Baldivis Secondary College

Question/Answer Booklet

MATHEMATICS APPLICATIONS UNIT 1
Section One: Calculator-free

SOLUTIONS

Student Number: In figures

In words   _____

Your name   _____

Time allowed for this section
Reading time before commencing work: five minutes
Working time for section: fifty minutes

Materials required/recommended for this section
To be provided by the supervisor
This Question/Answer Booklet
Formula Sheet

To be provided by the candidate
Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: nil

Important note to candidates
No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Working time (minutes)	Marks available	Percentage of exam
Section One: Calculator-free	7	7	50	52	35
Section Two: Calculator-assumed	12	12	100	98	65
			Total	150	100

Instructions to candidates

1. The rules for the conduct of examinations are detailed in the school handbook. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer Booklet.

3. You must be careful to confine your response to the specific question asked and to follow any instructions that are specified to a particular question.

4. Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
   - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
   - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

5. **Show all your working clearly**. Your working should be in sufficient detail to allow your answers to be checked readily and for marks to be awarded for reasoning. Incorrect answers given without supporting reasoning cannot be allocated any marks. For any question or part question worth more than two marks, valid working or justification is required to receive full marks. If you repeat any question, ensure that you cancel the answer you do not wish to have marked.

6. It is recommended that you **do not use pencil**, except in diagrams.

7. The Formula Sheet is **not** to be handed in with your Question/Answer Booklet.

See next page

Section One: Calculator-free 35% (52 Marks)

This section has **seven (7)** questions. Answer **all** questions. Write your answers in the spaces provided.

Working time for this section is 50 minutes.

Question 1 **(7 marks)**

(a) Evaluate $10 + 2 \times 3 - 5$. (1 mark)

$$10 + 6 - 5$$
$$= 16 - 5$$
$$= 11$$

(b) If $W = 3A - 2B$ determine

(i) W given that $A = 15$ and $B = 7$. (1 mark)

$$W = 3 \times 15 - 2 \times 7$$
$$= 45 - 14$$
$$= 31$$

(ii) A given that $W = 21$ and $B = 1.5$. (2 marks)

$$21 = 3A - 2 \times 1.5$$
$$21 = 3A - 3$$
$$24 = 3A$$
$$A = 8$$

(iii) B given that $W = 20$ and $A = 4$. (2 marks)

$$20 = 3 \times 4 - 2B$$
$$20 = 12 - 2B$$
$$8 = -2B$$
$$B = -4$$

(c) If $x = 4$ and $y = -3$ evaluate $x^2 - y^2$. (1 mark)

$$4^2 - (-3)^2 = 16 - 9$$
$$= 7$$

See next page

Question 2 **(6 marks)**

As part of a student's planning to purchase a car, the following table of expenses was drawn up.

Car expense	Monthly ($)	Annual ($)
Loan repayment	300	
Insurance		1 200
Registration		480
Petrol	100	
Maintenance		600
Parking	50	
Emergency assistance		120

(a)   Name an expense from the table above that is an example of a fixed expense.   (1 mark)

Loan repayment, insurance, registration or emergency assistance.

(b)   Name an expense from the table above that is an example of a discretionary expense.

(1 mark)

Petrol, maintenance or parking.

(c)   Determine the annual amount budgeted for petrol.   (1 mark)

$100 \times 12 = \$1200$

(d)   Determine the monthly amount budgeted for registration.   (1 mark)

$480 \div 12 = \$40$

(e)   Determine the total monthly amount that the student needs to set aside if they are to purchase and run a car.   (2 marks)

$$
\begin{array}{r}
300 \\
100 \\
40 \\
100 \\
50 \\
50 \\
10 \\
\hline
\text{Total} = \$650
\end{array}
$$

See next page

Question 3   **(8 marks)**

The table below is used by a removal company to quote customers the price of jobs in dollars from one to four hours long using between one and four workers.

Price (p)	Number of hours (h)						
Workers (w)	1	1.5	2	2.5	3	3.5	4
1	160	185	210	235	260	285	310
2	210	260	310	360	410	**A**	510
3	260	335	410	485	560	635	710
4	310	410	510	**B**	710	810	910

(a)   Use examples to show that only **one** of the formulas below will correctly produce all of the job prices in the above table.   (3 marks)

$I: p = 100 + 30(h + w)$ $h = 2, w = 2 \Rightarrow p = 220$ but should be 310

$II: p = 100 + 60hw$ $h = 2, w = 2 \Rightarrow p = 340$ but should be 310

$III: p = 110 + 50hw$ $h = 2, w = 2 \Rightarrow p = 310$ Correct!

(b)   Use the correct formula to

(i)   Determine the values of A and B in the table above.   (2 marks)

$$A = 110 + 50(3.5)(2) = 460$$

$$B = 110 + 50(2.5)(4) = 610$$

(ii)   Determine the cost of a job needing five workers for two and a half hours.   (1 mark)

$$p = 110 + 50(2.5)(5) = \$735$$
(or using patterns in table)

(c)   The quote for a job estimated to require n workers for k hours was $410. The job actually took half-an-hour less, saving the customer $75. Determine the values of n and k.
                                                                            (2 marks)

$$n = 3$$
$$k = 2$$

See next page

Question 4   **(9 marks)**

Consider the matrices $A = \begin{bmatrix} 0 & -2 \\ 1 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 5 & -1 \end{bmatrix}$, $C = \begin{bmatrix} -2 \\ 3 \end{bmatrix}$ and $D = \begin{bmatrix} 9 & 6 \end{bmatrix}$.

(a) State the size of

     (i) the column matrix   (1 mark)

> C is a 2 by 1 matrix

     (ii) the square matrix   (1 mark)

> A is a 2 by 2 matrix

(b) Determine $a_{12} \times d_{12}$.   (1 mark)

> $-2 \times 6 = -12$

(c) Matrix E is such that $3E = D$. Determine the matrix E.   (1 mark)

> $E = \begin{bmatrix} 3 & 2 \end{bmatrix}$

(d) Calculate

     (i) $8I + 2A$, where I is the identity matrix.   (2 marks)

> $$8 \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} + 2 \begin{bmatrix} 0 & -2 \\ 1 & 4 \end{bmatrix} = \begin{bmatrix} 8 & 0 \\ 0 & 8 \end{bmatrix} + \begin{bmatrix} 0 & -4 \\ 2 & 8 \end{bmatrix} = \begin{bmatrix} 8 & -4 \\ 2 & 16 \end{bmatrix}$$

     (ii) DAC.   (3 marks)

> $$\begin{bmatrix} 9 & 6 \end{bmatrix} \times \begin{bmatrix} 0 & -2 \\ 1 & 4 \end{bmatrix} \times \begin{bmatrix} -2 \\ 3 \end{bmatrix} = \begin{bmatrix} 9 & 6 \end{bmatrix} \times \begin{bmatrix} -6 \\ 10 \end{bmatrix} = \begin{bmatrix} 6 \end{bmatrix}$$

See next page

Question 5 **(6 marks)**

(a) A builders plan of a house, drawn to a scale of 1 : 200, shows the dimensions of a window as 1 cm tall by 1.4 cm wide. Determine the actual dimensions of the window in the completed house. (2 marks)

$$1 \times 200 = 200 \text{ cm tall}$$

$$1.4 \times 200 = 280 \text{ cm wide}$$

(b) A small map has a scale of 1 : 200 000.

(i) If two towns are 12 km from each other, determine how far they are from each other on the map, in centimetres. (2 marks)
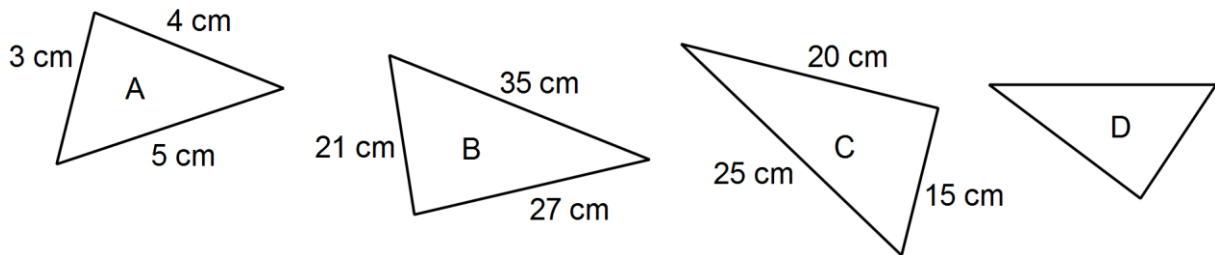
$$\frac{12 \times 1000 \times 100}{200000} = \frac{1200000}{200000}$$
$$= \frac{12}{2}$$
$$= 6 \text{ cm}$$

(ii) On the map, the distance between two towers is 25 mm. Determine how far apart the towers are in kilometres. (2 marks)

$$\frac{25 \times 200000}{1000 \times 1000} = \frac{5000000}{1000000}$$
$$= 5 \text{ km}$$

See next page

Question 6 **(8 marks)**

The dimensions of triangles A, B and C are shown below (diagram not to scale).

(a) Use Pythagoras' Theorem to show that triangle A is right-angled. (2 marks)

$$3^2 + 4^2 = 9 + 16$$
$$= 25$$
$$= 5^2$$

(b) Only one of triangles B or C is similar to triangle A. State which triangle is similar to triangle A and justify your answer. (2 marks)

Triangle C is similar as all sides are 5 times as long as the corresponding sides of triangle A.

(c) Show that the area of triangle A is 6 cm². (1 mark)

$$\text{Area} = 0.5 \times 3 \times 4$$
$$= 6 \text{ cm}^2$$

(d) Triangle D has an area of 600 cm² and is similar to triangle A. Determine the lengths of all the sides of triangle D. (3 marks)

Area scale factor is 600÷6=100

Length scale factor is $\sqrt{100} = 10$

Sides are 30, 40 and 50 cm.

See next page

Question 7 **(8 marks)**

Information about a small share portfolio owned by an investor is shown below.

Company name	Number of shares	Value of share ($)	Dividend per share (cents)	Dividend per share (%)
Ganges	200	5.00	-	4
Seine	300	4.00	20	-

(a) Calculate the total value of this small share portfolio. (2 marks)

$$200 \times 5 = 1000$$

$$300 \times 4 = 1200$$

$$1000 + 1200 = \$2200$$

(b) Determine the total dividend due for this portfolio of shares. (3 marks)

$$5 \times 4\% = 20 \text{ c per share}$$

$$200 \times 0.20 = 40$$
$$300 \times 0.20 = 60$$

$$40 + 60 = \$100$$

(c) Determine the price-to-earnings ratio for both shares in the portfolio and hence state which share has the lower price-to-earnings ratio. (3 marks)

$$\frac{500}{20} = 25$$

$$\frac{400}{20} = 20$$

Hence Seine shares have the lower P/E ratio.

End of questions

Additional working space

Question number: _____

Additional working space

Question number: _____