} - 1 \times 10^{-8}$
$= 99 \times 10^{-8}$
$= \mathbf{9.9 \times 10^{-7}}$

2(a) Length on map : Actual length
= 5 cm : 20 km
= 1 cm : 4 km
= (73.6 ÷ 4) cm : 73.6 km
= **18.4 cm** : 73.6 km
∴ the length of the river on the map is 18.4 cm.

2(b) Area on map : Actual area
= $(1 \text{ cm})^2 : (4 \text{ km})^2$
= $1 \text{ cm}^2 : 16 \text{ km}^2$
= $8.5 \text{ cm}^2 : 8.5 \times 16 \text{ km}^2$
= $8.5 \text{ cm}^2 : \mathbf{136 \text{ km}^2}$
∴ the actual area of the basketball court is 136 km^2.

3(a) **Order 1**

3(b)



Note: Square drawn must have the exact length and breath as the rest.

Line of symmetry –

4(a) $y \propto \dfrac{1}{\sqrt{x+13}}$

$y = \dfrac{k}{\sqrt{x+13}}$ where k is a constant

$x = 3$ when $y = 4$

$4 = \dfrac{k}{\sqrt{3+13}}$

$4 = \dfrac{k}{\sqrt{16}}$

$k = 16$

$\therefore y = \dfrac{16}{\sqrt{x+13}}$

4(b) When $y = 2$,

$2 = \dfrac{16}{\sqrt{x+13}}$

$\sqrt{x+13} = \dfrac{16}{2}$

$\sqrt{x+13} = 8$

$x+13 = 8^2$

$x+13 = 64$

$x = 64 - 13$

$x = 51$

5(i) $x^2 + 10x + 21 = (x+7)(x+3)$

5(ii) $221 = 100 + 100 + 21$

$= (10)^2 + 10(10) + 21$

$= (10+7)(10+3)$

$= 17 \times 13$

$\therefore$ The 2 prime factors are **17** and **13**.

6(a) $\dfrac{7y(x+y)}{56(x^2-y^2)} = \dfrac{7y(x+y)}{56(x-y)(x+y)}$

$= \dfrac{y}{8(x-y)}$.

6(b)
$$\frac{5m^3n^2}{7nq^5} \div \frac{15(mn)^4}{3mn} \times \frac{4qm}{3n^7} = \frac{5m^3n^2}{7nq^5} \times \frac{3mn}{15m^4n^4} \times \frac{4qm}{3n^7}$$
$$= \frac{1}{7q^5n^2} \times \frac{4qm}{3n^7}$$
$$= \frac{4m}{21q^4n^9}$$

7
$$\frac{1}{a} - \frac{1}{c} = \frac{b}{d}$$
$$\frac{c}{ac} - \frac{a}{ac} = \frac{b}{d}$$
$$\frac{c-a}{ac} = \frac{b}{d}$$
$$d(c-a) = abc$$
$$cd - ad = abc$$
$$cd = abc + ad$$
$$a(bc+d) = cd$$
$$a = \frac{cd}{bc+d}$$

8
$$3x + 2y = 8 \quad \text{------ (1)}$$
$$x - 3y = -23 \quad \text{------ (2)}$$

From (2), $x = -23 + 3y$ ------ (3)

Subst (3) into (1),
$$3(-23+3y) + 2y = 8$$
$$-69 + 9y + 2y = 8$$
$$11y = 77$$
$$\therefore y = 7$$

Alternatively,
From (2), $\times 3$,
$$3x - 9y = -69 \text{ ---- (3)}$$

(1) – (3),
$$11y = 77$$
$$\therefore y = 7$$

When $y = 7$, $x = -23 + 3(7)$
$$= -2$$
$$\therefore \mathbf{x = -2 \text{ and } y = 7}$$

Paper 2 Section A

1(a) $a(b+c)+5c(b-a)=ab+ac+5bc-5ac$

$=ab-4ac+5bc$

1(b) $(p-2q)^2-4p(p+q)=p^2-4pq+4q^2-4p^2-4pq$

$=-3p^2+4q^2-8pq$

2(a) $5d^3+35d^2e=5d^2(d+7e)$

2(b) $x^2y^2+x^2-y^2-1=x^2(y^2+1)-(y^2+1)$

$=(y^2+1)(x^2-1)$

$=(y^2+1)(x+1)(x-1)$

2(c) $16-p^4=(4-p^2)(4+p^2)$

$=(2-p)(2+p)(4+p^2)$

3(a) Outstanding balance after paying the downpayment = 0.7 × \$2770

= \$1939

Amount of money paid in instalments for first 12 months = 1.05 × \$1939

= \$2035.95

Amount of money paid in instalments for next 6 months = 1.025 × \$2035.95

= \$2086.84875

Monthly instalment = \$2086.84875 ÷ 18

= \$115.936.....

≈ **\$115.94**

(b) Amount of extra money paid = (\$2086.84875 + \$831) - \$2770

= \$2917.84875 - \$2770

= \$147.84875

Extra amount of money paid in percentage = \$(147.84875 ÷ 2770) × 100%

= **5.3375%**

4(a) In ΔAMB and ΔDMC ,

AM = MD = 5 cm (given)

$\angle$AMB = $\angle$CMD (vert. opp. $\angle$s)

$\angle$BAM = $\angle$MDC (alt. $\angle$s)

$\therefore \Delta AMB \equiv \Delta DMC\ (AAS)$

4(b) DC = AB = 8 cm

$$\frac{DC}{FE} = \frac{MD}{MF}$$

$$\frac{8}{10} = \frac{5}{MF}$$

$$MF = \frac{10 \times 5}{8}$$

$$MF = 6.25\ cm$$

$$DF = 6.25 - 5$$

$$= 1.25\ cm$$

5) Sum of exterior angle = 360°

One exterior angle = 180° – 144°

= 36°

$$\text{One exterior angle} = \frac{360°}{n}$$

$$\therefore \frac{360°}{n} = 36°$$

n = 10

Additional quadrilaterals needed = 10 – 3

= 7

6(a) $(x-3)^2 - (x-4)^2 = (x^2 - 6x + 9) - (x^2 - 8x + 16)$

$= \mathbf{2x - 7}$

6(b) From (a), $x = 600$. Thus, the value of $597^2 - 596^2$ $= 2(600) - 7$

$= 1200 - 7$

$= \mathbf{1193}$

7(a)

$$x-\frac{2x-8}{4}=\frac{x-3}{5}$$

$$\frac{4x}{4}-\frac{2x-8}{4}=\frac{x-3}{5}$$

$$\frac{4x-2x+8}{4}=\frac{x-3}{5}$$

$$\frac{2x+8}{4}=\frac{x-3}{5}$$

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

$$10x+40=4x-12$$

$$10x-4x=-12-40$$

$$6x=-52$$

$$x=-8\frac{2}{3}$$

7(b)

$$\frac{5}{x+4}=3+\frac{2}{x-2}$$

$$\frac{5}{x+4}=\frac{3(x-2)}{x-2}+\frac{2}{x-2}$$

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

$$\frac{5}{x+4}=\frac{3x-4}{x-2}$$

$$5(x-2)=(3x-4)(x+4)$$

$$5x-10=3x^2-16-4x+12x$$

$$0=3x^2-16+8x-5x+10$$

$$3x^2+3x-6=0$$

$$3(x^2+x-2)=0$$

$$x^2+x-2=0$$

$$(x+2)(x-1)=0$$

$$x+2=0 \quad or \quad x-1=0$$

$$x=-2 \quad or \quad x=1$$

8(a) Number of durians bought $= \frac{600}{x}$

8(b) Sum of money received $= (\frac{600}{x} - 10)(x + 1.2)$

or $= 588 + \frac{720}{x} - 10x$

8(c) $(\frac{600}{x} - 10)(x + 1.2) - 600 = 90$

$600 + \frac{720}{x} - 10x - 12 - 600 = 90$

$720 - 10x^2 - 12x = 90x$

$10x^2 + 102x - 720 = 0$

Divide eqn above by 2,

$5x^2 + 51x - 360 = 0$ (shown)

8(d) $(5x - 24)(x + 15) = 0$

$5x - 24 = 0$ or $x + 15 = 0$

$x = 4.8$ **or** $x = -15$ (reject)

Cost of each durian = **$4.80**

9) Let the digit at the tens position be x and the digit at units position be y.

$x = 4y$ ---------- (1)

$10x + y - (10y + x) = 54$ ---------- (2)

Subst. (1) into (2) $10(4y) + y - (10y + 4y) = 54$

$41y - 14y = 54$

$27y = 54$

$y = 2$

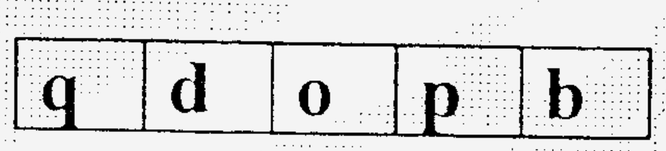
Subst. $y = 2$ into (1) $x = 4(2)$

$x = 8$

∴ **The number is 82**

Paper 2 Section B

10(a)



Note: either one of the above is acceptable.

10(bi) Reflex $\angle ABS = \dfrac{(8-2)\times 180°}{8} + \dfrac{(6-2)\times 180°}{6}$

$= \dfrac{6\times 180°}{8} + \dfrac{4\times 180°}{6}$

$= 135° + 120°$

$= \mathbf{255°}$

10(bii) $\angle SBA = 360° - 255°$

$= \mathbf{105°}$ ($\angle$s at a point)

$\angle HBA = \dfrac{180° - 135°}{2}$

$= \mathbf{22.5°}$ (isos. triangle)

$\angle RBS = \dfrac{180° - 120°}{2}$

$= \mathbf{30°}$ (isos. triangle)

$\therefore$ Obtuse $\angle RBH = 22.5° + 30° + 105°$

$= \mathbf{157.5°}$

10(biii) Acute $\angle BSW = \dfrac{360° - 105° - 105°}{2}$

$= \mathbf{75°}$

11(a) Length of CO $= \frac{1}{2}(x-7)$ cm

11(b) Area of ABCD $= 22.5\ \text{cm}^2$

$$\frac{1}{2}(x-7)x - \frac{1}{2}(6) \times \frac{1}{2}(x-7) = 22.5$$

$$(x-7)x - \frac{1}{2}(6) \times (x-7) = 22.5 \times 2$$

$$x^2 - 7x - 3x + 21 = 45$$

$$x^2 - 10x + 21 - 45 = 0$$

$$x^2 - 10x - 24 = 0 \quad (\textit{shown})$$

11(c)

$$x^2 - 10x - 24 = 0$$

$$(x-12)(x+2) = 0$$

$$x - 12 = 0 \quad \textit{or} \quad x + 2 = 0$$

$$x = 12 \quad \textit{or} \quad x = -2 \ (\textit{rejected})$$

11(d) Length of CO $= \frac{1}{2}(x-7)$

$$= \frac{1}{2}(12-7)$$

$$= \frac{1}{2}(5)$$

$$= \mathbf{2.5\ cm}$$

Area of CDE $= \frac{1}{2} \times 6 \times 2.5$

$$= \mathbf{7.5\ cm^2}$$