



2011 SAMPLE MATHEMATICAL APPLICATIONS PAPER, Semester 1

The external assessment requirements of this subject are listed on page 42.

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SUPERVISOR CHECK

RE-MARKED

ATTACH SACE REGISTRATION NUMBER LABEL TO THIS BOX

Graphics calculator	<input type="checkbox"/>
Brand	_____
Model	_____
Computer software	<input type="checkbox"/>

Time: 1½ hours

Pages: 42
Questions: 23

Examination material: one 42-page question booklet
one SACE registration number label

Approved dictionaries, notes, calculators, and computer software may be used.

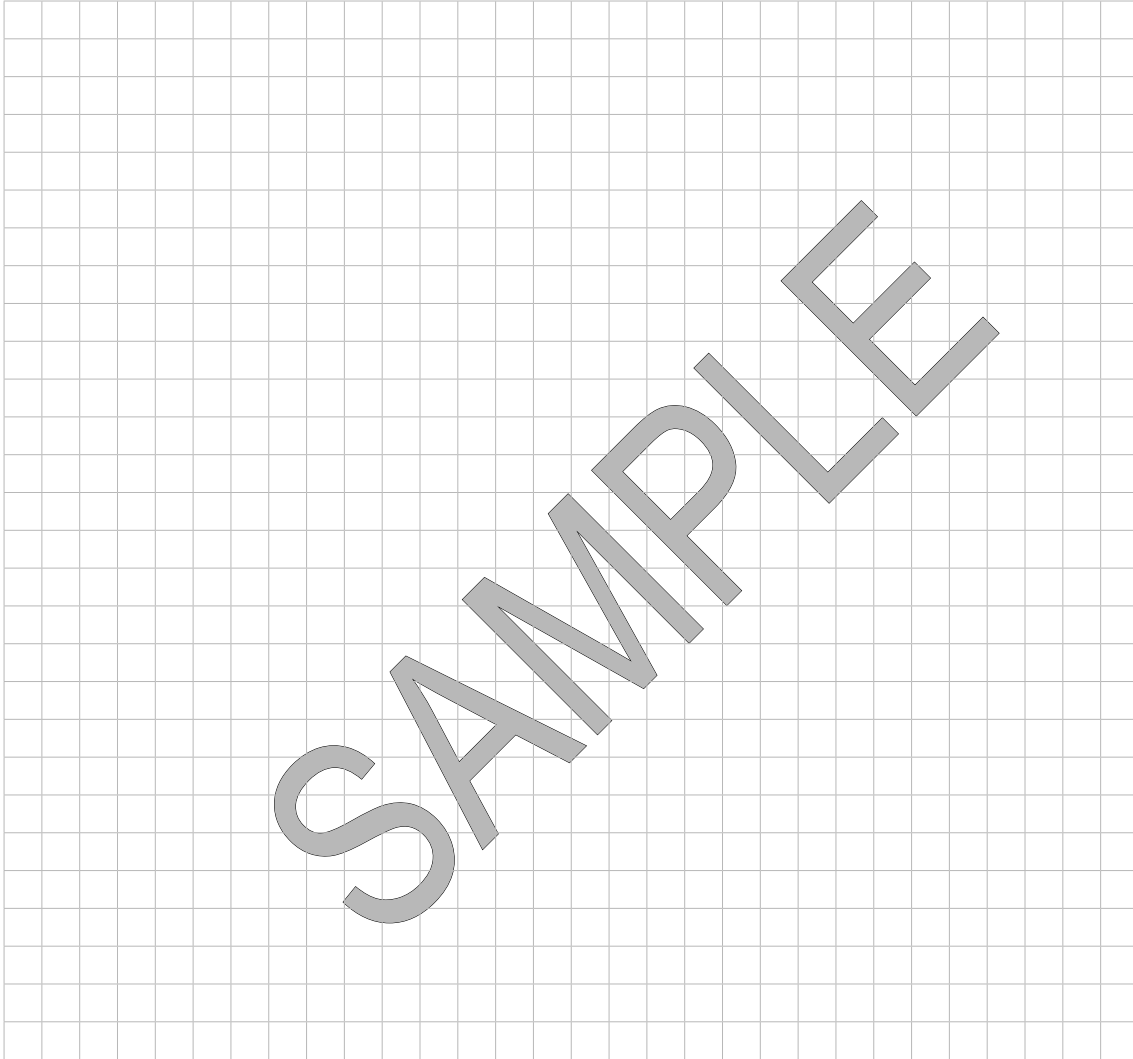
Instructions to Students

- You will have 10 minutes to read the paper. You must not write in your question booklet or use a calculator during this reading time but you may make notes on the scribbling paper provided.
- This paper consists of five topics. **Tick the boxes by the two topics you have studied in Semester 1:**
 - Topic 2: Investment and Loans (Questions 1 to 5), pages 2 to 8
 - Topic 4: Matrices (Questions 6 to 9), pages 10 to 18
 - Topic 5: Optimisation (Questions 10 to 14), pages 20 to 28
 - Topic 6: Share Investments (Questions 15 to 19), pages 29 to 35
 - Topic 7: Statistics and Working with Data (Questions 20 to 23), pages 36 to 41
- Answer all questions on the two topics you have studied in Semester 1.
- All topics are of equal value.
- Write your answers in the spaces provided in this question booklet. There is no need to fill all the space provided. Write on pages 9 and 19 if you need more space, making sure to label each answer clearly.
- Appropriate steps of logic and correct answers are required for full marks.
- Show all working in this booklet. (You are strongly advised **not** to use scribbling paper. Work that you consider incorrect should be crossed out with a single line.)
- Use only black or blue pens for all work other than graphs and diagrams, for which you may use a sharp dark pencil.
- State all answers correct to three significant figures, unless otherwise stated or as appropriate.
- Diagrams, where given, are not necessarily drawn to scale.
- Complete the box on the top right-hand side of this page with information about the electronic technology you are using in this examination.
- Attach your SACE registration number label to the box at the top of this page.

2. Jay returns from his holiday and wants to buy a car. He finds a car for \$16 000, and researches his options for loan rates over 4 years. He narrows the loan rates down to the following two options:

- Option 1 — a nominal rate of 9.65% per annum, compounded weekly, with a \$120 set-up fee and a service fee of \$1.50 per week
- Option 2 — 9.95% per annum, compounded weekly, with no additional fees.

Using effective rates, advise Jay on which of the two loan options is better.



(6 marks)

3. (a) Jay likes to plan ahead. He is 25 years old and wants to retire when he is 55, so he starts investigating superannuation. He decides he can top up his employer's payment so that \$1520 per quarter is paid into his superannuation account, which earns interest of 8.2% per annum, compounded quarterly.

Show that Jay can expect to have just over \$772 000 in the account in 30 years' time.

(2 marks)

- (b) His accountant has recommended that Jay should aim to have \$1 million in his superannuation account when he retires.

- (i) How much longer than 30 years will Jay have to work to achieve this?

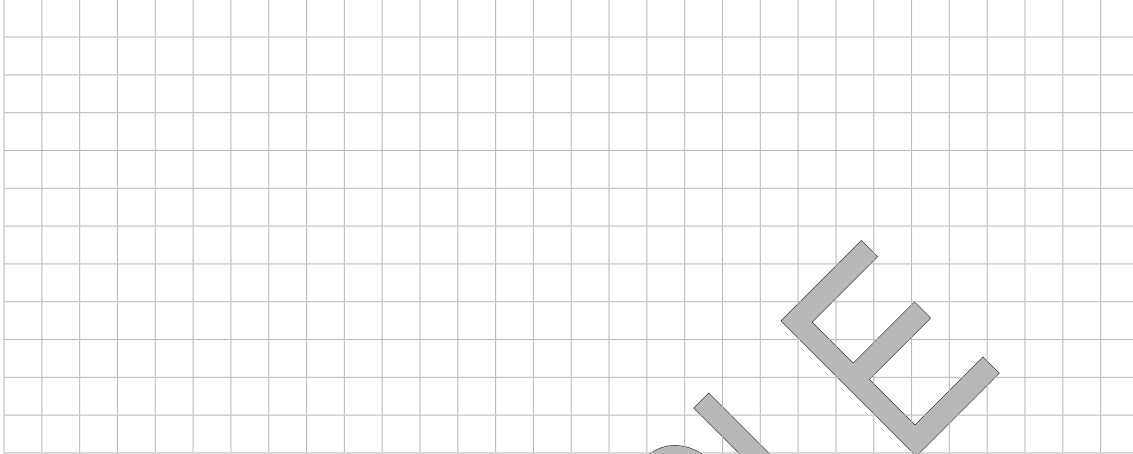
(3 marks)

- (ii) If Jay still wants to retire at 55, how much more would he have to contribute to the account each month to achieve the goal of \$1 million?

(3 marks)

- (c) His accountant has told Jay that he should be able to draw \$19200 per quarter from his superannuation account when he retires. Jay now lives on \$9000 per quarter.

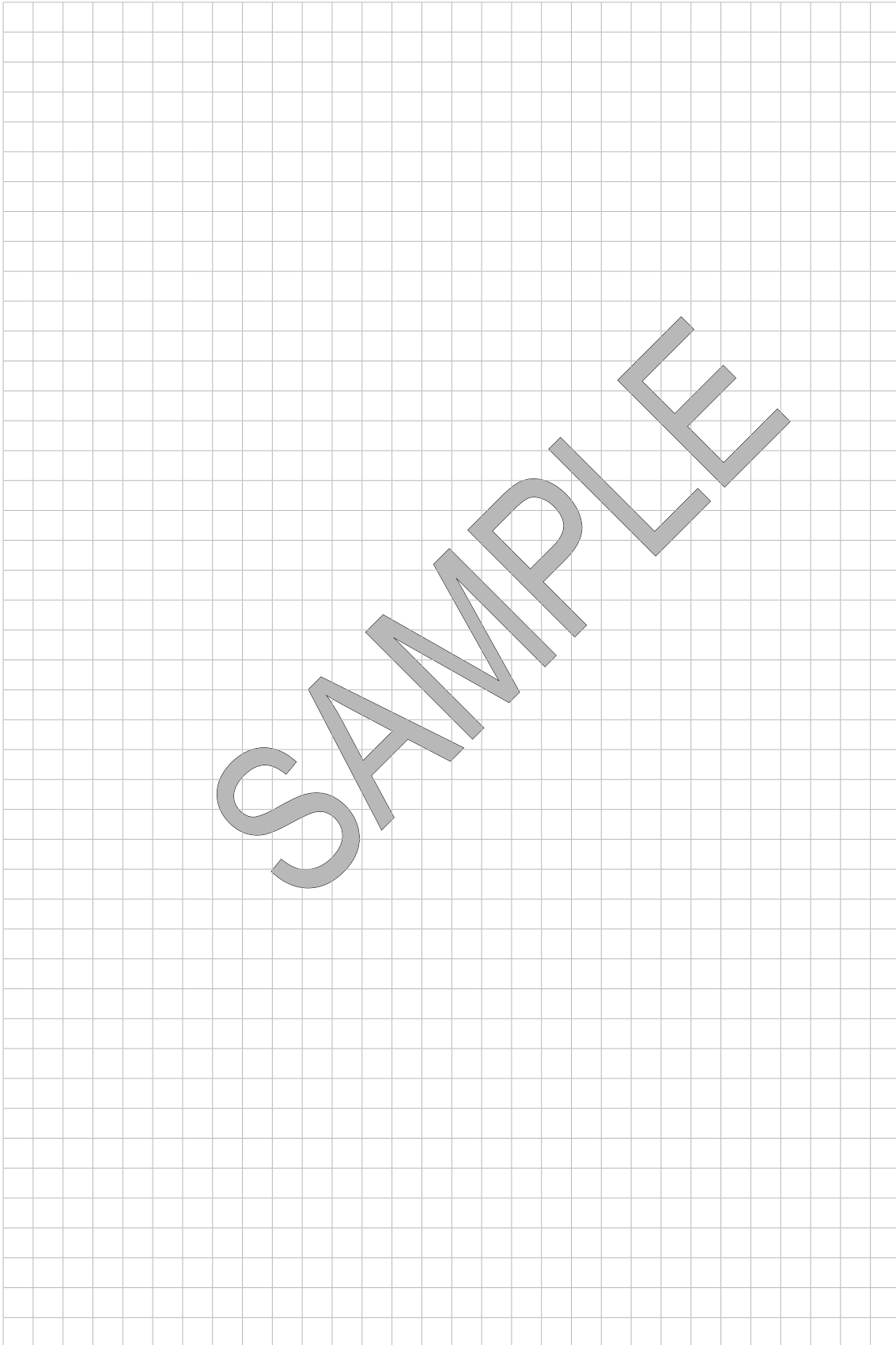
If inflation averages 2.5% per annum, what will \$9000 be equivalent to in 30 years' time? Will it be enough to maintain Jay's lifestyle? Discuss, including one key assumption.



(3 marks)

SAMPLE

You may write on this page if you need more space to finish your answers. Make sure to label each answer carefully (e.g. 'Question 18(a) continued').



TOPIC 4: MATRICES (Questions 6 to 9)

(35 marks)

Answer *all* questions on this topic.

6. Five players (A, B, C, D, and E) are taking part in the regional finals of a snooker championship. The results of the first nine games are shown in matrix R :

$$R = \begin{matrix} & \begin{matrix} A & B & C & D & E \end{matrix} \\ \begin{matrix} A \\ B \\ C \\ D \\ E \end{matrix} & \begin{bmatrix} 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} \end{matrix}$$

- (a) Calculate $S = R + \frac{1}{2} R^2$.


(3 marks)

- (b) Using matrix S , determine the rankings of the five players.

(1 mark)

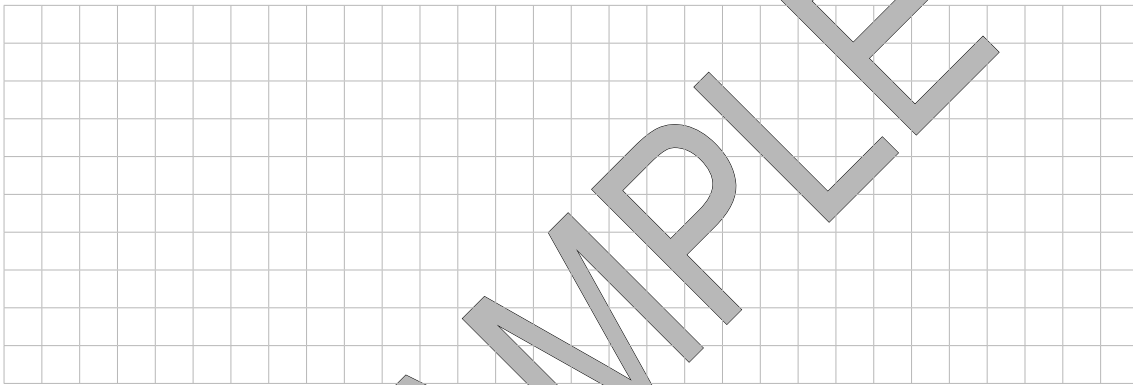
(b) Aussie Auto Company placed a corporate order for 20 T-shirts, 45 caps, and 100 water bottles.

(i) Construct a column matrix, O , for this order.



(1 mark)

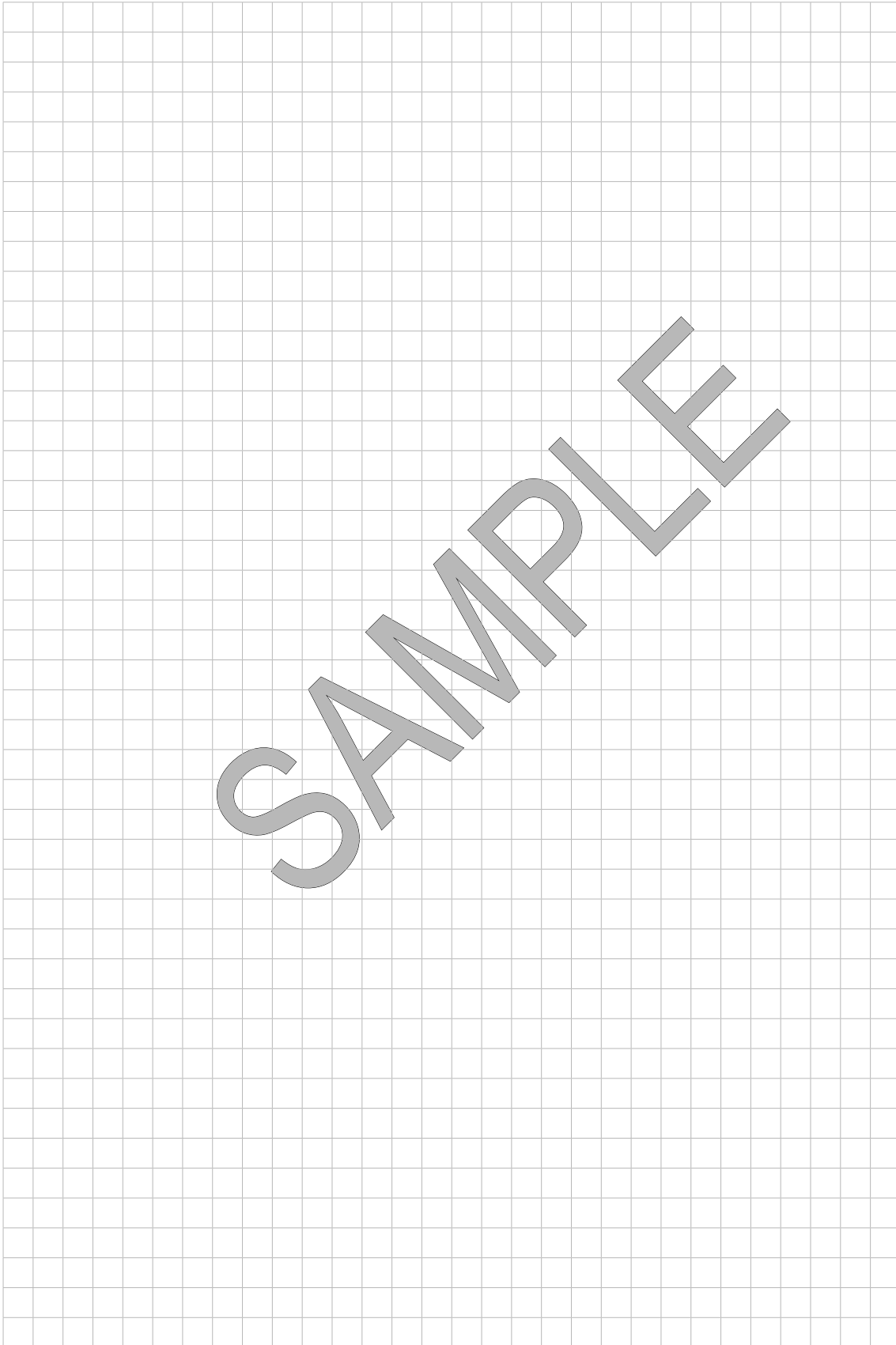
(ii) Using matrix methods, calculate the amount to be charged to Aussie Auto Company if the order is given a 12% discount.



(2 marks)

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You may write on this page if you need more space to finish your answers. Make sure to label each answer carefully (e.g. 'Question 18(a) continued').

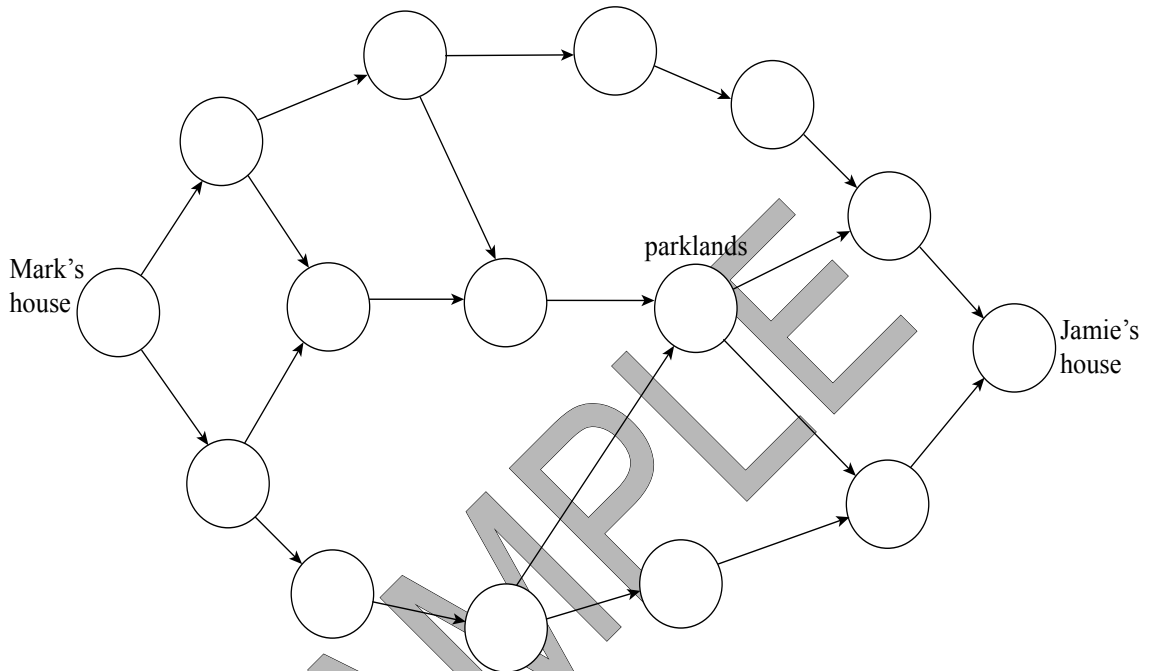


TOPIC 5: OPTIMISATION (Questions 10 to 14)

(35 marks)

Answer *all* questions on this topic.

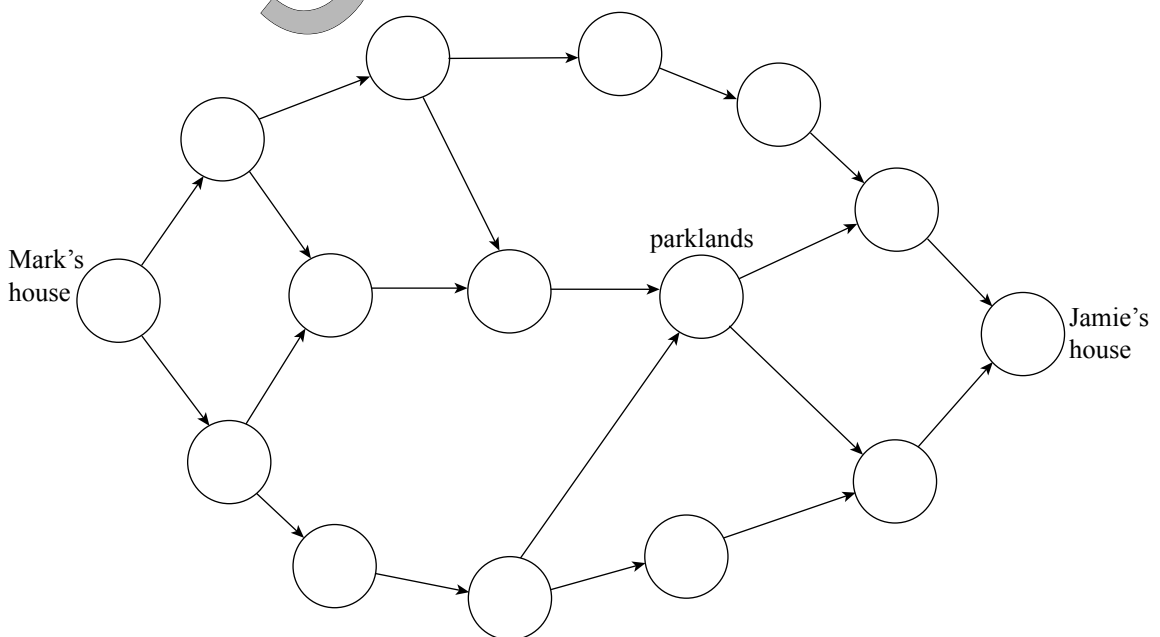
10. (a) Using the network below, find the number of routes from Mark's house to Jamie's house.



Number of routes:

(2 marks)

- (b) How many routes from Mark's house to Jamie's house pass through the parklands?



Number of routes:

(2 marks)

14. Furry Friends is a company that makes a variety of gift packs for pets. The company decides to make only the following two packs, as they have sold very well:

- Pedigree Pooch, which contains ten chockie treats, four beef chews, and two toys
- Pampered Pup, which contains two chockie treats, two beef chews, and four toys.

Let x be the number of Pedigree Pooch gift packs sold and y be the number of Pampered Pup gift packs sold.

Furry Friends sells the Pedigree Pooch gift pack for a profit of \$5 and the Pampered Pup gift pack for a profit of \$7, giving an objective function of:

$$\text{Profit (\$)} = 5x + 7y.$$

Each week Furry Friends has 150 chockie treats, 90 beef chews, and 144 toys available to pack.

(a) Complete the table below.

Gift pack	Chockie treats	Beef chews	Toys
Pedigree Pooch			
Pampered Pup			

(1 mark)

(b) Five constraints are used to model this situation.

Complete the list below.

$$10x + 2y \leq 150 \quad \longrightarrow \quad y \leq -5x + 75$$

$$4x + 2y \leq 90 \quad \longrightarrow \quad y \leq -2x + 45$$

$$\underline{\hspace{2cm}} \quad \longrightarrow \quad \underline{\hspace{2cm}}$$

$$\underline{\hspace{2cm}}$$

$$\underline{\hspace{2cm}}$$

(2 marks)

TOPIC 6: SHARE INVESTMENTS (Questions 15 to 19)

(35 marks)

15. Lucia bought a parcel of shares in 2000 and sold them in 2008. The following tables show information about the shares Lucia owned, and about the all-ordinaries index and the consumer price index (CPI):

Share/Index	No. of shares	Cost per share in 2000	Total value in 2000	Cost per share in 2008	Total value in 2008
Billabong	500	\$8.15	\$4075	\$8.85	_____
CMI	1 200	\$1.51	\$1812	\$1.39	_____
Netcomm	40 000	\$0.05	\$2000	\$0.06	_____
			\$7887		\$8493

Index	2000	2008
all-ordinaries index (points)	3257.6	3363.3
consumer price index (points)	126.6	136.6

(a) Complete the top table above. (1 mark)

(b) Working to one decimal place, calculate the percentage change from 2000 to 2008 in the value of Lucia's share portfolio for the:

(i) all-ordinaries index.

(2 marks)

(ii) CPI.

(1 mark)

(c) Comment on the change in value of Lucia's investment compared with the change in the market, and any real return compared with inflation over the same time.

(2 marks)

16. Refer to the following table, which lists information about Australian shares published on Saturday 6 September 2008, when answering all parts of this question:

<i>Year high</i>	<i>Year low</i>	<i>Stock</i>	<i>Close</i>	<i>Move</i>	<i>Buy</i>	<i>Sell</i>	<i>Vol. (100s)</i>	<i>Sales high</i>	<i>Sales low</i>	<i>Yield</i>
4.75	3.32	ARB Corp	4.20		4.20	4.21	53	4.21	4.20	3.10
6.70	3.53	Auspine	6.10	-0.04	6.10	6.14	32	6.10	6.10	2.79
39.79	23.86	BHP Billiton	38.90	+0.46	38.90	38.91	137083	38.92	38.00	2.00
28.06	20.00	Caltex	24.53	-0.02	24.22	24.35	2488	24.45	23.85	3.90
2.06	1.19	CMI	1.41	+0.01	1.41	1.45	103	1.41	1.41	2.13
4.10	2.70	Dominos	3.26	-0.04	3.25	3.27	529	3.30	3.25	3.34
5.39	3.91	Fairfax	4.52	-0.02	4.52	4.55	33852	4.55	4.45	4.42
11.94	8.43	IOOF	9.86	-0.15	9.86	9.95	432	10.02	9.83	3.35
44.70	35.75	NAB	39.30	-0.53	39.20	39.30	5307	39.60	38.82	4.35
5.85	3.315	Qantas Air	5.61	-0.06	5.60	5.61	5814	5.64	5.54	4.63

(a) How many Caltex shares were traded on Friday 5 September 2008?

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(1 mark)

(b) If you wanted to buy shares in Qantas Air, what price per share would you have to pay in order to guarantee purchase?

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(1 mark)

(c) (i) How much would you pay for 800 CMI shares at the closing price, with 2% brokerage and 10% GST?

(2 marks)

- (ii) Find the break-even price for the CMI shares at the closing price.

(3 marks)

- (d) You have the opportunity to invest in either BHP Billiton or Caltex.

Using the information from the table on page 30, discuss two main points that would help you in making your decision.

(2 marks)

18. The paid-up capital of a particular company is \$5 million, made up of 2 million 1-dollar 6% preference shares and 6 million 50-cent ordinary shares. Last year the company declared a profit of \$980 000. It retained \$494 000 for taxation and future requirements.

- (a) Show that the dividend cheque for an investor holding 1500 preference shares and 1100 ordinary shares would be \$156.00. Work to the nearest cent when calculating the dividend per ordinary share.

(5 marks)

- (b) The investor received the following dividend payment advice for the ordinary shares:

This advice represents payment of your final dividend for the year ended 31 December. This dividend is fully franked at the Class C company taxation rate of 30%.

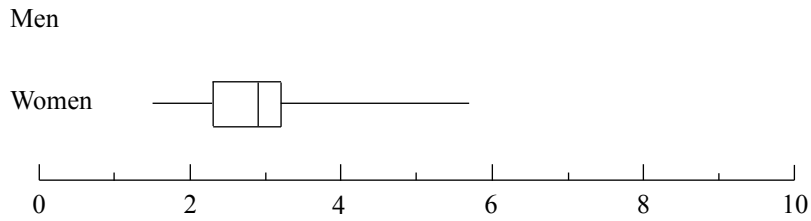
Class	Rate	No. of shares	Unfranked amount	Franked amount	Imputation credit
ordinary	6 cents	1100	—	\$66.00	\$28.29

Calculate the after-taxation return if the marginal taxation rate is 40%.

(3 marks)

(c) A box plot for the women is shown on the axis below.

Using the same axis, draw and label a box plot for the men in the space provided.



(2 marks)

(d) Interpret some measures of centre and spread from part (b) and/or part (c) in order to compare the men's weight loss with the women's weight loss over the month.

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(3 marks)

(e) Identify a possible outlier in the men's data and suggest how it could have happened.

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(1 mark)

(f) This value was found to be the result of error. Remove the outlier and recalculate the mean and the standard deviation for the men's data.

(1 mark)

(g) Compare the mean weight loss, in kilograms, of both groups, with the outlier removed.

(1 mark)

2011 SAMPLE MATHEMATICAL APPLICATIONS PAPER

The purpose of this sample paper is to show the structure of a Mathematical Applications examination (using the Semester 1 topics) and the style of questions that may be used. The following extract is from the subject outline for Mathematical Applications:

EXTERNAL ASSESSMENT

Assessment Type 3: Examination (30%)

For a 10-credit subject, students undertake one external examination at the end of the semester of study.

For a 20-credit subject, students undertake two external examinations, one at the end of each semester.

The external examinations are undertaken under supervision. The total time spent by students on external examinations is 90 minutes for a 10-credit subject, or 90 minutes at the end of each semester for a 20-credit subject.

The examinations are based on the subtopics, key questions, and key ideas outlined in the topics studied in the semester. The considerations for developing teaching and learning strategies are provided as a guide only, although applications described under this heading may provide useful contexts for examination questions. The examination questions are evenly balanced across the topics in each semester. Each examination is set by the SACE Board and conducted under supervision in schools on a common day and time to be nominated by the Board.

The examination at the end of the first semester contains questions on each of the following topics:

- Topic 2: Investment and Loans
- Topic 4: Matrices
- Topic 5: Optimisation
- Topic 6: Share Investments
- Topic 7: Statistics and Working with Data.

The examination at the end of the second semester contains questions on each of the following topics:

- Topic 1: Applied Geometry
- Topic 2: Investment and Loans
- Topic 3: Mathematics and Small Business
- Topic 6: Share Investments
- Topic 7: Statistics and Working with Data.

Students answer questions from only the two topics studied during the semester.

Examinations consist of a range of questions, some focusing on knowledge, routine skills, and applications, and others focusing on analysis and interpretation. Students are required to provide explanations and arguments, and use notation, terminology, and representation correctly throughout the examination.

Students must have access to approved electronic technology during the external examination. However, students need to be discerning in their use of electronic technology to solve questions in examinations

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

- mathematical knowledge and skills and their application
- mathematical modelling and problem-solving
- communication of mathematical information.

Source: Mathematical Applications 2011 Subject Outline Stage 2, pp. 43–4, on SACE website, www.sace.sa.edu.au