WESTERN REGION

2014

TRIAL
HIGHER SCHOOL CERTIFICATE
EXAMINATION

Mathematics General 2

- General Instructions
- Reading time – 5 minutes
- Working time – $2\frac{1}{2}$ hours
- Write using black or blue pen
  Black pen is preferred
- Board-approved calculators may be used
- A formulae and data sheet is provided at the back of this paper
- In Questions 26 – 30, show relevant mathematical reasoning and/or calculations

Total Marks – 100

Section I │ Pages 2 – 11

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

Section II │ Pages 12 – 35

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.

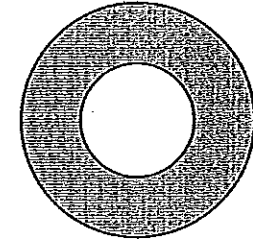Use the multiple-choice answer sheet for Questions 1 – 25.

1. Which formula could be used to find the shaded area below?

   (A) $A = \frac{1}{2}ab \sin C$

   (B) $A = \frac{h}{2}(a + b)$

   (C) $A = \pi(R^2 - r^2)$

   (D) $A = \frac{\theta}{360}\pi r^2$

2. Mason borrows $10 000 at 6% pa to buy a car and chooses to repay it in monthly repayments over 5 years.

   Use the table below to find how much will he will pay for the car altogether.

   Monthly Repayments on a loan of $10 000
   Time (years)

		2	3	4	5	6	7	8
	4	$434.25	$295.24	$225.79	$184.17	$156.45	$136.69	$121.89
Rate	5	$438.71	$299.71	$230.29	$188.71	$161.05	$141.34	$126.60
(%	6	$443.21	$304.22	$234.85	$193.33	$165.73	$146.09	$131.41
pa)	7	$447.73	$308.77	$239.46	$198.01	$170.49	$150.93	$136.34
	8	$452.27	$313.36	$244.13	$202.76	$175.33	$155.86	$141.37

   (A) $193.33

   (B) $966.65

   (C) $1599.80

   (D) $11599.80

3. Mohsen has three spare tickets to an opera performance. He texts the ten friends on his phone who like opera and offers a ticket each to the first three who text him back. How many different combinations of three friends could get the tickets?

(A) 120

(B) 240

(C) 360

(D) 720

4. Josh researches the life expectancy at birth and the infant mortality rate for a number of countries. He then draws a scatterplot with a line of best fit.

What is the likely correlation coefficient for this data?

(A) − 0.95

(B) − 0.59

(C) 0.59

(D) 0.95

Life Expectancy at Birth (years)
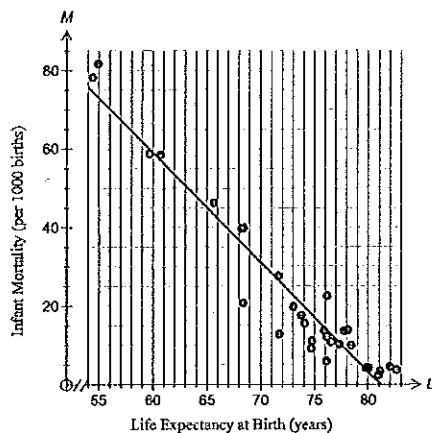
5. Austin has a laptop which has an internal hard drive with a capacity of 1280 megabytes.

He buys an external hard drive with capacity of 12.5 gigabytes to back up his laptop.

Which is true?

(A) The external drive does not have enough capacity to back up his laptop.

(B) The external drive has twice the capacity needed to back up his laptop.

(C) The external drive has five times the capacity needed to back up his laptop.

(D) The external drive has ten times the capacity needed to back up his laptop.

6. Ashleigh has a credit card which charges 18.5% pa simple interest calculated daily, which is debited to the card on the last day of each month. She had $2 500 owing on her credit card on the 30th June after the interest was debited. She decides to pay off the total owing on the card before she makes any further purchases. She pays $1 200 off the card on 30th June and pays off the remaining balance including interest on the 31st July.

How much was paid on 31st July?

(A) $1 320.43

(B) $1 338.54

(C) $1540.50

(D) $3 342.60

7. Expand and simplify the expression $3ab - 3a(2a - 4b) - a^2$.

(A) $5a^2 - 9ab$.

(B) $7a^2 - 15ab$.

(C) $9ab - 5a^2$.

(D) $15ab - 7a^2$.

8. A group of 120 workers took a competency test in welding and their results were normally distributed. The mean score of the group was 90% with a standard deviation of 5%.

Kevin scored 80% on the test. What is this as a z-score?

(A) -2

(B) -1

(C) 1

(D) 2

9. Over a month, Juliette records the number of minutes she spends on exercise each day.

The data is displayed in the stem and leaf plot.

Minutes of Exercise per Day

1	5	8	8	9	
2	2	4	6	8	8
3	2	3	4	6	6	9
4	1	3	6	7	8
5	0	3	5	7	
6	3	6	9	9	
7	3	4	5		

What is the interquartile range of the data?

(A) 28

(B) 29

(C) 41

(D) 57

10. Courtney shades on her calendar, the days on which it rained. Her results are typical of January and July rainfall for the last ten years.

January						
M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

July						
M	T	W	T	F	S	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Which statement could not be made for the future, based on the results?

(A) It is less likely to rain in January than July.

(B) The probability of rain on a weekend in January is zero.

(C) The probability of rain lasting several days is greater in July than in January.

(D) It is twice as likely to rain on any given day in July than in January

11. Given the formula : $B = 2\pi\left(R + \dfrac{T}{2}\right) \times \dfrac{A}{360}$

What is the value of A, when $R = 20$, $T = 30$ and $B = 55$.

(A) $A = 0.5$

(B) $A = 5.0$

(C) $A = 45.0$

(D) $A = 90.0$

12. A flagpole casts a 6.4 m shadow. At the same time a 2.0 m tall fence post casts a shadow which is 1.6 m long.

How tall is the flagpole?

(A) 8.0 m

(B) 9.6 m

(C) 16.0 m

(D) 32.0 m

2.0 m

6.4 m   1.6 m
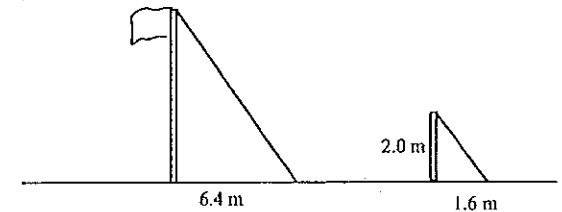
13. The radar chart shows the number of guests each month at a mountain resort.

How many months had fewer guests than in May?

(A) 5 months

(B) 6 months

(C) 7 months

(D) 8 months

14. Adi buys a new heater which is rated at 2 000 watts. He uses it on 120 days of the year for an average of 8 hours per day. Electricity costs are $0.30 per kilowatt hour.

What would the heater cost to run for the year?

(A) $7.20

(B) $57.60

(C) $72.00

(D) $576.00

15. Handicloth is a brand of kitchen cloth which is sold in various sizes and has been tested to absorb liquid at a rate of 5 L/m². How much liquid could a 30 cm square Handicloth absorb?
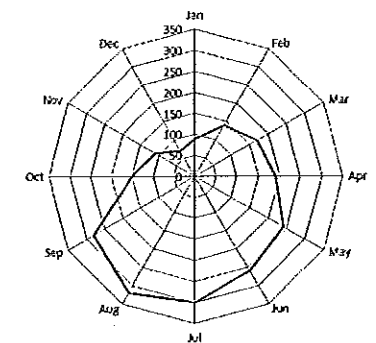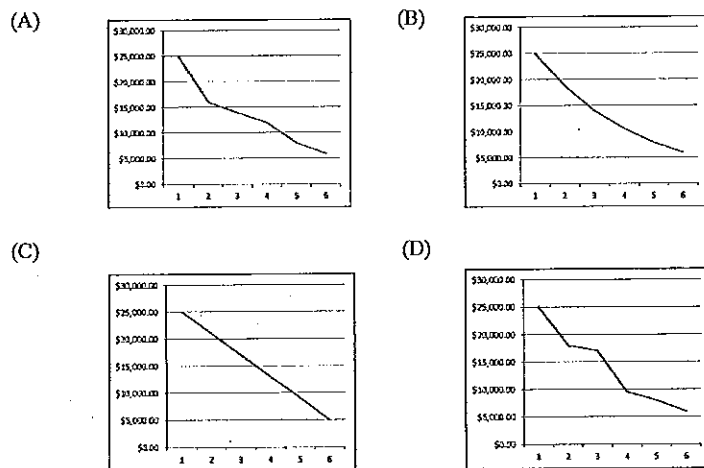
(A) 45 mL

(B) 450 mL

(C) 4.5 L

(D) 45 L

16. Caleb is investigating the different forms of depreciation of a vehicle. He collects the depreciation tables from four car dealers and graphs the value of a car initially valued at $25 000 over 5 years under each table.

Which graph shows that a declining balance method of depreciation was used?

(A)

(B)

(C)

(D)

17. A plane flies due north from Kensington (K) for 230 km to Wishire(W). It then turns and flies due east for a distance of 320 km to Trenton (T). What is the bearing of Kensington from Trenton?
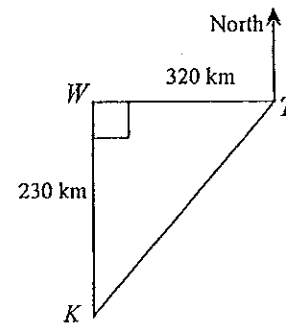
(A) 036°

(B) 216

(C) 234°

(D) 306°

18. On the 1ˢᵗ January 2012 Rebecca invested $1 450 in an account which pays 12% pa interest, compounded quarterly. On the 1ˢᵗ January 2013 she added a further $1 280 to the account. How much has she in the account on the 1ˢᵗ January 2014?

(A) $3252.48

(B) $2 911.99

(C) $3 277.47

(D) $5 604.25

19. Nola's car has a fuel consumption rate of 15 litres/100 km on city roads and 10 litres/100 km on the open highway.

How much fuel will she use in a trip which has 50 km of city driving and 250 km of driving on the open highway?

(A) 7.5 litres.

(B) 25.0 litres.

(C) 32.5 litres.

(D) 50.0 litres.

20. Lily and Ethan start paying off a home loan for $250 000 with an initial interest rate of 6% pa, calculated monthly. Lily creates a spreadsheet to keep track of their balance. She entered all interest rate changes and any changes they made to their repayment amount when they occurred.

	A	B	C	D	E	F
1						
2			Balance Start		Balance Start	
3	Date	Repayment	Month	Interest	Month	
4	Jan-14	$1,600.00	$250,000.00	$1,250.00	$249,650.00	
5	Feb-14	$1,600.00	$249,650.00	$1,248.25	$249,298.25	
6	Mar-14	$1,600.00	$249,298.25	$1,246.49	$248,944.74	
7	Apr-14	$1,600.00	$248,944.74	$1,244.72	$248,589.46	
8	May-14	$2,000.00	$248,589.46	$1,242.95	$247,832.41	
9	Jun-14	$2,000.00	$247,832.41	$1,342.43	$247,174.84	
10	Jul-14	$2,000.00	$247,174.84	$1,338.86	$246,513.70	
11	Aug-14	$2,000.00	$246,513.70	$1,335.28	$245,848.98	
12						
13						

Sheet1 / Sheet2 / Sheet3

In which month and by how much did the interest rate change?

(A) It decreased by 1.0% pa in May.

(B) It increased by 0.5% pa in June.

(C) It increased by 1.0% pa in June.

(D) It increased by 0.5% pa in July.

21. Harry is working as a nurse on a children's ward. He uses Young's formula to calculate an 8 year old child's dose of Adamine.

Young's Formula : Dosage for child 1-12 $= \dfrac{\text{age of child (in years)} \times \text{adult dose}}{\text{age of child (in years)} + 12}$

Given the adult dosage of Adamine is 15 mL, what is the child's dose?

(A) 1.5 mL

(B) 3 mL

(C) 6 mL

(D) 12 mL

22. Leo boards a plane in London at 6 pm on Wednesday 10th September and flies for 22 hours before arriving in Sydney. Given that Sydney's time zone is ten hours ahead of London's, what is the local time when he disembarks in Sydney?

(A) 6:00am on Friday the 12th Sept.

(B) 2:00am on Friday the 12th Sept.

(C) 6:00am on Thursday the 11th Sept.

(D) 2:00am on Thursday the 11th Sept.

23. A water delivery truck has a cylindrical tank with the dimensions shown, on a trailer.
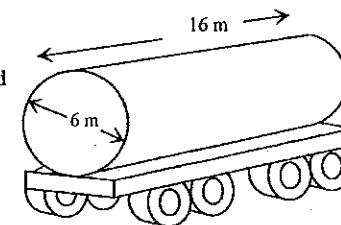
How many 150 kilolitre house tanks could be filled by the tank on the trailer?

(A) 3 tanks

(B) 6 tanks

(C) 9 tanks

(D) 30 tanks

24. Which equation describes the relationship between the two variables a and b.

(A) $b = 2a + 3$

(B) $b = 3a + 2$

(C) $b = 6a + 3$

(D) $b = 6a + 15$
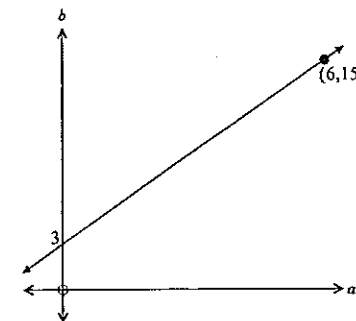
25. Lauren holds a survey of the residents of her block of units. She recorded some of the results in the two way table below.

	Male	Female	Total
Problems to report.	16	24	
No Problems to report.	35	25	
Total			

If a female resident were chosen at random, what is the probability that she had no problems?

(A) $\frac{6}{25}$

(B) $\frac{1}{4}$

(C) $\frac{24}{49}$

(D) $\frac{25}{49}$

Mathematics General 2

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 37. If you use this space, clearly indicate which question you are answering.

Class and Teacher

Student Number

Student Name

Please turn over

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Question 26 (15 marks)

(a)   The container for water in Kate's aviary is in the shape of a half cylinder as shown. Kate measures the dimensions of the container using a ruler marked in half centimetre divisions.
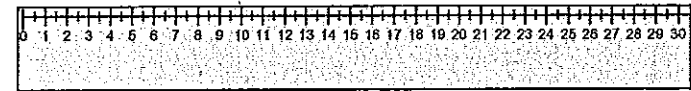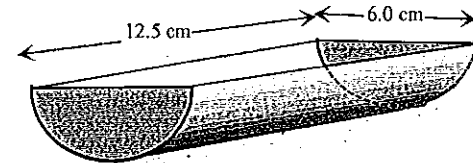
(i)   What is the percentage error in her measurement of the length (12.5 cm)?   1

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(ii)   What is the capacity of the container in mL?   1
        (1 cm^3 contains 1 mL)

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(b) (i) Ella measures her mass as being 45 kg.
On Saturday night she had 4 standard drinks
in 2½ hours.
Show that her BAC was more than 0.08
after her last drink.

1

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(ii) When her BAC is greater than 0.08, Ella's reaction times increase by 20%.
When unaffected by alcohol, her reaction time in a braking test was 0.9 seconds.
What would her reaction time have been on the braking test after drinking on
Saturday night?

1

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(iii) If she were driving a car travelling at 25 m/s, how many further metres would the
car have travelled because of her slower reaction time?

1

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(c) (i) Chelsea works in a used car yard, where she spends some time doing clerical work
and when needed, she acts as a salesperson. She is paid $19.50 per hour for the
time she spends working at the car yard plus a commission of 4% of any sales that
she generates. Last week she worked for 35 hours and generated sales to the value
of $16 000.

2

What was her gross pay last week?

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(ii) Last financial year Chelsea earned a taxable income of $68770. Use the table
below to calculate the income tax due for the year.

1

Taxable income	Tax on this income
0 – $18,200	Nil
$18,201 – $37,000	19c for each $1 over $18,200
$37,001 – $80,000	$3,572 plus 32.5c for each $1 over $37,000
$80,001 – $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

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(d) Barbara conducts a survey on the driving experience of the 52 Year 12 students at her school. She begins to design a questionnaire to collect her data.

1. Do you have a drivers licence?

   Yes ◯ No ◯

2. If yes, how many times did you need to take your test to get your licence?

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3. What car do you drive?

   Own ◯   Parents ◯   Siblings ◯   Other ◯

4. How heavy is the car that you regularly drive?

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(i) Would you suggest that she collect her data through a census or a sample? Explain why.   **1**

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(ii) Describe what is meant by quantitative discrete data and illustrate it with one of the questions above.   **1**

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(e) David records the duration of his phone calls (in minutes) over a day. The results are shown on the dot plot.

Call Duration (minutes).
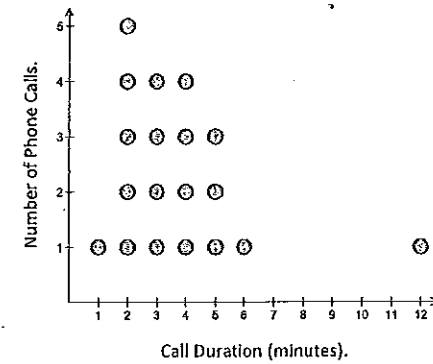
(i) What was the interquartile range of David's calls?   **1**

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(ii) Was David's twelve minute call an outlier? Justify your answer with a calculation.   **1**

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(f) Jasmine has signed up to the Basic Plan' mobile phone plan shown.

> **Basic Plan**
>
> **Monthly cost of plan: $ 50.00**
>
> This includes $150 worth of calls and messages and 2 GB of data.
>
> **Voice Calls:** 90 cents per minute plus 40 cents connection fee.
>
> **Text picture and video:** 5 cents per standard text message, 50 cents for picture message and 75 cents for video messages.
>
> **Excess data:** 10 cents / MB.

Last month Jasmine made 100 calls with an average time of 1.5 minutes, she sent 300 standard text messages, 30 picture texts and 6 video texts. She used 2.5 GB of data.   1

   (i)   How many MB of excess data usage did Jasmine have last month?

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   (ii)   What would Jasmine pay altogether for her mobile usage last month?   2

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End of Question 26

Question 27 (15 marks)

(a) Amapá City in Brazil and Kampala in Uganda are both on the equator, with longitude 51°W and 33°E respectively.

   (i)   What is the shortest distance around the earth's surface between the two cities, correct to 2 significant figures?   2

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   (ii)   A plane flies from Kampala to Amapá City taking 11 hours and 45 min. What was the average speed of the plane?   1

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(b) A freshwater lake contains mainly herrings and catfish. To estimate their numbers, a trawl was done of the lake which produced 54 herring and 20 catfish. These were all tagged and released and a month later, another trawl was done which netted 60 herrings, of which 3 were tagged and 30 catfish of which 3 were tagged. How many of the two species would you estimate were in the lake?   2

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(c) Dustin's tablet has a download speed of 125 kilobits per second. How many minutes would it take him to download 12 songs with an average size of 2.5 megabytes? (to the nearest half minute)   2
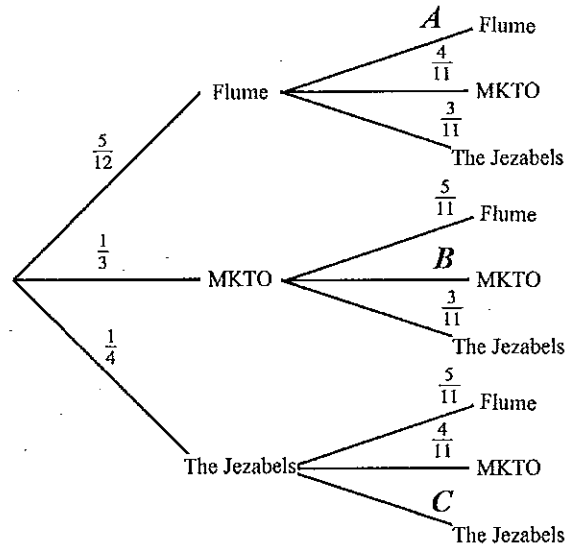
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(d) Jason downloads 12 songs to his digital player. Five of them are by Flume, four by MKTO and three by the Jezabels. He plays two tracks randomly from those he downloaded. A probability tree has been started for which artists are played.

(i) What probabilities should be written at positions A, B and C? 1

(ii) What is the probability that both tracks are by the same artist? 1

(iii) What is the probability that the two tracks are by different artists? 1
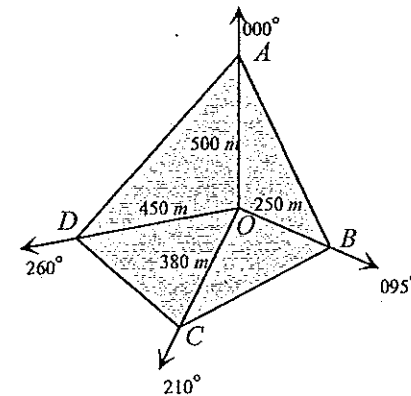
(e) Solve the equation: $3y - 1 = 3(3 - y) + 5$. 2

(f) Ryan completes a radial survey of a field $ABCD$, from a central point O. The measurements that he takes are shown on the diagram below.

(i) Calculate the area (in hectares) of the triangular section AOB. 2

(ii) Calculate the length of the boundary BC. 1
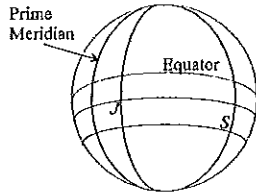
End of Question 27

Question 28 (15 marks)

(a) Sydney (S) is located at 34° S, 151° E and Johannesburg (J) is at 26° S, 28° E.

(i) The Wallabies rugby team are playing a game which starts at 6 pm on Saturday   2
in Johannesburg. What is the local time in Sydney when the game starts?

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(ii) The Wallabies fly out of Johannesburg at 10:00 am local time on Sunday on a   1
non-stop flight and arrive in Sydney at 5:28 am on Monday, Sydney time. How
long was the flight?

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(b) A microdrip IV pump which delivers 60 drops/mL is used to administer medications and
fluids. It requires a drip rate in drops per minute (dpm) to be set.
The formula below is used to calculate the drip rate.

$$\text{Drip rate} = \frac{\text{volume(mL)} \times \text{drops/mL}}{\text{time in minutes}}$$

(i) A patient requires 1200 mL of fluid to be given intravenously over 10 hours.   1
Calculate the drip rate?

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(ii) Jason is working on a ward and notices the drip rate on a patient's microdrip IV is   2
set to 75 dpm. The IV has a volume of 900 mL.

How long should this IV run?

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(c) Amy has a farm dam to supply water for her stock. The equally spaced cross sectional areas of the dam are shown below.
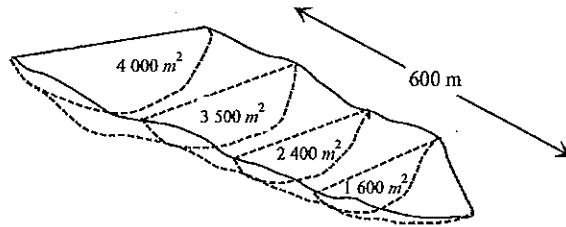
(i) Use Simpson's rule twice, find the approximate volume of the dam. **2**

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(ii) Amy removes 2500 kilolitres of water each day to fill stock troughs and she estimates that a further 1 500 kilolitres evaporates on average each day. **1**

From full, how long would the water in the dam last during a drought with no rain to top it up?

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(d) James pays $8 to play a game in which he throws three dice. He is paid $16 for each die that shows a 6. **3**

The probability that all three dice show a six is $\frac{1}{216}$.

The probability that two of the three dice show a six is $\frac{15}{216}$.

The probability that only one of the three dice show a six is $\frac{75}{216}$.

The probability that none of the three dice show a six is $\frac{125}{216}$.

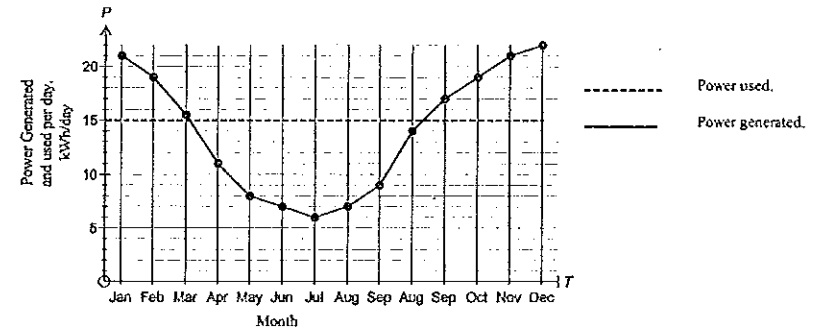What is the financial expectation of this game?

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(e) Emma and Liam have a solar array installed on their home. Depending on the time of year, it generates differing amounts of power, as illustrated by the graph.

(i) Based on the graph, how many kWh would be generated during the month of April? **1**

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(ii) Emma and Liam's average daily usage of power was 15 kWh/day, as indicated by the horizontal line on the graph. For how many months of the year were they generating more electricity than they used? **1**

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(iii) In the months where they generated more than they used, they were paid 20 cents per kilowatt hour for the excess power, which was fed back into the grid. How much would they receive in total for the excess electricity generated during January? **1**
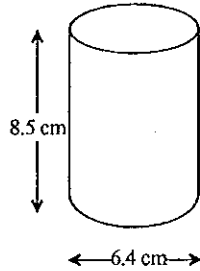
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End of Question 28

Question 29 (15 marks)

(a) A machine on a production line produces solid metal cylindrical parts. The design specifies a diameter of 6.4 cm and a height of 8.5 cm.

8.5 cm

←—6.4 cm—→

(i) Calculate the surface area of the cylinder. 1

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(ii) In practice the cylinders which come off the production line have diameters which 2
are normally distributed with a mean of 6.3 cm and a standard deviation of
0.05 cm. Any cylinder with a diameter greater than 6.4 cm or less than 6.25 cm
must be rejected. What percentage of the cylinders are rejected?

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(b) The table shows present value interest factors for some monthly interest rates (r) and loan terms in months (N).

Monthly Interest Rate (r)

Term in months (N)	0.0040	0.0045	0.0050	0.0055	0.0060	0.0065	0.0070
106	86.2556	84.1540	82.1234	80.1612	78.2645	76.4310	74.6581
107	86.9080	84.7725	82.7099	80.7172	78.7918	76.9309	75.1322
108	87.5577	85.3883	83.2934	81.2702	79.3159	77.4277	75.6030
109	88.2049	86.0013	83.8741	81.8202	79.8369	77.9212	76.0705
110	88.8495	86.6115	84.4518	82.3672	80.3547	78.4115	76.5347
111	89.4916	87.2190	85.0267	82.9112	80.8695	78.8987	76.9958
112	90.1310	87.8238	85.5987	83.4522	81.3812	79.3827	77.4536
113	90.7680	88.4259	86.1678	83.9903	81.8899	79.8636	77.9082
114	91.4023	89.0253	86.7342	84.5254	82.3955	80.3413	78.3597
115	92.0342	89.6220	87.2977	85.0576	82.8981	80.8160	78.8081
116	92.6636	90.2160	87.8584	85.5868	83.3977	81.2877	79.2533
117	93.2904	90.8074	88.4163	86.1132	83.8944	81.7562	79.6954
118	93.9147	91.3961	88.9714	86.6367	84.3880	82.2218	80.1345
119	94.5366	91.9822	89.5238	87.1573	84.8788	82.6844	80.5705
120	95.1560	92.5656	90.0735	87.6751	85.3666	83.1439	81.0035
121	95.7729	93.1465	90.6204	88.1901	85.8515	83.6005	81.4334
122	96.3873	93.7247	91.1645	88.7022	86.3335	84.0542	81.8604
123	96.9993	94.3004	91.7060	89.2115	86.8126	84.5049	82.2844

Ruby borrows $65 000 for home improvements. She repays the loan with monthly repayments over 10 years. She is charged 6% pa interest.

(i) Calculate the amount of her monthly instalment. 1

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(ii) How much less interest would she pay if she took the loan over 9 years instead of 10? 2

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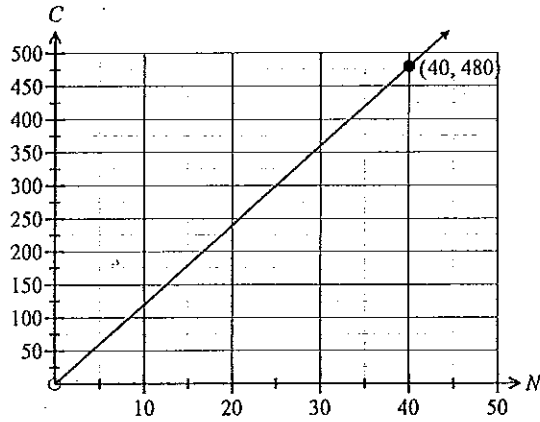..

(c) Ebony is the manager of a company which produces widgets. She draws the graph of the line which gives the income (C) from selling N widgets.

(i) What is the equation of the line? 1

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(ii) Ebony also wants to draw the line representing the cost of producing N widgets. 2
The equation of this line is $C = 8N + 100$.
Draw the line on the graph.
You can show any necessary working to obtain the line here.

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(iii) Give the coordinates of the break-even point and interpret this in terms of profit 2
and loss.

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(d) Sylvia and Mark are surveying an area of the Central West of NSW by helicopter. The map 2
shows the area in which they are working.
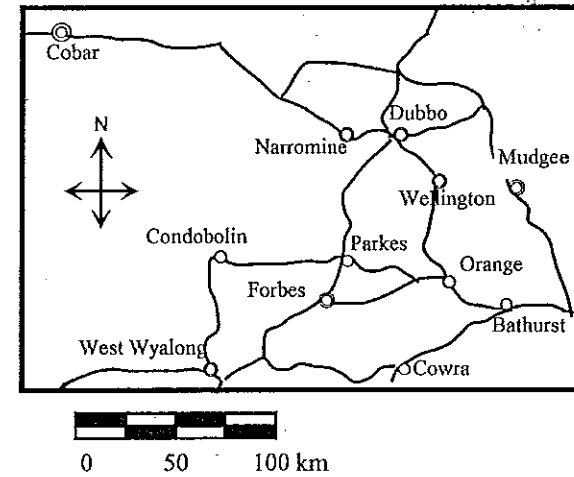
On one day, they survey a circular area centred at Parkes and with Dubbo on the circumference.

What is the area of the circle they are surveying on that day?

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(e) (i) Liza buys a car which has a market value of $60 000 before on-road costs.   1
        Stamp duty on the car is calculated at these rates:

- 3% of the market value up to and including $45,000
- 5% of the market value over $45,000.

        Calculate the stamp duty payable on the purchase of the car.

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(ii) The car depreciates at a rate of 4.5% pa.   1
      What is the value of the car 3 years after Liza buys it?

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End of Question 29

Question 30 (15 marks)

(a) Emily collects data from a sample of students in all years of her school.
She draws the scatterplot below using the data she collected on arm span and foot length.
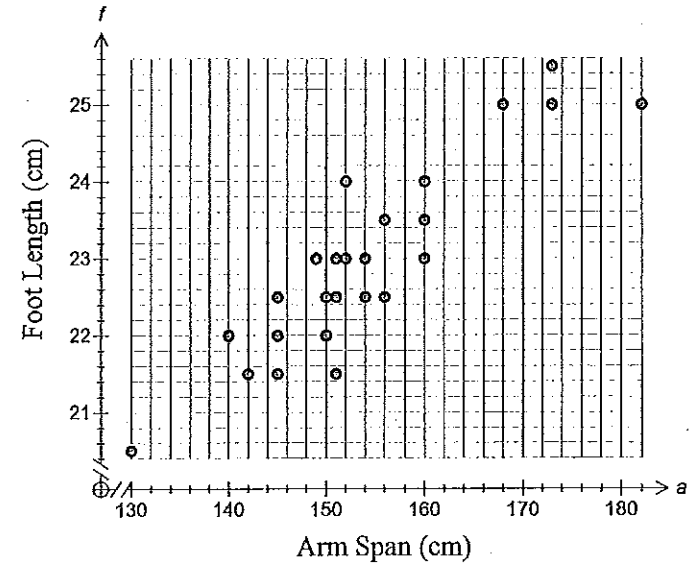
Arm Span (cm)

(i) Emily decides to include herself in the data. Her arm span was 164 cm and her
foot length was 24 cm.
Plot a point on the graph to represent Emily and label it E.   1

(ii) Emily uses a statistics software package to calculate the correlation coefficient
and gets a value of 0.9.
Explain what this result tells you about arm span and foot length.   1

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(iii) The statistics package also gives the results below for the mean and standard   1
deviation of the two quantities.

	Arm Span (a)	Foot Length (f)
Mean	154.0	23.0
SD	11.3	1.3

Use this information to show that the gradient of the least-squares line of best fit is
0.1 (correct to 1 decimal place).

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(iv) Use the information above to calculate the intercept of the least-squares line of best   1
fit on the f axis.

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(v) Using the variables a and f, write down the equation of the least-squares line of best   2
fit and use it to estimate the foot length of a student whose arm span was 170 cm.

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(vi) By using the equation from part (v) find a second point and draw the least-squares   1
line of best fit on the graph.

(b) Jimmy analyses the retention rate (the percentage of information recalled at the next
lesson) for lessons at the local community college. Lessons are either one hour or a half
hour in length and can be held in the morning, afternoon or evening. The table shows a
summary of his results The mean and standard deviation for the morning half hour class
is missing.

Length of Lesson		Time of Day		
		Afternoon	Evening	Morning
Half-Hour	Mean of Retention Rate	51%	43%	
	Standard Deviation of Retention Rate	10%	15%	
Hour	Mean of Retention Rate	65%	62%	73%
	Standard Deviation of Retention Rate	7%	10%	11%

(i) The raw data for the 8 students in the morning half-hour class is given below. Find   2
the mean and standard deviation for this class.

35%   55%   45%   40%   65%   40%   40%   50%

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(ii) Which class had the greatest variability in their retention rates?   1

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(c) The table below gives the future value interest factors for a range of loan terms and interest rates.

Table of future value interest factors

Period	Interest Rate per Period								
	0.35%	0.40%	0.45%	0.50%	0.55%	0.60%	0.65%	0.70%	0.75%
115	141.2881	145.6553	150.1958	154.9172	159.8275	164.9349	170.248	175.7761	181.5285
116	142.7826	147.2379	151.8717	156.6918	161.7065	166.9245	172.3547	178.0065	183.89
117	144.2823	148.8269	153.5551	158.4753	163.5959	168.926	174.475	180.2526	186.2692
118	145.7873	150.4222	155.2461	160.2677	165.4957	170.9396	176.609	182.5143	188.6662
119	147.2976	152.0239	156.9447	162.069	167.4059	172.9652	178.757	184.7919	191.0812
120	148.8131	153.632	158.651	163.8793	169.3267	175.003	180.9189	187.0855	193.5143
121	150.334	155.2465	160.3649	165.6987	171.258	177.053	183.0949	189.3951	195.9656
122	151.8601	156.8675	162.0866	167.5272	173.1999	179.1153	185.285	191.7208	198.4354
123	153.3916	158.4949	163.8159	169.3649	175.1525	181.19	187.4894	194.0629	200.9236
124	154.9285	160.1289	165.5531	171.2117	177.1158	183.2772	189.7081	196.4213	203.4306
125	156.4708	161.7694	167.2981	173.0678	179.09	185.3768	191.9412	198.7963	205.9563

(i) Find the future value of an annuity of $450 per month invested at 6.6% pa compounding monthly for 10 years. (Answer to the nearest dollar)   1

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(ii) What is the minimum term required for an annuity of $500 per month at 9% pa compounding monthly to reach a value of $100 000?   1

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(d) A sum of $2 000 is invested at 5% pa compounding annually.
The graph of the equation $FV = 2000(1.05)^n$ illustrates how the investment grows.
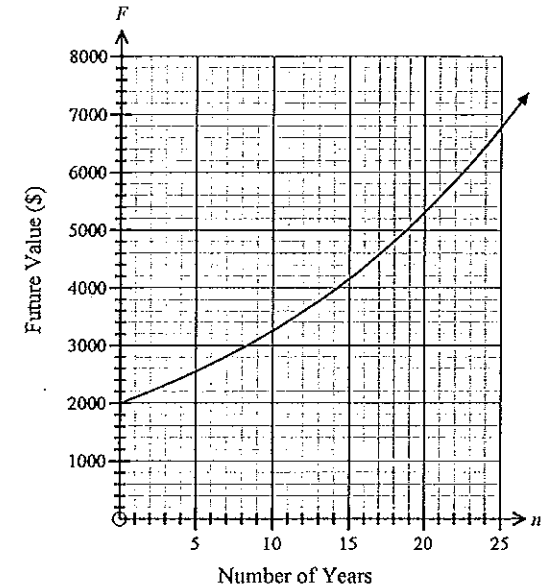
Number of Years

(i) Estimate the number of years it would take this investment to double in value (ie reach a future value of $4 000).   1

....

(ii) Compare the time it takes the investment to triple in value with the time that it takes to double in value. Explain the difference.   2

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End of Paper

Section II   Extra writing space

If you use this space, clearly indicate which question you are answering.

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FORMULAE AND DATA SHEET

Financial Mathematics

Simple interest

$$I = Prn$$

P is initial amount

r is interest rate per period, expressed as a decimal

n is number of periods

Compound Interest

$$A = P(1+r)^n$$

A is final amount

P is initial amount

r is interest rate per period, expressed as a decimal

n is number of compounding periods

Present value and future value

$$PV = \frac{FV}{(1+r)^n}, \qquad FV = PV(1+r)^n$$

r is interest rate per period, expressed as a decimal

n is number of compounding periods

Straight-line method of depreciation

$$S = V_0 - Dn$$

S is salvage value of asset after n periods

V_0 is initial value of asset

D is amount of depreciation per period

n is number of periods

Declining-balance method of depreciation

$$S = V_0(1-r)^n$$

S is salvage value of asset after n periods

V_0 is initial value of asset

r is depreciation rate per period, expressed as a decimal

n is number of periods

Data Analysis

Mean of a sample

$$\bar{x} = \frac{\text{sum of scores}}{\text{number of scores}}$$

z-score

For any score x_i

$$z = \frac{x - \bar{x}}{s}$$

$\bar{x}$ is mean

s is standard deviation

Outlier(s)

score(s) less than $Q_L - 1.5 \times IQR$

or

score(s) more than $Q_U + 1.5 \times IQR$

Q_L is lower quartile

Q_U is upper quartile

IQR is interquartile range

Least-squares line of best fit

$$y = \text{gradient} \times x + y\text{-intercept}$$

$$\text{gradient} = r \times \frac{\text{standard deviation of } y \text{ scores}}{\text{standard deviation of } x \text{ scores}}$$

$$y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})$$

r is correlation coefficient

$\bar{x}$ is mean of x scores

$\bar{y}$ is mean of y scores

Normal distribution

- approximately 68% of scores have z-scores between −1 and 1
- approximately 95% of scores have z-scores between −2 and 2
- approximately 99.7% of scores have z-scores between −3 and 3

Circumference of a circle

$$C = 2\pi r \quad \text{or} \quad C = \pi D$$

r is radius
D is diameter

Arc length of a circle

$$l = \frac{\theta}{360} 2\pi r$$

r is radius
θ is number of degrees in central angle

Radius of Earth

(taken as) 6400 km

Time differences
For calculation of time differences using longitude:
15° = 1 hour time difference

Area

Circle

$$A = \pi r^2$$

r is radius

Sector

$$A = \frac{\theta}{360} \pi r^2$$

r is radius
θ is number of degrees in central angle

Annulus

$$A = \pi \left(R^2 - r^2 \right)$$

R is radius of outer circle
r is radius of inner circle

Trapezium

$$A = \frac{h}{2} \left(a + b \right)$$

h is perpendicular height
a and b are the lengths of the parallel sides

Area of land and catchment areas
unit conversion: 1 ha = 10 000 m²

Sphere

$$A = 4\pi r^2$$

r is radius

Closed cylinder

$$A = 2\pi r^2 + 2\pi rh$$

r is radius
h is perpendicular height

Volume

Prism or cylinder

$$V = Ah$$

A is area of base
h is perpendicular height

Pyramid or cone

$$V = \frac{1}{3} Ah$$

A is area of base
h is perpendicular height

Volume and capacity
unit conversion: 1 m³ = 1000 L

Approximation Using Simpson's Rule

Area

$$A \approx \frac{h}{3} \left(d_f + 4d_m + d_l \right)$$

h is distance between successive measurements
d_f is first measurement
d_m is middle measurement
d_l is last measurement

Volume

$$V \approx \frac{h}{3} \left\{ A_L + 4A_M + A_R \right\}$$

h is distance between successive measurements
A_L is area of left end
A_M is area of middle
A_R is area of right end

Trigonometric Ratios
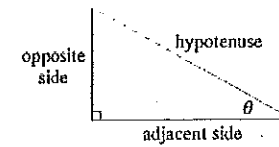
$$\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$$

Sine rule

In $\triangle ABC$,

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Area of a triangle

In $\triangle ABC$,

$$A = \frac{1}{2} ab \sin C$$

Cosine rule

In $\triangle ABC$,

$$c^2 = a^2 + b^2 - 2ab \cos C$$

or

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Units of Memory and File Size

1 byte = 8 bits
1 kilobyte = 2^{10} bytes = 1024 bytes
1 megabyte = 2^{20} bytes = 1024 kilobytes
1 gigabyte = 2^{30} bytes = 1024 megabytes
1 terabyte = 2^{40} bytes = 1024 gigabytes

Blood Alcohol Content Estimates

$$BAC_{male} = \frac{10N - 7.5H}{6.8M}$$

or

$$BAC_{female} = \frac{10N - 7.5H}{5.5M}$$

N is number of standard drinks consumed
H is number of hours of drinking
M is person's mass in kilograms

Distance, Speed and Time

$$D = ST, \quad S = \frac{D}{T}, \quad T = \frac{D}{S}$$

$$\text{average speed} = \frac{\text{total distance travelled}}{\text{total time taken}}$$

$$\text{stopping distance} = \left\{ \begin{array}{c} \text{reaction-time} \\ \text{distance} \end{array} \right\} + \left\{ \begin{array}{c} \text{braking} \\ \text{distance} \end{array} \right\}$$

Probability of an Event

The probability of an event where outcomes are equally likely is given by:

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Straight Lines

Gradient

$$m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$$

Gradient-intercept form

$$y = mx + b$$

m is gradient
b is y-intercept

Western Mathematics Exams
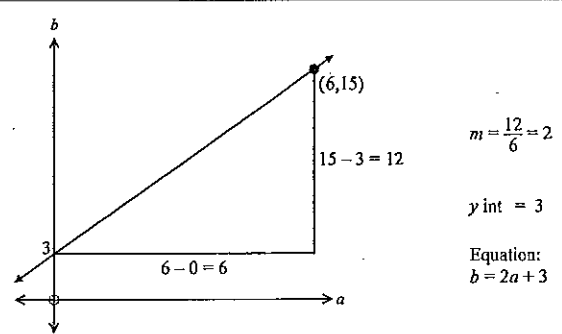
2014
TRIAL HSC
EXAMINATION

Mathematics General

SOLUTIONS

	Multiple Choice Worked Solutions	
1	The shape is an annulus, so from formula sheet the formula is $A = \pi(R^2 - r^2)$.	C
2	Monthly repayment =$193.33 from table. There are $5 \times 12 = 60$ repayments. Amount paid = $193.33 \times 60 = \$11\ 599.80$	D
3	Unordered selections of 3 from $10 = \dfrac{10 \times 9 \times 8}{3 \times 2 \times 1}$ $= 120$	A
4	One variable decreases as the other increases, so the correlation will be negative. The data is grouped close to the line so the value will be close to -1. So -0.95 is the most likely.	A
5	12.5 gigabytes $= 12.5 \times 1024 = 12800$ megabytes Number of times $= 12800 \div 1280 = 10$ times	D
6	Amount owing for July = 1300. Daily interest rate $= \dfrac{18.5}{365} = 0.05\%$ per day Interest $= 1300 \times 0.005 \times 31$ $= \$20.43$ Amount to Pay $= 1300 + 20.43$ $= \$1\ 320.43$	A
7	$3ab - 3a(2a - 4b) - a^2 = 3ab - 6a^2 + 12ab - a^2$ $= 15ab - 7a^2$	D
8	80% as a z score $= \dfrac{80 - 90}{5} = -2$.	A
9	$\begin{array}{r\|lllll} 1 & 5 & 8 & 8 & 9 \\ 2 & 2 & 4 & 6 & 8 & 8 \\ 3 & 2 & 3 & 4 & 6 & 6 & 9 \\ 4 & 1 & 3 & 6 & 7 & 8 \\ 5 & 0 & 3 & 5 & 7 \\ 6 & 3 & 6 & 9 & 9 \\ 7 & 3 & 4 & 5 \end{array}$ Median = 41 Q1 = 28 and Q3 = 57. Interquartile range $= 57 - 28 = 29$	B
10	Based on the results. P(rain in Jan) $= \dfrac{8}{31}$ P(rain in July) $= \dfrac{16}{31}$ A is true from the probabilities above. B appears to be true, but rain does not recognise days of the week, so not true. C.There are a more extended periods in July which could be due to weather patterns, so probably true. D is true from the probabilities above.	B

11	$B = 2\pi\left(R + \dfrac{T}{2}\right) \times \dfrac{A}{360}$	D
	$55 = 2\pi\left(20 + \dfrac{30}{2}\right) \times \dfrac{A}{360}$	
	$55 = 2\pi(35) \times \dfrac{A}{360}$	
	$55 = 220 \times \dfrac{A}{360}$	
	$A = 55 \times \dfrac{360}{220}$	
	$A = 90$	
12	$\dfrac{h}{2.0} = \dfrac{6.4}{1.6}$	A
	$h = 2.0 \times \dfrac{6.4}{1.6}$	
	$= 8\ m$	
13	From October to April had lower numbers than May. So 7 months.	C
14	The heater is 2 000 watts which is 2 kw. It is run for $120 \times 8 = 960$ hours per year Power used $= 960 \times 2 = 1920$ kwh Cost at $0.30 per kwh $= 1920 \times 0.3 = \$576$	D
15	Area of the cloth $= 30^2 = 900\ cm^2$. An area of $1\ m^2 = 100 \times 100 = 10\ 000\ cm^2$ Area of cloth $= \dfrac{900}{10000} = 0.09\ m^2$ Amount absorbed $= 0.09 \times 5 = 0.45\ L = 450\ mL$	B
16	Under the declining balance method, each succeeding years price is a percentage of the previous year's price, which means the value goes down by gradually lesser amounts each year. Graph B indicates this. Graph C is a straight line depreciation and A and D are erratic amounts.	B
17	$tan\ \angle WTK = \dfrac{230}{320}$ $\angle WTK = tan^{-1}\dfrac{230}{320}$ $= 36°$ Bearing $= 270 - 36$ $= 234°$	C
18	Quarterly interest rate $= 0.12 \div 4 = 0.03$ After first year the investment $= 1450 \times (1.03)^4 = \$1\ 631.99$ After she added \$1 280 value $= \$1\ 631.99 + \$1\ 280 = \$2\ 911.99$ After second year the investment $= \$2\ 911.99 \times (1.03)^4 = \$3\ 277.47$	C
19	50 km at 15 litres/100 km $= 15 \div 2 = 7.5$ litres 250 km at 10 litres/100 km $= 10 \times 2.5 = 25$ litres Total $= 25 + 7.5 = 32.5$ litres	C
20	Looking down the interest column, the interest amount increased in June. Int Rate May $= \$1,242.95 \div \$248,589.46 = 0.0050$ (4 dec places) Int Rate June $= \$1,342.43 \div \$247,832.41 = 0.0054$ (4 dec places) Increase in annual interest rate $= 0.0004 \times 12 \times 100 = 0.5\%$ (1 dec place)	B

21	Dosage for child 1-12 $= \dfrac{\text{age of child (in years)} \times \text{adult dose}}{\text{age of child (in years)} + 12}$ $= \dfrac{8 \times 15}{8 + 12}$ $= \dfrac{120}{20}$ $= 6\ mL$	C
22	Leaves at 6 pm Wed and flies for 22 hrs so time of arrival is 4 pm Thursday (London time) Sydney time is a further 10 hrs ahead, so is 2:00 am on Friday 12th. OR Time he leaves London (Sydney time) is 4 am Thursday. Time for flight is 22 hours, so arrives at 2 am Friday.	B
23	area of cross section $= \pi \times 3^2 = 28.3\ m^2$ volume $= 28.3 \times 16 = 452.4\ m^3$ capacity $= 452.4$ kL Number of 150 kL tanks $= \dfrac{452.4}{150} = 3.015$ 3 tanks could be filled.	A
24	$m = \dfrac{12}{6} = 2$ y int $= 3$ Equation: $b = 2a + 3$	A
25	P(no prob given female) $= \dfrac{25}{49}$	D

Name_____   Teacher_____

Section I – Multiple Choice Answer Sheet

Allow about 15 minutes for this section

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: 2 + 4 =   (A) 2   (B) 6   (C) 8   (D) 9

A ○   B ●   C ○   D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ●   B ✖   C ○   D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.

correct

A ✖   B ✖   C ○   D ○

1.	A ○ B ○ C ● D ○				14.	A ○ B ○ C ○ D ●		
2.	A ○ B ○ C ○ D ●				15.	A ○ B ● C ○ D ○		
3.	A ● B ○ C ○ D ○				16.	A ○ B ● C ○ D ○		
4.	A ● B ○ C ○ D ○				17.	A ○ B ○ C ● D ○		
5.	A ○ B ○ C ○ D ●				18.	A ○ B ○ C ● D ○		
6.	A ● B ○ C ○ D ○				19.	A ○ B ○ C ● D ○		
7.	A ○ B ○ C ○ D ●				20.	A ○ B ● C ○ D ○		
8.	A ● B ○ C ○ D ○				21.	A ○ B ○ C ● D ○		
9.	A ○ B ● C ○ D ○				22.	A ○ B ● C ○ D ○		
10.	A ○ B ● C ○ D ○				23.	A ● B ○ C ○ D ○		
11.	A ○ B ○ C ○ D ●				24.	A ● B ○ C ○ D ○		
12.	A ● B ○ C ○ D ○				25.	A ○ B ○ C ○ D ●		
13.	A ○ B ○ C ● D ○							

Question 26		2014	
Part	Solution	Marks	Comment
(a)	(i) Error = half of the smallest unit (0.5 cm) = 0.25 cm % error $= \pm\dfrac{0.25}{12.5} \times 100$ $= \pm 2\%$	1	
	(ii) Volume $= Ah = \dfrac{\pi r^2}{2} \times h$ $= \dfrac{\pi \times 3^2}{2} \times 12.5$ $= 176.7 \text{ cm}^3$ $= 177 \text{ mL}$	1	1 mark for volume
(b)	(i) $BAC_{FEMALE} = \dfrac{10N - 7.5H}{5.5M}$ $= \dfrac{10 \times 4 - 7.5 \times 2.5}{5.5 \times 45}$ $= 0.08585$ $= 0.086 \ (2 \text{ d p})$ Which is more than 0.08	1	1 for correct answer
	(ii) Reaction time when BAC is greater that 0.08, increases by 20%. New Reaction Time $= 1.2 \times 0.9$ $= 1.08 \ sec$	1	1 for correct answer
	(iii) Additional time $= 1.08 - 0.9 = 0.18$ seconds. $S = \dfrac{D}{T}$ $D = S \times T$ $D = 25 \times 0.18$ $= 4.5 \ m$ extra	1	1 for correct answer
(c)	(i) Hourly earnings $= 35 \times 19.5 = \$682.50$ Commission $= 0.04 \times 16000 = \$640$ Total Earnings $=\$ 682.50 + \$640 = \$ 1322.50$	2	2 for correct answer 1 if either part found correctly
	(ii) Tax on 68 770 $= (68770 - 37000) \times 0.325 + 3572$ $= \$13 \ 897.25$	1	1 for correct answer
(d)	(i) Due to the relatively small numbers a census would be practicable; a sample may be too small to be representative.	1	1 for any reasonable answer supported by knowledge of sampling.
	(ii) Quantitative discrete data is numerical and uses numbers which are separate such as counting numbers. Question 2 is an example as the answer will be the counting numbers 1, 2, 3 etc.	1	1 for correct answer
(e)	(i) From 19 calls the median is the 10th which is a 3 From lower 9 callsQ_L is 5th which is a 2. From upper 9 callsQ_U is 5th which is a 5. Interquartile range$= 5 - 2 = 3$.	1	1 for correct answer
	(ii) A high score is an outlier if it is greater than $Q_U + 1.5 \times IQR = 5 + 1.5 \times 3 = 9.5$ So 12 is an outlier.	1	1 for correct answer

Question 26			2014	
Part	Solution		Marks	Comment
(f)	(i) Excess = 2.5 GB − 2.0 GB = 0.5 GB Excess MB = 0.5 × 1024 = 512 MB		1	1 for correct answer
	(ii) 150 minutes of calls = 150 × 0.90 = $135 100 connection fees = 100 × 0.4 = $40 300 text messages = 300 × 0.05 = $15 30 picture messages = 30 × 0.50 = $15 6 video messages = 6 × 0.75 = $4.50 Total over allowance = $209.50 − 150 = $59.50 Excess Data = 512 × 0.10 = $51.20 Total for month = $50 + $59.50 + $51.20 = $160.70		2	2 marks for correct answer. 1 mark for an answer which shows correct calculation of some parts of the cost.
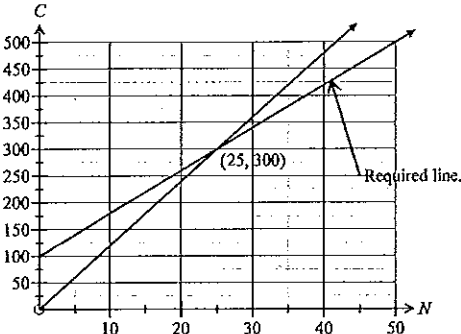
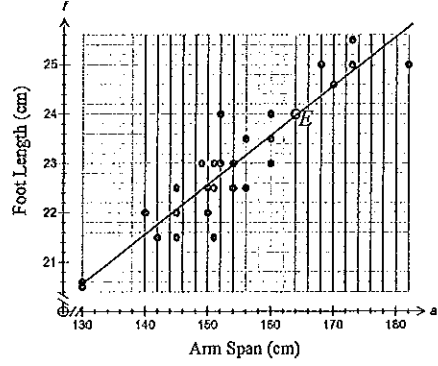| Question 27			2014	
Part	Solution		Marks	Comment
(a)	(i) Angular distance = 51 + 33 = 84° Arc length on great circle = $\dfrac{\theta}{360} \times 2\pi r$ $= \dfrac{84}{360} \times 2 \times \pi \times 6400$ $= 9382.9$ $= 9400$ km		2	2 marks for correct answer. 1 mark for an answer which shows correct calculation of some parts of the answer.
	(ii) Speed = $\dfrac{9400}{11.75}$ = 800 km/h		1	1 for correct answer
(b)	Of 60 herrings 3 were tagged which is $\dfrac{3}{60} \times 100 = 5\%$ 54 herring correspond to 5% of total, so 5% of Herrings = 54 1% of Herrings = $\dfrac{54}{5} = 10.8$ 100% of Herrings = 10.8 × 100 = 1080 Of 30 catfish 3 were tagged which is $\dfrac{3}{30} \times 100 = 10\%$ 10% of Catfish = 20 1% of Catfish = $\dfrac{20}{10} = 2$ 100% of Catfish = 2 × 100 = 200 Estimate there are 1080 herrings and 200 catfish in the lake.		2	2 marks for correct answer. 1 mark for one correct answer. 1 mark if neither answer correct, but a similar simple mistake made in both calculations.
(c)	12 × 2.5 MB = 12 × 2.5 × 2^{20} bytes $= 31457280$ bytes $= 31457280 \times \dfrac{8}{1000}$ kilobits $= 251658.24$ kilobits Download time $= 251658.24 \div 125$ sec $= 2013.27$ sec $= 2013.27 \div 60$ min $= 33.55$ $= 33.5$ min (nearest half minute)		2	2 marks for correct answer. 1 mark for an answer which shows correct conversion of units, or which calculates time correctly from an incorrect conversion of units.
(d)	(i) $A \ \dfrac{4}{11}$ $B \ \dfrac{3}{11}$ $C \ \dfrac{2}{11}$		1	1 mark if all three are correct.
	(ii) $P(Same) = \dfrac{5}{12} \times A + \dfrac{1}{3} \times B + \dfrac{1}{4} \times C$ $= \dfrac{5}{12} \times \dfrac{4}{11} + \dfrac{1}{3} \times \dfrac{3}{11} + \dfrac{1}{4} \times \dfrac{2}{11}$ $= \dfrac{19}{66}$		1	1 mark if correct answer or answer determined correctly from (i)

Question 27		2014	
Part	Solution	Marks	Comment
	(iii) $P(Different) = 1 - P(same)$ $= 1 - \frac{19}{66}$ $= \frac{47}{66}$	1	1 mark if correct answer or answer determined correctly from (ii)
(e)	$3y - 1 = 3(3 - y) + 5$ $3y - 1 = 9 - 3y + 5$ $3y = 15 - 3y$ $6y = 15$ $y = \frac{15}{6} = 2.5$	2	2 marks for correct answer. 1 mark for an answer which shows some progress toward the solution.
(f)	(i) $\angle AOB = 95°$ Area $= \frac{1}{2}ab \sin O$ $= \frac{1}{2} \times 250 \times 500 \times \sin 95°$ $= 62262$ $= 62\,000\ m^2$ $= 6.2\ ha$	2	2 marks for correct answer in hectares. 1 mark if not given in correct units or if an error made in calculation, but converted to hectares correctly
	(ii) $\angle BOC = 210 - 95 = 115°$ $BC^2 = 250^2 + 380^2 - 2 \times 250 \times 380 \times \cos 115°$ $= 287197$ $BC = 536\ m$	1	1 for correct answer
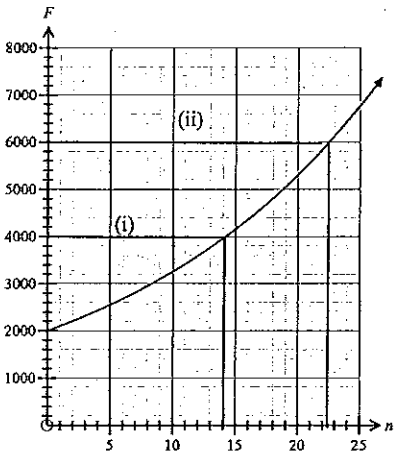
Question 28		2014	
Part	Solution	Marks	Comment
(a)	(i) Longitude difference Sydney to J'burg $= 151 - 28 = 123°$ Time difference Sydney to J'burg $= 123° \div 15 = 8.2$hrs $= 8$ hrs 12 min Time in Sydney $= 6$ pm $+ 8$ hrs 12 min $= 2:12$ am on Sunday	2	2 marks for correct answer. 1 mark for an answer which shows correct calculation of some parts of the answer.
	(ii) Time in Jo'burg when leaving 10am Sunday. Time of arrival Sydney time 5:28 am Monday Time of arrival Jo'burg time 5:28 am − 8:12 = 9:16 pm Sunday Time of flight from 10 am to 9:16 pm = 11 hours 16 min.	1	1 for correct answer
(b)	(i) Drip rate $= \frac{volume(mL) \times drops/mL}{time\ in\ minutes}$ $= \frac{1200 \times 60}{10 \times 60}$ $= \frac{72000}{600}$ $= 120$ dpm	1	1 for correct answer
	(ii) Drip rate $= \frac{volume(mL) \times drops/mL}{time\ in\ minutes}$ $75 = \frac{900 \times 60}{T \times 60}$ $75 \times 60 \times T = 54000$ $T = \frac{54000}{4500}$ $= 12$ hours	2	2 for correct answer 1 for attempt to substitute into the equation and change the subject or rearrange the equation to find the time.
(c)	(i) $V \approx \frac{h}{3}\{A_L + 4A_M + A_R\}$ $V \approx \frac{150}{3}\{4000 + 4 \times 3500 + 2400\} + \frac{150}{3}\{2400 + 4 \times 1600 + 0\}$ $V \approx 50 \times 20400 + 50 \times 8800$ $V \approx 1\,460\,000\ m^3$ Capacity $\approx 1\,460\,000$ kL	2	2 for correct answer 1 for Correct substitution into S R with error in calculation. Or error in substitution and correct calculation. Or using SR only once.
	(ii) Total removed each day $= 2500 + 1500 = 4000$ kL Time to empty $= 1\,460\,000 \div 4000 = 365$ days	1	1 for correct answer

Question 28		2014	
Part	Solution	Marks	Comment
(d)	The return if three dice show a six is +40 – probability $\frac{1}{216}$. The return if two dice show a six is +24 – probability $\frac{15}{216}$. The return if one die shows a six is +8 probability $\frac{75}{216}$. The return if no dice show a six is -8 probability $\frac{125}{216}$. Financial Expectation $= 40 \times \frac{1}{216} + 24 \times \frac{15}{216} + 8 \times \frac{75}{216} - 8 \times \frac{125}{216}$ $= \frac{1000}{216} - \frac{1000}{216}$ $= \$0$ So it is a fair game.	3	3 marks for correct answer of 0. 2 marks if working along the correct lines with one or two simple errors. 1 mark if correct returns are calculated or if some attempt is made to multiply returns by probabilities
(e)	(i) In April they generated 11 kWh/day. There are 30 days in April, so the amount they generated $= 30 \times 11 = 330$ kWh.	1	1 for correct answer
	(ii) There were 7 months when the power generated exceeded usage. J, F, M and S, O, N, D.	1	1 for correct answer
	(iii) In January they generated 21 kWh/d and used 15kWh/d, an excess of 6 kWh/d. 31 days in January $\times 6$ kWh/d $= 186$ kWh. Payment $= 186 \times 0.20 = \$37.20$.	1	1 for correct answer

Question 29		2014	
Part	Solution	Marks	Comment
(a)	(i) $SA = 2\pi r^2 + 2\pi r h$ $= 2 \times \pi \times 3.2^2 + 2 \times \pi \times 3.2 \times 8.5$ $= 235$ cm^2 (3 sig fig)	1	1 for correct answer
	(ii) Convert to z-scores. For a diameter of 6.4 $\;\; z = \frac{6.4 - 6.3}{0.05}$ $= 2$ For a diameter of 6.25 $\;\; z = \frac{6.25 - 6.3}{0.05}$ $= -1$ Approximately 68% of scores have z-scores between –1 and 1 Percentage of z-scores less than -1 $= \frac{100 - 68}{2} = 16\%$ Approximately 95% of scores have z-scores between –2 and 2 Percentage of z scores more than 2 $= \frac{100 - 95}{2} = 2.5\%$ Total percentage rejected $= 16 + 2.5 = 18.5\%$	2	2 for correct answer 1 for answer which used correct percentages but has a single error in calculation. 1 for answer which uses one incorrect percentage but has calculations correct.
(b)	(i) 6% p.a. interest = 0.5% per month. So $r = 0.0050$ Ten years is 120 months, so $N = 120$ From table the factor is 90.0735. So $\;\; 90.0735 \times$ Monthly repayment $= 65000$ $\qquad$ Monthly repayment $= \frac{65000}{90.0735}$ $\qquad = \$721.63$	1	1 for correct answer
	(ii) Total repaid (ten years) $= 721.63 \times 120 = \$86\,595.60$ Nine years is 108 months, so $N = 108$ From table the factor is 83.2934. So $\;\; 83.2934 \times$ Monthly repayment $= 65000$ $\qquad$ Monthly repayment $= \frac{65000}{83.2934}$ $\qquad = \$780.37$ Total repaid (nine years) $= 780.37 \times 108 = \$84\,279.96$ Amount of interest saved $=\$86\,595.60-\$84\,279.96$ $\qquad\qquad = \$2\,315.64$	2	2 for correct answer 1 if able to correctly determine total amount or interest for either 9 or 10 years, 1 if used correct method but made minor error in calculation or in reading table.
(c)	(i) Passes through (40, 480) and the origin, so $\qquad Gradient = m = \frac{480}{40} = 12$ C intercept $= 0$ Equation is $\;\; C = 12N$	1	1 mark for correct equation

Question 29		2014	
Part	Solution	Marks	Comment
(ii)	Gradient = 8 and C intercept is 100. Plot the intercept and use gradient to obtian a second point. 	2	2 marks for line drawn correctly. 1 mark if either gradient or y intercept correct. 1 mark if using a table and either completing the tableincorrectly or plotting points incorrectly.
(iii)	Break even point is (25, 300) which means that when 25 widgets are sold the income equals the expenses, so if less than 25 widgets are sold, a loss is made, but for more, a profit is made.	2	1 for correct point read from their graph. 1 for any reasonable explanation that recognises the balance of cost and income to determine profit and loss.
(d)	Measurement = 2.7cm from Parkes to Dubbo 1cm = 25km So distance =2.7 x 25km = 67.5 radius $A = \pi r^2$ $= \pi \times 67.5^2$ $= 14314 \text{ km}^2$	2	Accept 2.5cm – 2.8cm 1 for radius 1 for answer
(e)	(i) Stamp duty = 3% of 45 000 + 5% of 15 000 $= .03 \times 45\,000 + .05 \times 15\,000$ $= 1\,350 + 750$ $= \$2\,100$	1	1 for correct answer
	(ii) $S = V_c(1 - r)^n$ $= 60\,000(0.955)^3$ $= \$52\,259.03$	1	1 for correct answer

Question 30		2014	
Part	Solution	Marks	Comment
(a) (i)	 See point E on graph.	1	1 for correct point E.
(a) (ii)	A correlation approaching 1 means that as one quantity increases, so does the other in a close linear relationship.	1	1 for any reasonable explanation of correlation close to 1.
(a) (iii)	gradient $= r \times \dfrac{\text{standard deviation of } y \text{ scores}}{\text{standard deviation of } x \text{ scores}}$ $= 0.9 \times \dfrac{1.3}{11.3}$ $= 0.1035398$ $= 0.1$ (correct to 1 dp)	1	1 for correct substitution to obtain required answer.
(a) (iv)	$y - \text{intercept} = \bar{y} - (\text{gradient} \times \bar{x})$ $f - \text{intercept} = \bar{f} - (\text{gradient} \times \bar{a})$ $f - \text{intercept} = 23 - 0.1 \times 154$ $f - \text{intercept} = 7.6$	1	1 for correct answer.
(a) (v)	Equation (using a and f as variables) is $f = 0.1a + 7.6$ Where $a = 170$, $f = 0.1 \times 170 + 7.6$ $= 24.6$	2	1 for equation and 1 for value of 24.6
(a) (vi)	Plotting any 2 points from the equation in part (v) and joining to make a straight line.	1	1 for correct line.
(b)	(i) From calculator Mean = 46% and SD = 9%.	2	1 for mean 1 for SD
	(ii) The evening half hour class has an Sd of 15% so has the greatest variability.	1	1 for correct answer, taking into account the SD value from previous part

Question 30		2014	
Part	Solution	Marks	Comment
(c)	(i) 6.6% pa % $= \frac{6.6}{12} = 0.55\%$ per month. From table interest factor for 0.55% for 12 years (120 months) is 169.3267. Future value $= 450 \times 169.3267 = \$76\ 197$ (nearest dollar)	1	1 mark for correct answer.
	(ii) 9.0% pa % $= \frac{9.0}{12} = 0.75\%$ per month. Let I be the required interest factor Then $500 \times I = \$100\ 000$ $$I = \frac{100000}{500} = 200$$ From table, in the column for 0.75% the first interest factor to exceed 200 is for 123 months (200.9236), So the minimum term is 10 years and 3 months	1	1 mark for correct answer.
(d)	(i) It takes 14 years (from the graph).	1	1 mark for correct answer.
	(ii) The time to triple is about 22.5 years, compared to 14 years to double, so it is increasing at an increasing rate, or it is increasing exponentially.	2	2 marks for correct time to triple and an explanation that mentions the rate increasing or mentions exponential growth.