CSSA
CATHOLIC SECONDARY SCHOOLS ASSOCIATION OF NSW

Centre Number

Student Number

2017
TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics General 2

Morning Session
Thursday, 3 August 2017

General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using black pen
- NESA-approved calculators may be used
- A formulae and data sheet is provided on a SEPARATE sheet
- In Questions 26 - 30, show relevant mathematical reasoning and/or calculations
- Write your Centre Number and Student Number on the top of this page and on each question where indicated.

Total marks – 100

Section I Pages 3 - 11

25 marks

- Attempt Questions 1 - 25
- Allow about 35 minutes for this section

Section II Pages 13 - 33

75 marks

- Attempt Questions 26 - 30
- Allow about 1 hour and 55 minutes for this section

Section I

25 marks

Attempt Questions 1–25
Allow about 35 minutes for this section

Use the Multiple-Choice Answer Sheet for Questions 1–25.

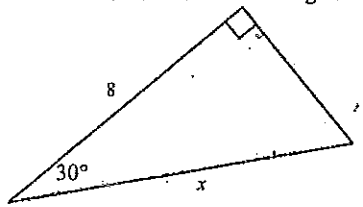
1 Which of the following is classified as quantitative, continuous data?

(A) The number of students in a class
(B) The height of the students in a class
(C) The names of the students in a class
(D) The month of birth of students in a class

2 A car is travelling on a motorway at an average speed of 83 km/h. Correct to 1 decimal place, how many kilometres will the car travel in 1 hour and 26 minutes?

(A) 57·9
(B) 65·9
(C) 104·6
(D) 119·0

3 What is the correct expression for the value of x in this triangle?



(A) $\dfrac{8}{\cos 30°}$

(B) $\dfrac{8}{\sin 30°}$

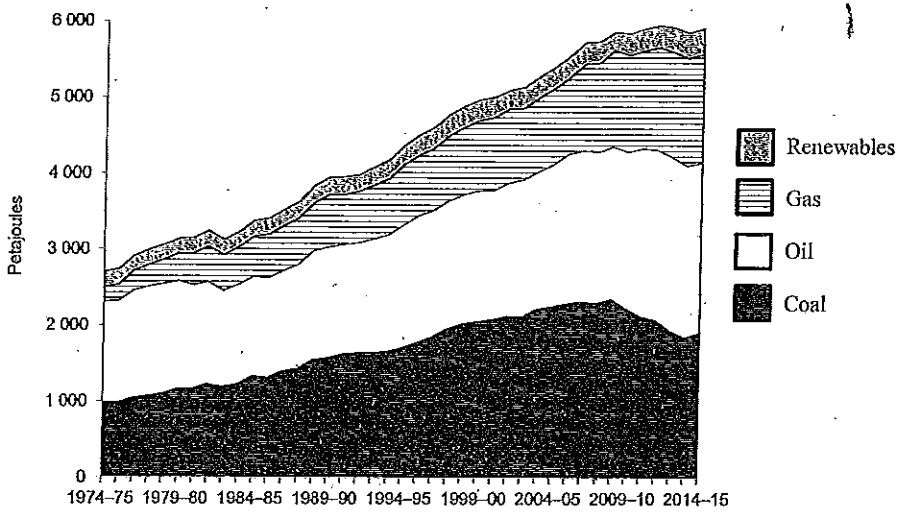
(C) $8 \times \cos 30°$

(D) $8 \times \sin 30°$

4 Use the formula $v^2 = u^2 + 2as$ to find the value of v^2 when $u = -3$, $a = 7$ and $s = 0{\cdot}5$.

(A) –2
(B) 2
(C) 4
(D) 16

5 The area chart shows the energy consumption by fuel type in Australia from 1974 to 2015.



Which of the fuel types has shown the greatest increase in consumption over that time?

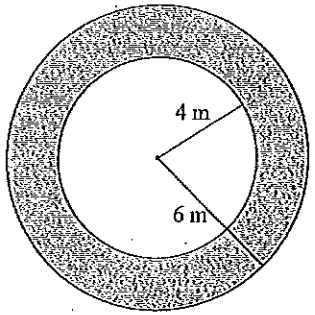
(A) Oil
(B) Gas
(C) Coal
(D) Renewables

6 The correlation coefficient for two sets of data is calculated to be 0·73.

Which term best describes the relationship between the two sets of data?

(A) Weak
(B) Moderate
(C) Very strong
(D) No relationship exists

7 Which is the best estimate for the area of the annulus below?



(A) 16 m^2
(B) 31 m^2
(C) 22 m^2
(D) 63 m^2

8 The five figure summary for a set of data is shown below where the numbers represent the lowest score, lower quartile, median, upper quartile and highest score respectively.

2 3 7 11 12

Which of these sets of data was used to create the summary?

(A) 2, 3, 5, 9, 11, 12
(B) 2, 3, 7, 7, 10, 12
(C) 2, 3, 4, 7, 11, 12, 12
(D) 2, 3, 6, 7, 11, 12, 12

9 Last week Massima earned \$161·20 when she worked 13 hours at normal rate in her part time job. This week she worked 12 hours at normal rate and 2 hours at time and a half.

How much did she earn this week?

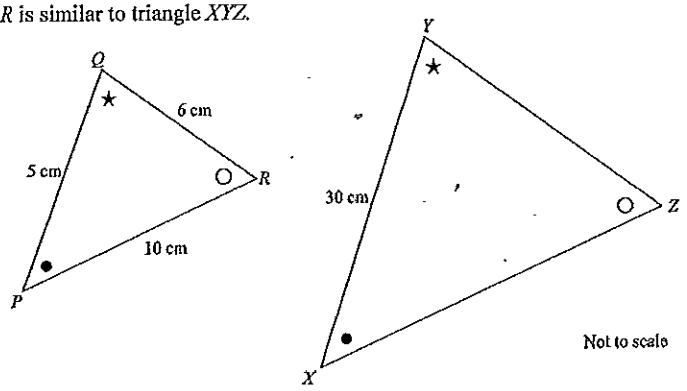
(A) \$148·80
(B) \$173·60
(C) \$186·00
(D) \$260·40

10 The weather forecast has stated that the probability of rain on any chosen day in August is 40%.

What is the probability that, of any two days in August chosen at random, at least one day will have rainfall?

(A) 16 %
(B) 24 %
(C) 48 %
(D) 64 %

11 Triangle PQR is similar to triangle XYZ.



What is the perimeter of triangle XYZ?

(A) 36 cm
(B) 60 cm
(C) 105 cm
(D) 126 cm

12 In NSW the stamp duty to be paid when purchasing a car is calculated on the market value of the vehicle at the following rate:

Market value	Stamp duty payable
Up to \$45 000	3% of the market value.
Over \$45 000	\$1 350 plus 5% of the value in excess of \$45 000.

A new vehicle has a market value of \$49 990.

What is the stamp duty payable on purchasing this car?

(A) \$1 499·70
(B) \$1 599·50
(C) \$2 499·50
(D) \$3 849·50

13 The ages of male and female employees at a small business are recorded in this back-to-back stem-and-leaf plot.

Female		Male
7 6	2	3 4
9 7 4 2	3	2 7 8
8 8 5	4	2 8 8 9
7 5 2	5	1 4

Considering the two sets of data, which of the following statements is **not** correct?

(A) The means are equal.
(B) The ranges are equal.
(C) The modes are equal.
(D) The medians are equal.

14 It takes 4 workers, 4 hours to dig 4 holes.

How long would it take 2 workers to dig 6 holes?

(A) 3 hours
(B) 6 hours
(C) 9 hours
(D) 12 hours

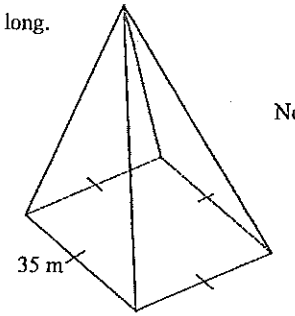
15 Sasha borrows \$12 000 to renovate her kitchen. Interest is charged at 3·6% p.a. on the amount owing at the beginning of each month. She agrees to make payments of \$464·00 on the last day of each month.

How much does Sasha owe at the beginning of the second month?

(A) \$11 536·00
(B) \$11 568·00
(C) \$11 572·00
(D) \$11 951·30

16 A pyramid has a volume of 8 820 cubic metres.

The base is a square with sides that are 35 metres long.



Not to scale

Which of the following best represents the height of the pyramid?

(A) 7 metres
(B) 15 metres
(C) 22 metres
(D) 30 metres

17 On a particular mobile phone plan, voice calls are charged at a rate of \$0·44 per 30 second block. The provider also charges a connection fee of \$0·32 per call.

What was the maximum length of a call for which the user was charged \$9·12?

(A) 9 minutes
(B) 10 minutes
(C) 15 minutes
(D) 30 minutes

18 A lumen, l, is a measure of light intensity. The intensity is known to be inversely proportional to a measured value, s, related to the distance of an object from the light source and follows the equation:

$$l = \frac{k}{s}$$

Given that $l = 450$ when $s = 4$, find the value of l when $s = 9$.

(A) 200
(B) 300
(C) 600
(D) 1 800

19 Amanda has a credit card balance of \$1 346 owing for 28 days. There is no interest free period and interest is compounded daily at 18% p.a.

How much interest is she charged?

(A) \$0·66
(B) \$18·59
(C) \$18·71
(D) \$1 364·71

20 An appliance has an energy rating label indicating that the energy consumption is 670 kWh per year. If the cost of electricity is 24·55 cents per kWh, what is the average quarterly cost of using this appliance?

(A) \$27·29
(B) \$41·12
(C) \$54·83
(D) \$164·49

21 A patient is to receive 600 mL of solution via an intravenous drip. The drip is set at a rate of 25 drops/minute and delivers 30 drops/mL.

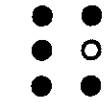
How long will it take for the patient to receive the complete solution?

(A) 1 hour 15 minutes
(B) 8 hours 20 minutes
(C) 12 hours
(D) 48 hours

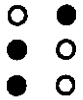
22 The Braille alphabet is used by visually impaired people to assist with reading. It relies on patterns of six dots, either raised or flat. Each set of dots represents a letter, number, word or symbol.

For example :

The word 'and' is represented as :



The letter 'S' is displayed as :



where ● indicates a 'raised' dot and ○ indicates a flat space.

How many different Braille alphabet items can be represented using this system of dots?

(A) 12

(B) 36

(C) 64

(D) 72

23 Kyriakos paid $4 079 income tax last year.

This tax was based on his taxable income using the table below.

Taxable income	Tax on this income
$0 - $18 200	Nil
$18 200 - $37 000	19c for each $1 over $18 200
$37 001 - $80 000	$3 572 plus 32·5c for each $1 over $37 000
$80 000 - $180 000	$17 547 plus 37c for each $1 over $80 000
$180 001 and over	$54 547 plus 45c for each $1 over $180 000

To the nearest dollar, what was Kyriakos' taxable income?

(A) $38 560

(B) $38 561

(C) $39 668

(D) $49 551

24 A bag contains 22 red marbles, 22 green marbles and 1 marble that is black.

A marble is chosen at random, the colour noted and then recorded. The marble is then replaced in the bag and the bag is shaken before a second marble is chosen.

This process is repeated and the table below shows the outcome of 200 trials.

Marble colour	Frequency
Red	96
Green	96
Black	8

Frankie used this data to compare the experimental probability of choosing a green marble with the theoretical probability for the same outcome.

Which of the following conclusions is correct?

(A) The experimental probability is less than the theoretical probability.

(B) The experimental probability is greater than the theoretical probability.

(C) The experimental probability is the same as the theoretical probability.

(D) There is not enough information available to compare the two probabilities.

25 A biologist wishes to estimate the number of flying foxes in a colony. A sample of N flying foxes is captured, tagged and released. The next night a second sample of S flying foxes is captured and it is noted that M of them had been previously tagged.

Which is the correct expression to estimate the number of flying foxes in the colony.

(A) $\frac{MN}{S}$

(B) $\frac{NS}{M}$

(C) $\frac{MS}{N}$

(D) $\frac{N}{MS}$

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Section II

75 marks
Attempt Questions 26 - 30
Allow about 1 hour and 55 minutes for this section

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.

Extra writing space is provided on page 35. If you use this space, clearly indicate which question you are answering.

Question 26 (15 marks)

(a) The total age of four dogs in a boarding kennel is 26 years. The mean age of three of the dogs is six years. 1

Calculate the age of the other dog.

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(b) Sheryl invested $580 and after one year the value of her investment had increased by 8%. During the second year, the value decreased by 4%. 1

What was the value of Sheryl's investment at the end of the second year?

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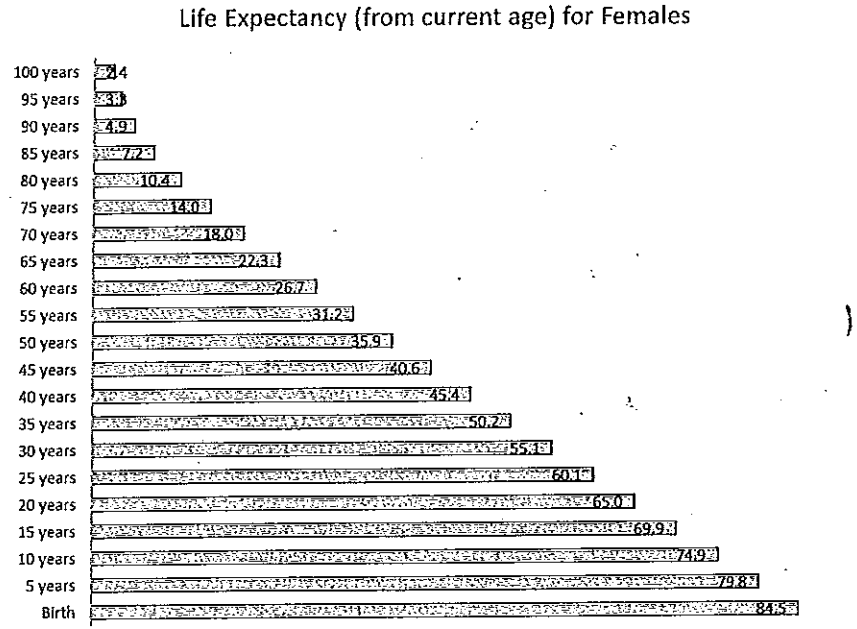
Question 26 (continued)

(c) 2



Source : Australian Bureau of Statistics
Australian Bureau of Statistics (2016). *Life Tables, States, Territories and Australia*. Cat No. 3302.0.55.001. <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3302.0.55.001Main+Features12013-2015?OpenDocument>
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The graphic above shows the number of years that a female can expect to live from her current age. For example, a 5 year old female can expect to live for a further 79·80 years.

According to the Australian Bureau of Statistics, a 35 year old male can expect to live a further 46·5 years.

Magnus is 35 years old and his wife Astrid is 30 years old. According to the data given, what is the difference in their life expectancies?

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Question 26 (continued)

(d) Cameron purchased 3 000 shares in an internet company for $3·40 each. The brokerage fee was 2·5 cents per share. Later that year the internet company paid a dividend of 40 cents per share and Cameron then sold the shares for $4·80 each.

(i) What was the total cost of the shares when Cameron bought them? 1

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(ii) Calculate the dividend yield when the shares were sold. 1

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(e) Fried's formula is used to calculate the correct dose of a drug for children aged 1 to 2 years. 1

$$dose\ for\ a\ child = \frac{age\ in\ months \times adult\ dose}{150}$$

The adult dose of a drug is 40 mg and the child's dose is 4·8mg.

Calculate the age of the child.

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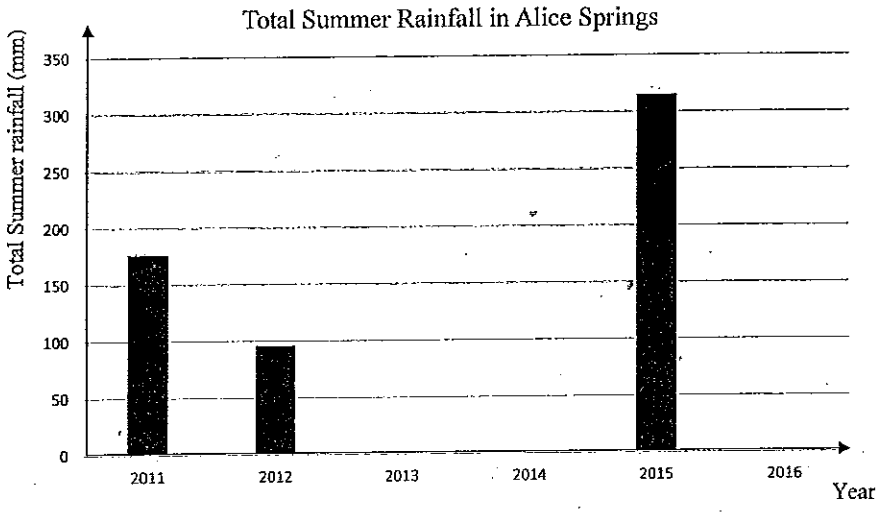
Question 26 (continued)

(f) In Alice Springs, the total rainfall (in mm) for each of the summer months from 2011 to 2016 was recorded and is shown in the table. 2

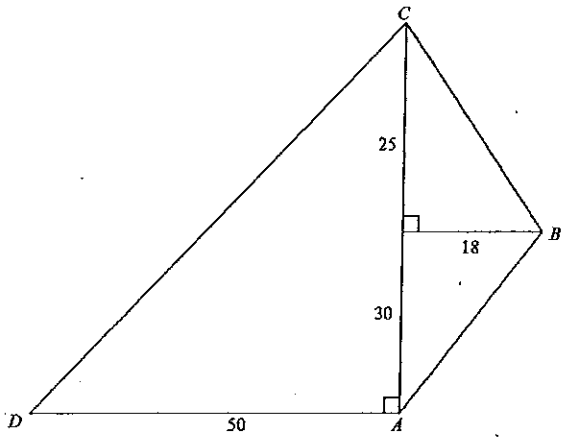
	2011	2012	2013	2014	2015	2016
Dec	4	25	31	35	120	131
Jan	64	27	23	33	195	40
Feb	108	44	12	46	0	26
Total	176	96			315	

Complete the table to show the total for the summer months for all years from 2011 to 2016 then use this information to complete the column graph.



Question 26 (continued)

(g) Kevin is a surveyor who took the following measurements, in metres, from a block of land.



Not to scale

(i) Sketch a notebook entry that Kevin would have drawn for this block of land. 1

(ii) Kevin wants to construct a fence between points C and D. The fence will cost \$25 per metre. 2

How much will it cost Kevin to construct the fence?

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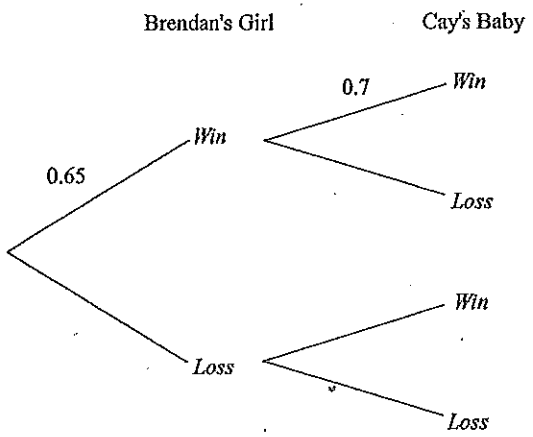
Question 26 (continued)

(h) Stefanie is training two horses, Brendan's Girl and Cay's Baby. 3

She has determined that the probability that Brendan's Girl wins a race is 0·65, while the probability that Cay's Baby wins is 0·7.

Next weekend, both horses will compete in races at a carnival.

Complete the probability tree diagram below to determine the probability that only one of Stefanie's horses will win their race next weekend.



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Question 27 (15 marks)

(a) A survey was undertaken involving 360 adult commuters at a railway station to determine how many people were eligible for a concession fare. 2
The results are shown in the table.

	Male	Female
Full fare	65	83
Concession fare		77

What percentage of male commuters are eligible for a concession fare?

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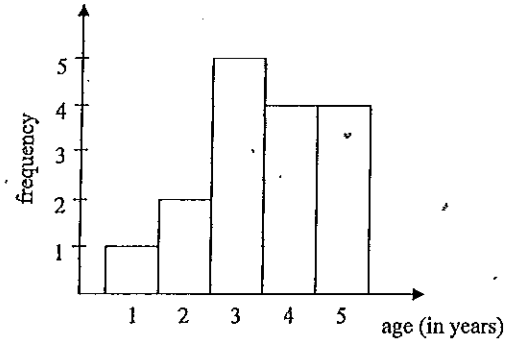
(b) The frequency histogram displays the age of the children in a day care centre based on data collected at the beginning of January. 2



In February, one four year old left the centre and two children, both aged two years, were enrolled. What effect did these changes have on the mean age of the children enrolled at the centre? Justify your response.

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Question 27 (continued)

(c) A group of male athletes have their weight and height recorded. The information is displayed in the table

	Mean	Standard deviation
Weight in kg. (x)	88·1	4·9
Height in cm. (y)	180·9	3·6

(i) Given that the gradient of the least-squares line of best fit is 0·60, show that the correlation coefficient (r) is 0·82 (correct to two decimal places). 1

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(ii) Find the equation of the least-squares line of best fit. 2

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(d) Adam and Samantha have decided to put their home up for sale. The house is expected to sell for $760 000. 3

Two real estate agents would like to manage the sale and have provided the following information about their fees and charges :

Williams and Black (Agent 1)	Johnson and Smythe (Agent 2)
• 2·2% of the total sale price • plus $650 for advertising the property	• 2·4% on the first $500 000 • 1·6% on amounts over $500 000 • The advertising fee is $580

Calculate the difference in the amount charged by the two agencies.

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(e) Below is an extract from a household water usage bill. 2

Account for residential property

Last bill	Payments	Balance	This bill	Total amount due
$351.63	$351.63	$0.00	$427.79	$427.79

Please pay by 10/05/17

MRS X SAMPLE
MR X SAMPLE
23 GENERAL STREET
MATHSTOWN NSW 9876

Account number 987 6543

Fixed charges – GST free	1 Apr 17 – 30 Jun 17		$
Water service			22.48
Wastewater (sewerage) service			145.90
Usage charges – GST free	20 Feb 17 – 21 Apr 17		
Water	20/02 – 21/04	27 kL at $2.00 a kL	
Recycled water	20/03 – 21/04	95 kL at $1.79 a kL	
Other charges and credits			
Mathstown stormwater drainage charge 01/04/17 – 30/06/17			
		Total amount due	**$ 427.79**

Use this information to calculate the stormwater drainage charge in Mathstown.

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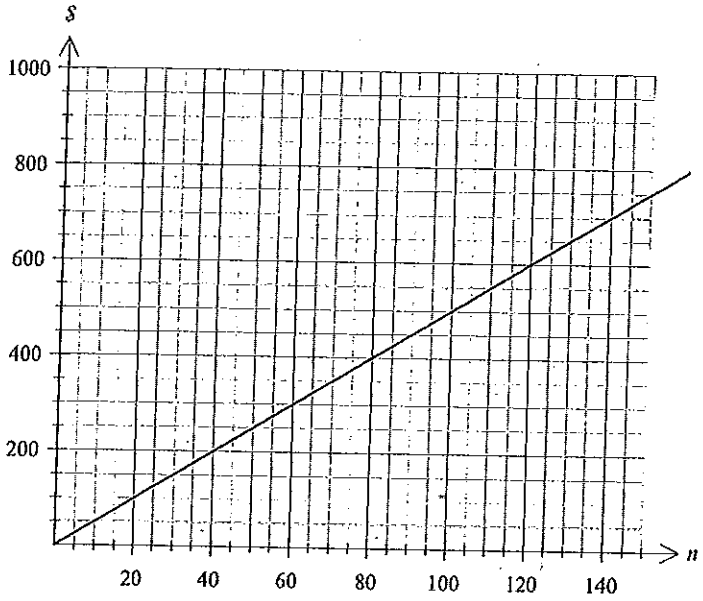
(f) A company manufactures a variety of children's toys for inclusion in meals at a fast food restaurant. The toys are packaged in boxes and sold to the restaurant for $5 per box.

The initial set up cost is $300 and each box costs the company $2 to produce.

The line $I = 5n$ is drawn on the graph and represents the company's income according to the number of boxes sold.

(i) By constructing the line representing the company's costs, find the number of boxes that need to be produced in order to cover the cost involved in manufacture. 2



Number of boxes needed to cover cost :

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(ii) The company is limited to a daily production of 150 boxes. What is their maximum possible profit based on one day's operation? 1

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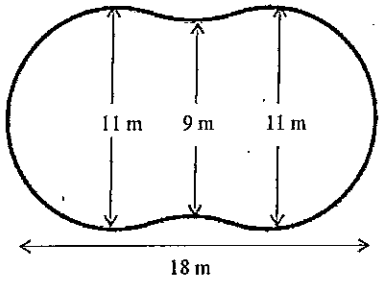
Question 28 (15 marks)

(a) The diagram below shows an aerial view of a swimming pool which has a uniform depth of 2·3 metres. The pool is 18 metres long. 3



Jamie took three measurements, equal distance apart, and found that the pool was 11 metres wide at the widest points and 9 metres wide at the centre.

Use two applications of Simpson's rule to find the volume of the pool.

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(b) Movies or TV shows can be downloaded as either standard definition or high definition files. 3

To download a movie in high definition will take Samuel 2 hours and 35 minutes. Samuel has a home internet connection that is able to download data at a speed of 3·5 megabits per second. Samuel decides, instead, to download the movie in standard definition. The movie has a file size of 1·75 GB.

To the nearest minute, how much faster will Samuel be able to download the standard definition movie?

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Question 28 (continued)

(c) An examination consists of two sections.

Section I contains multiple choice questions, while Section II requires written responses. The results for each section are normally distributed with the measures shown in the table below.

	Mean	Standard Deviation
Section I	13·5	3·5
Section II	35·0	9·0

(i) What percentage of students scored more than 17 marks in Section I? 1

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(ii) Sarah claims that she performs better in written response sections than she does in multiple choice sections of examinations. 2

Her results for this examination were:

Section I 20

Section II 50

Comment on Sarah's claim, considering her results in this examination, and justify your statements with appropriate calculations.

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(d) A car is travelling at 90 km/h when the driver sees an obstacle 120 metres away on the road ahead. The conditions are fine and the breaking distance, d (in metres), can be calculated using the formula 3

$$d = 0 \cdot 01v^2$$

where v is the speed at which the vehicle is moving in km/h.

Assuming a reaction time of 2·5 seconds determine whether or not the vehicle will stop without hitting the obstacle.

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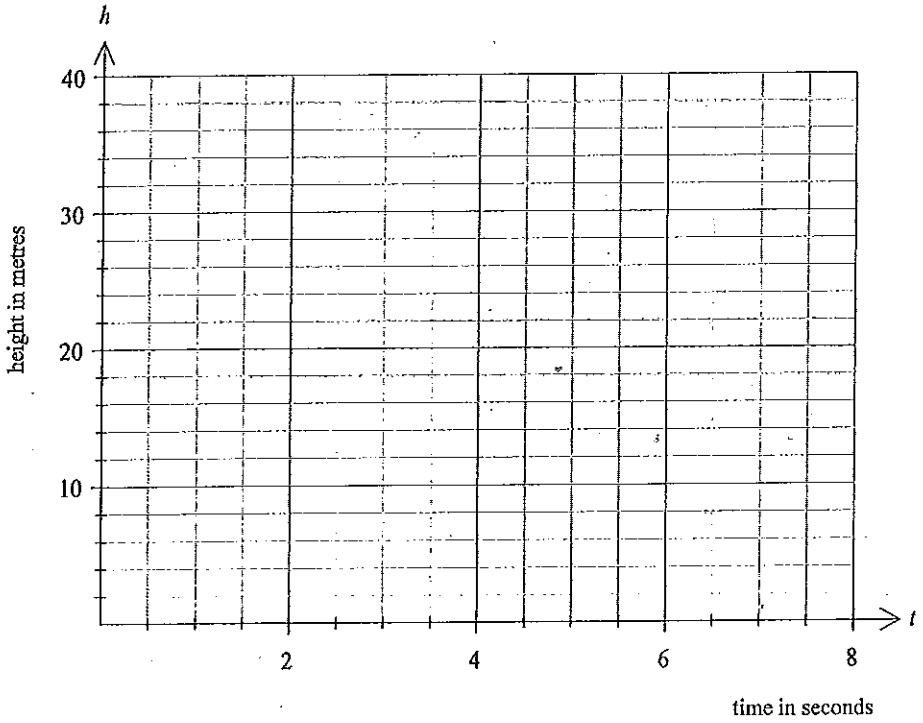
Question 28 (continued)

(e) A ball is thrown into the air from a height of 2 metres above the ground. The height (h), measured in metres, at any time t (in seconds) is modelled by the equation 3

$$h = 18t - 3t^2 + 2$$

By completing the table of values and graphing the path taken by the ball, determine the maximum height reached by the ball.

t	0	1	2	3	4	5	6
h	2	17					



Maximum height reached : .....

Centre Number

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Question 29 (15 marks)

(a) Solve simultaneously the equations: 2

$$2x + y = 11$$
$$3x - y = 9$$

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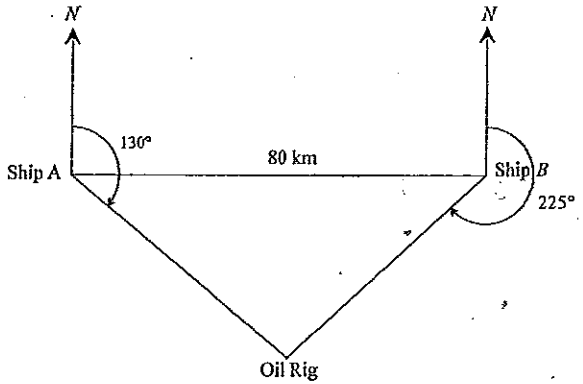
(b) Two ships are 80 km apart with Ship B due east of Ship A. From Ship B, the bearing of an oil rig is 225° and from Ship A the bearing is 130°. 3



Find the distance of the oil rig from Ship A.

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(c) Giovanna's father has promised her $10 000 to travel overseas when she graduates from university in 4 years. He invests a lump sum at 5% p.a. with interest compounded every six months. 2

How much is the lump sum that he must invest now in order to keep his promise?

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(d) A magician has altered four coins so that the outcome when each coin is tossed is biased. 3

If the four biased coins are tossed simultaneously then the probability of 0, 1, 2, 3 or 4 tails has been calculated and is shown in the second row of the table.

No. of tails	0	1	2	3	4
Probability with **biased** coins	$\frac{1}{16}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{8}$	$\frac{3}{16}$
Probability with **fair** coins	$\frac{1}{16}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{16}$

Compare the expected number of tails if the four biased coins and then four fair coins are tossed simultaneously.

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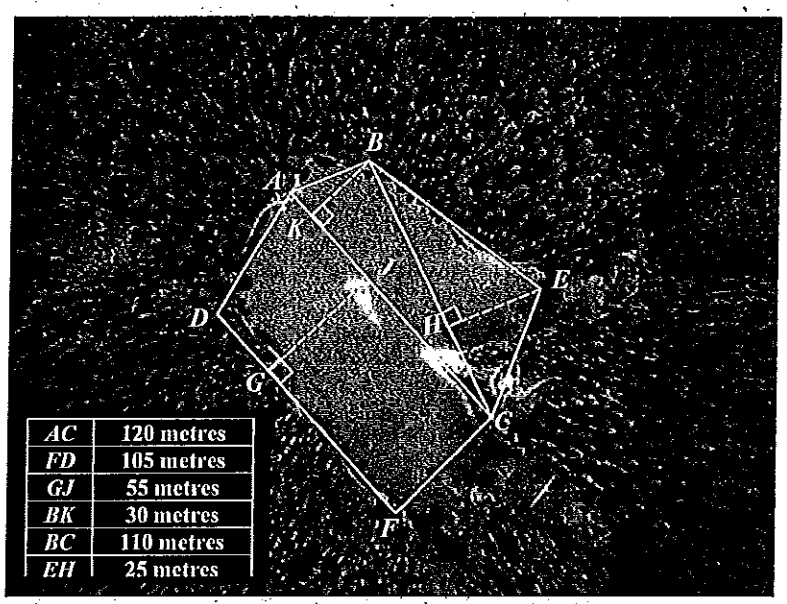
(e) The aerial photograph shows a lake that supplies water to a small town. 5
The measurements shown in the table were taken by a surveyor.



AC	120 metres
FD	105 metres
GJ	55 metres
BK	30 metres
BC	110 metres
EH	25 metres

A survey of the town found that the average water usage per household is 650 litres per day.
The town's population reside in 740 houses.
When full, the average depth of the lake is 3·6 metres.
If the lake was 80% full, and no further rain falls, how many days would the water in the lake sustain the town's water usage needs?

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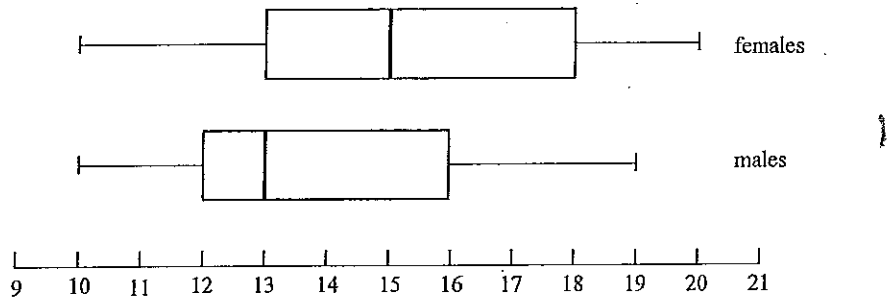
Centre Number

Student Number

Question 30 (15 marks)

(a) The times, in minutes, for male and female triathletes to complete an 800 metre swim are displayed in the plots below.



(i) There were 60 female swimmers in the event. 1

An equal number of male and female swimmers completed the course in 13 minutes or less.

What was the total number of male swimmers who completed the 800 metre swim?

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(ii) With reference to measures of location and spread, as well as the shape of the distributions, compare the results for male and female triathletes. 3

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Question 30 (continued)

(b) A flight leaves Sydney, Australia (34°S, 151°E) at 9:30 am on Monday and arrives in Vancouver, Canada (49°N, 123°W) at 6:30 am, local time, on the same day.

(i) What is the time difference between Sydney and Vancouver? 1

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(ii) What is the flight time from Sydney to Vancouver? 2

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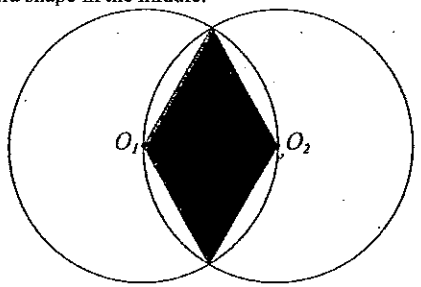
(c) Bill is making a new logo for his company. He is planning on designing a logo that is made from two circles with a diamond shape in the middle. 3



The centre of each circle lies on the circumference of the other.
Both circles have the same radius of 5 centimetres.

Find the area of the shaded section of the logo.

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Question 30 (continued)

(d) (i) Jack borrows \$12 500 at a variable interest rate and agrees to repay the loan in 36 monthly repayments of \$358·60. 1

How much is owing on the loan after one year?

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(ii) The table below shows the present value of each \$1 borrowed at various interest rates over different loan repayment periods.

Present value of \$1						
	Interest rate per month					
r	0·0038	0·0042	0·0046	0·0050	0·0054	0·0058
Period						
24	22·8966	22·7846	22·6734	22·5629	22·4531	22·3441
36	33·5866	33·3457	33·1072	32·8710	32·6372	32·4057
48	43·8010	43·3888	42·9819	42·5803	42·1839	41·7296
60	53·5610	52·9393	52·3275	51·7256	51·1332	50·5502
72	62·8866	62·0213	61·1274	60·3395	59·5224	58·7206

After one year, the interest rate on Jack's loan increases to 6·96% p.a. and the monthly repayments are recalculated on the balance owing at that time using the information in the table. 4

By calculating the total amount that Jack pays on his loan over 3 years, find the equivalent flat interest rate for his loan.

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CSSA

CATHOLIC SECONDARY SCHOOLS ASSOCIATION OF NSW
2017 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION
MATHEMATICS GENERAL 2

Section I
25 marks

Questions 1-25 (1 mark each)

Question	Answer	Content	Syllabus Assessed	Targeted Performance Bands
1	B	Types of data	DS1	2 – 3
2	D	Speed, distance, time	FSDr3	2 – 3
3	A	Right angle triangle trigonometry	MM5	2 – 3
4	D	Substitition into formula	AM1	2 – 3
5	B	Area chart – interpretation	FSRe3	2 – 3
6	B	Correlation	FSHe1	2 – 3
7	D	Area of an annulus	MM4	2 – 3
8	A	Five number summary	DS2	3 – 4
9	C	Wages – hourly rates of pay	FM1	3 – 4
10	D	Probability	PB2	3 – 4
11	D	Similar triangles	MM3	3 – 4
12	B	Stamp duty	FSDr1	3 – 4
13	A	Stem-and-leaf plot	DS4	3 – 4
14	D	Variation	MM1	4 – 5
15	C	Time payments	FM5	3 – 4
16	C	Volume of a pyramid	MM4	3 – 4
17	B	Mobile phone rates	FSCo1	3 – 4
18	A	Inverse variation	AM5	3 – 4
19	C	Credit card interest	FM4	4 – 5
20	B	Electricity costs	FSRe3	3 – 4
21	C	Rates – intravenous drip	FSHe2	4 – 5
22	C	Probability	PB1	4 – 5
23	A	Income tax table	FM3	5 – 6
24	A	Probability	PB1	4 – 5
25	B	Capture-recapture	DS6	5 – 6

Section II
Question 26

26(a) (1 mark)
Content: DS2
Outcomes assessed: MGP-1
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
Total age of 3 dogs = 3×6 = 18 Age of fourth dog = 26 – 18 = 8 years	1 mark for correct answer.	1

26(b) (1 mark)
Content: MM1
Outcomes assessed: MGP-1
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
Value of investment = 580 × 1·08 × 0·96 = $601·34	1 mark correct answer.	1

26(c) (2 marks)
Content: FSHe3
Outcomes assessed:MG2H-2
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
Magnus' life expectancy : 35 + 46·5 = 81·5 years Astrid's life expectancy : 30 + 55·1 = 85·1 years Difference in their life expectancies : 85·1 – 81·5 = 3·6 years	1 mark correctly calculating Astrid's life expectancy. 2 marks for correct solution.	2

26(d) (i) (1 mark)
Content: FM2
Outcomes assessed: MGP-6
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
Total cost : 3 000 × 3·40 + 3 000 × 0·025 = $10 275	1 mark correct answer.	1

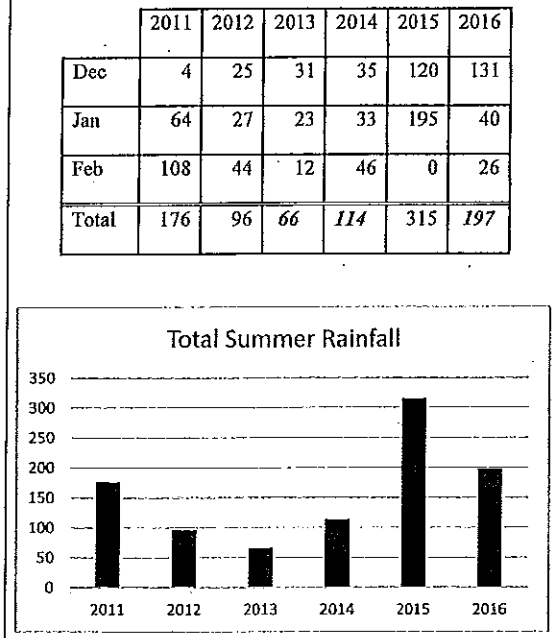
26(d) (ii) (1 mark)
Content: FM2
Outcomes assessed: MGP-6
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
Dividend yield = $\frac{0.40}{4.80} \times 100$ = $8\frac{1}{3}\%$	1 mark correct answer.	1

26(e) (1 mark)
Content: FSHe2
Outcomes assessed: MG2H-3
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
$4.8 = \frac{A \times 40}{150}$ A = 18 months	1 mark correct answer.	1

26(f) (2 marks)
Content: FSRe1
Outcomes assessed: MG2H-2
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
	1 mark correct values in table with some further progress in completing graph. or 1 mark partial correct completion of column graph with only one minor error. 2 marks correct completion of table and graph.	2

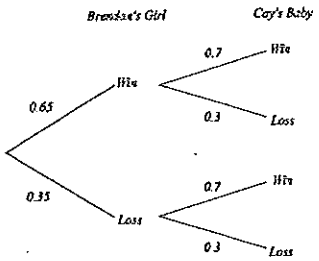
26(g)(i) (1 mark)
Content: MM2
Outcomes assessed: MGP-4
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
D 50 | C 55 | 30 | 0 | A 18 B	1 mark correct notebook entry.	1

26(g)(ii) (2 marks)
Content: MM2
Outcomes assessed: MGP-4
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
Length of boundary CD : $CD^2 = 50^2 + (30 + 25)^2$ $= 5\,525$ $CD = 74{\cdot}33034374$ $= 74{\cdot}33$ m (2 decimal places) Cost of fencing $= 74{\cdot}33034\ldots\ldots \times 25$ $= \$1\,858{\cdot}26$	1 mark calculating correct length CD. or 1 mark correct calculation of cost from incorrectly calculated value of CD. 2 marks correct solution.	2

26(h) (3 marks)
Content: PB2
Outcomes assessed: MG2H-8
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
 P(WL) or P(LW) $= 0{\cdot}65 \times 0{\cdot}3 + 0{\cdot}35 \times 0{\cdot}7$ $= 0{\cdot}44$	1 mark for correct probabilities listed on the tree diagram with little or no further progress. or 1 mark for either P(WL) or P(LW) correctly calculated. or 1 mark for calculating $1 - P(LL) = 0{\cdot}895$ 3 marks correct solution.	3

Question 27
27(a) (2 marks)
Content: DS4
Outcomes assessed: MG2H-2
Targeted Performance Bands: 2-3

Solution	Criteria	Marks
Percentage of male concession fares : $\frac{135}{200} \times 100 = 67{\cdot}5\%$	1 mark correctly identifying 135 male concession fares. 2 marks correct answer.	2

27(b) (2 marks)
Content: DS3
Outcomes assessed: MGP-10
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
Original mean : $(1 \times 1 + 2 \times 2 + 5 \times 3 + 4 \times 4 + 4 \times 5) \div 16 = 3{\cdot}5$ New mean : $(1 \times 1 + 4 \times 2 + 5 \times 3 + 3 \times 4 + 4 \times 5) \div 17 = 3{\cdot}29$ The mean age decreases from 3·5 to 3·29. Alternately, a statement that demonstrates that while the total of the ages remains the same, the number of students increases by 1. Therefore, the mean will decrease.	1 mark for correct calculation of either mean. 2 marks correct conclusion from sound calculations or reasoning.	1 2

27(c)(i) (1 mark)
Content: FSHe2
Outcomes assessed: MG2H-7
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
$gradient = \frac{r \times s_y}{s_x}$ $0{\cdot}60 = \frac{r \times 3{\cdot}6}{4{\cdot}9}$ $r = \frac{0{\cdot}60 \times 4{\cdot}9}{3{\cdot}6}$ $= 0{\cdot}81\dot{6}$ $= 0{\cdot}82$ as required.	1 mark correctly substituting to show the given value of r.	1

27(c)(ii) (2 marks)
Content: FSHe2
Outcomes assessed: MG2H-7
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
$y = gradient \times x + y - intercept$ $y - intercept = \bar{y} - (gradient \times \bar{x})$ $= 180{\cdot}9 - (0{\cdot}60 \times 88{\cdot}1)$ $= 128{\cdot}04$ Equation : $y = 0{\cdot}60x + 128{\cdot}04$	**1 mark** correct calculation of y-intercept. **2 marks** for correct equation.	2

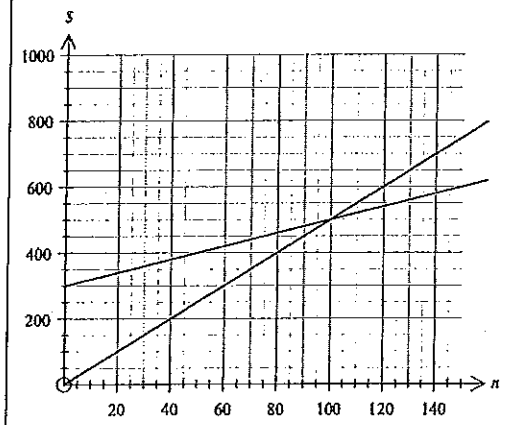
27(d) (3 marks)
Content: FM1
Outcomes assessed: MGP-6
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
Williams and Black : Total = \$650 + 0·022 × 760 000 = \$17 370 Johnson and Smythe : Total = \$580 + 0·024 × 500 000 + 0·16 × 260 000 = \$16 740 Difference : \$17 370 - \$16 740 = \$630	**1 mark** each for total costs associated with the two different companies. **2 marks** difference calculated from one incorrect and one correct total. **3 marks** correct solution with working.	3

27(e) (2 marks)
Content: FSRe1
Outcomes assessed: MG2H-1
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
Water cost : $27 \times 2{\cdot}00 = \$54$ Recycled water cost : $95 \times 1{\cdot}79 = \$170{\cdot}05$ Stormwater drainage charge : $\$427{\cdot}79 - (22{\cdot}48 + 145{\cdot}90 + 54{\cdot}00 + 170{\cdot}05) = \$35{\cdot}36$	**1 mark** correct calculation of water and recycled water costs. **2 marks** correct solution.	2

27(f)(i) (2 marks)
Content: AM4
Outcomes assessed: MG2H-3
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
 Number of boxes to cover cost : 100 boxes	**1 mark** correct line drawn on the graph. **1 mark** for correct answer from incorrect line drawn. **2 marks** correct solution from graph or algebraically.	2

27(f)(ii) (1 mark)
Content: AM4
Outcomes assessed: MG2H-3
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
From graph : Profit = \$750 - \$600 = \$150	**1 mark** correct answer read from graph or calculated algebraically.	1

Question 28

28(a) (3 marks)

Content: MM4

Outcomes assessed: MG2H-4

Targeted Performance Bands: 3-4

Solution	Criteria	Marks
$A \approx \frac{h}{3}[d_f + 4d_m + d_l]$ $A \approx \frac{4 \cdot 5}{3}[0 + 4 \times 11 + 9]$ $= 79{\cdot}5\ \text{m}^2$ Total area of pool surface $= 2 \times 79{\cdot}5$ $= 159\ \text{m}^2$. Volume $= A \times h$ $= 159 \times 2{\cdot}3$ $= 365{\cdot}7\ \text{m}^3$	**1 mark** for one correct application of Simpson's rule. or **1 mark** for any area multiplied by pool depth to generate volume. **2 marks** correct area ($159\ \text{m}^2$). **3 marks** correct solution.	**3**

28(b) (3 marks)

Content: FSCo2

Outcomes assessed: MGP-1

Targeted Performance Bands: 4-5

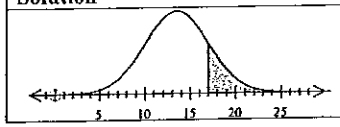
Solution	Criteria	Marks
$1 \cdot 75\ \text{GB} = \frac{1 \cdot 75 \times 1024^3 \times 8}{1000^2}$ Time to download in standard definition. $= \frac{1 \cdot 75 \times 1024^3 \times 8}{1000^2 \times 3 \cdot 5}$ $= 4294 \cdot 967296$ seconds $= \frac{4294 \cdot 967296}{60 \times 60}$ $= 1{\cdot}193046471$ hours 1 hour and 12 minutes. Difference in time between HD and SD : 2 hours and 35 minutes – 1 hour and 12 minutes = 1 hour and 23 minutes.	**1 mark** correctly changing GB to Mb. **2 marks** calculating the time in seconds, minutes or hours. **3 marks** correctly converting time to hours and stating the time difference.	**3**

28(c)(i) (1 mark)

Content: DS5

Outcomes assessed: MG2H-7

Targeted Performance Bands: 3-4

Solution	Criteria	Marks
 17 is one standard deviation above the mean. ½ (100 – 68) = 16%	**1 mark** correct answer.	**1**

28(c)(ii) (2 marks)

Content: DS5

Outcomes assessed: MG2H-7, MG2H-10

Targeted Performance Bands: 3-4

Solution	Criteria	Marks
Section I : z-score $\frac{20 - 13 \cdot 5}{3 \cdot 5} = 1 \cdot 857\ (3dp)$ Section II : z-score $\frac{50 - 35}{9} = 1 \cdot 666\ (3dp)$ Sarah has performed better in Section I where her z score is higher. Therefore, her claim is not justified.	**1 mark** correct calculation of z-scores with incorrect conclusion. or **1 mark** for correct conclusion from two incorrect z-scores. **2 marks** correct calculation of both z-scores with correct conclusion.	**2**

28(d) (3 marks)

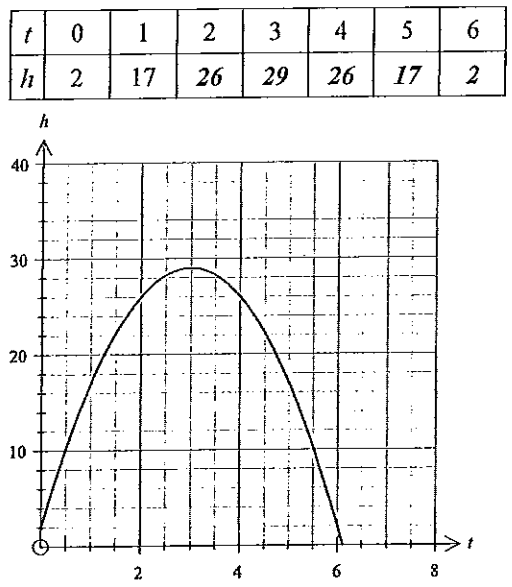
Content: FSDr3

Outcomes assessed: MGP-3

Targeted Performance Bands: 4-5

Solution	Criteria	Marks
Braking distance : $d = 0 \cdot 01 \times 90^2$ $= 81\ \text{m}$ Reaction distance : $\frac{90 \times 1000}{60 \times 60} \times 2 \cdot 5 = 62 \cdot 5\ \text{m}$ Stopping distance $= 81 + 62{\cdot}5$ $= 143{\cdot}5$ metres The vehicle will not be able to stop in time to avoid the obstacle.	**1 mark** correct calculation of the braking distance. **1 mark** correct calculation of the reaction distance. **2 marks** correct calculation of appropriate distances with no conclusion stated. **3 marks** correct conclusion supported be calculations of braking distance, reaction distance and stopping distance.	**3**

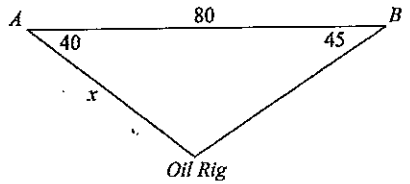
28(e) (3 marks)
Content: AM5
Outcomes assessed: MG2H-3
Targeted Performance Bands: 4-5

Solution	Criteria	Marks
 Maximum height : 29 metres	**1 mark** correct values shown in the table. ***or*** **1 mark** graphing values from table. ***or*** **1 mark** maximum height from incorrect values/graph. **2 marks** correct table and graph but no/incorrect maximum height. **3 marks** correct solution including table of values and graph.	3

Question 29
29(a) (2 marks)
Content: AM3
Outcomes assessed: MGP-3
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
$2x + y = 11$ $3x - y = 9$ $5x = 20 \therefore x = 4$ $2 \times 4 + y = 11$ $8 + y = 11$ $y = 3$	**1 mark** for 1 correct value of either x or y. ***or*** **1 mark** for correct value of x or y from incorrect value of x or y. **2 marks** correct solution.	2

29(b) (3 marks)
Content: MM5
Outcomes assessed: MG2H-4
Targeted Performance Bands: 4-5

Solution	Criteria	Marks
 $\angle AOB = 180° - (40° + 45°)$ $\frac{x}{\sin 45°} = \frac{80}{\sin 95°}$ $x = \frac{80 \sin 45°}{\sin 95°}$ $x = 56 \cdot 78462514$ Ship A is 56·78 km from the Oil Rig (to 2 decimal places)	**1 mark** for indicating correct angles of 40° and 45° on the diagram. or **1 mark** for a correct value of $\angle AOB$ from other incorrect angles. **2 marks** for correct substitution of angles from the diagram into the sine rule. **3 marks** for correct solution with appropriate working.	3

29(c) (2 marks)
Content: FM4
Outcomes assessed: MG2H-6
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
$FV = \$10\,000$ $r = 0{\cdot}025$ for 6 months $n = 8$ $PV = \frac{FV}{(1+r)^n}$ $PV = \frac{10\,000}{(1+0.025)^8}$ He needs to invest \$8 207·47	**1 mark** correctly converting r and n to compound six monthly. ***or*** **1 mark** for present value calculation using 5% and 4 years, leading to \$8 227·02. **2 marks** correct solution.	2

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29(d) (3 marks)
Content: PB2
Outcomes assessed: MG2H-8
Targeted Performance Bands: 5-6

Solution	Criteria	Marks
Expected number of tails using the biased coin : $\frac{1}{16}\times 0+\frac{1}{4}\times 1+\frac{3}{8}\times 2+\frac{1}{8}\times 3+\frac{3}{16}\times 4 = 2{\cdot}125$ Expected number of tails using the fair coin : $\frac{1}{16}\times 0+\frac{1}{4}\times 1+\frac{3}{8}\times 2+\frac{1}{4}\times 3+\frac{1}{16}\times 4 = 2$ When using the biased coin, the expected number of tails is 2·125 compared to 2 tails with the fair coin.	**1 mark** for either expected number of tails. **2 marks** for two correct expected values. **3 marks** for correct expected values and comparative statement.	3

29(e) (5 marks)
Content: FSRe2
Outcomes assessed: MG2H-4
Targeted Performance Bands: 5-6

Solution	Criteria	Marks
Area of lake : $\Delta ABC = \frac{1}{2}\times 120\times 30$ $= 1\,800\ m^2$ $\Delta BEC = \frac{1}{2}\times 110\times 25$ $= 1\,375\ m^2$ trapezium $ACFD = \frac{1}{2}\times 55\times (120+105)$ $= 6\,187{\cdot}5\ m^2$ Total area = $9\,362{\cdot}5\ m^2$ Volume of water in the lake when full: Vol = $9\,362{\cdot}5\times 3{\cdot}6$ $= 33\,705\ m^3$ 80% of volume = $0{\cdot}8\times 33\,705$ $= 26\,964\ m^3$ $26\,784\ m^3 = 26\,964\ 000$ L Total daily usage = 650×740 $= 481\,000$ L Number of days = $26\,964\,000 \div 481\,000$ ≈ 56 days	*Throughout this question, award marks for errors that are carried forward and used correctly.* **1 mark** correct calculation of lake area. **1 mark** for correct calculation of volume when full in any units. **1 mark** for finding 80% of volume. **1 mark** for finding total daily usage **1 mark** for number of days.	5

Question 30
30(a)(i) (1 mark)
Content: DS4
Outcomes assessed: MG2H-7
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
25% of female swimmers completed the course in 13 minutes of less. 25 % of 60 = 15 swimmers. 50 % of male swimmers completed the course in 13 minutes of less. 50% is 15 swimmers, therefore there are 30 males.	**1 mark** for correct answer.	1

30(a)(ii) (3 marks)
Content: DS4
Outcomes assessed: MG2H-7
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
The median time for female swimmers is 15 which is higher than the median time for males swimmers which is 13. The IQR of the times for females is 5 compared with 4 for the males indicating a greater spread of times for females. *(range could also be used)* The distribution for females is close to symmetrical but the distribution for males is positively skewed.	**1 mark** for comparison of medians. **1 mark** for comparison of spread (range or IQR). **1 mark** for correct descriptions of the shape of both distributions.	3

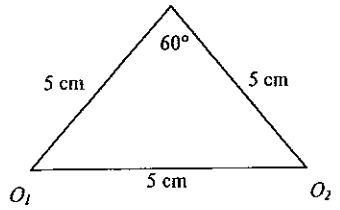
30(b)(i) (1 marks)
Content: MM6
Outcomes assessed: MG2H-5
Targeted Performance Bands: 3-4

Solution	Criteria	Marks
Difference in longitude 123° + 151° = 274° Time difference = 274 × 4 minutes = 1 096 minutes = 18 hours and 16 minutes.	**1 mark** for correct answer.	1

30(b)(ii) (2 marks)
Content: MM6
Outcomes assessed: MG2H-5
Targeted Performance Bands: 5-6

Solution	Criteria	Marks
At 9.30am on Monday in Sydney, the time in Vancouver is 3.14pm on Sunday. Flight time : from 3.14pm Sunday to 6.30 am Monday is 15 hours and 16 minutes.	**1 mark** for progress towards correct flight time. **2 marks** for correct solution.	2

30(c) (3 marks)
Content: MM2
Outcomes assessed: MG2H-4
Targeted Performance Bands: 5-6

Solution	Criteria	Marks
Distance from O_1 to O_2 is 5 cm.  Area = ½ × 5 × 5 × sin 60° = 10·82531755 Shaded area = 2 × area of the triangle. = 2 × 10·82531755 = 21·65063509 Shaded area is 21·65 cm^2 (to 2 decimal places)	**1 mark** for correctly identifying equilateral triangle and marking sides and angles. **2 marks** finding area of one triangle or equivalent. **3 marks** for correct solution.	3

30(d)(i) (1 mark)

Content: FM5
Outcomes assessed: MG2H-6
Targeted Performance Bands: 5-6

Solution	Criteria	Marks
Balance after one year = 12 500 - 358·60 × 12 = $8 196·80	1 mark for correct answer.	1

30(d)(ii) (4 marks)
Content:FM5
Outcomes assessed: MG2H-6
Targeted Performance Bands: 5-6

Solution	Criteria	Marks
6·96% pa = 0·0058, n = 24 Monthly payment = 8 196·80 ÷ 22·3441 = $366·84 Total repaid = 366·84 × 24 + 358·60 × 12 = $13 107·36 Interest paid = $13 107·36 – 12 500 = $607·36 $607·36 = $12 500 × r × 3 r = 0·01619626667 Flat rate is 1·6% (to 1 decimal place)	*Throughout this questions, award marks for errors that are carried forward and used correctly.* **1 mark** for changing interest rate and time period to find 22·3441 from the table. **1 mark** calculating the monthly repayment. **1 mark** for calculating the total repaid. **1 mark** finding flat interest rate. **4 marks** correct solution.	4