

2006

TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

General Instructions

- Reading time: 5 minutes
- Working time: $2\frac{1}{2}$ hours
- Write using blue or black pen.
- Calculators may be used.
- Use Multiple Choice Answer Sheet provided.
- A separate Formula Sheet is provided.

Total Marks: 100

Section I (Pages 3-11)

Total Marks: 22

- Attempt Questions 1-22
- Allow about 30 minutes for this section

Section II (Pages 12-20)

Total Marks: 78

- Attempt Questions 23-28
- Allow about 2 hours for this section

Committee

Patrick Curteis	Kambala, Rose Bay
Neila Darrough	La Salle College, Bankstown
Lynne Knapman	PLC Sydney, Croydon
Julie McDougal	St Clare's College, Waverley
Bill Waddell	St Patrick's Marist College, Dundas (Convenor)

Section I

22 marks

Attempt Questions 1–22

Allow about 30 minutes for this section

Use the multiple-choice answer sheet.

- 1** What is the median of the set of scores?

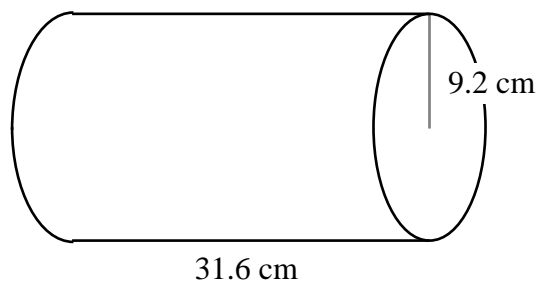
20, 21, 22, 22, 22, 23, 24, 24, 25, 26

- (A) 6
 - (B) 22
 - (C) 22.5
 - (D) 22.9
- 2** The distance from Port Douglas to Sydney is 2017 km. If 1 nautical mile = 1.852 km, then this distance, in nautical miles, is:
- (A) 1089
 - (B) 1090
 - (C) 3735
 - (D) 3736
- 3** Simplify: $7 + 3(x - 2)$
- (A) $3x + 1$
 - (B) $3x + 13$
 - (C) $8x$
 - (D) $10x - 2$

- 4 A piece of A4 paper has a mass of 0.000785 grams. Express this number in scientific notation, correct to 2 significant figures.

- (A) 7.8×10^{-4}
(B) 7.9×10^{-4}
(C) 7.8×10^4
(D) 7.9×10^4

5

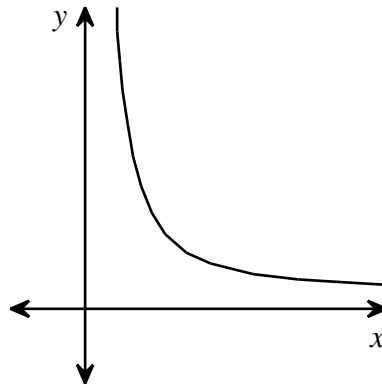


NOT
TO
SCALE

The surface area of this closed cylinder is closest to:

- (A) 1827 cm^2
(B) 2093 cm^2
(C) 2358 cm^2
(D) 8403 cm^2
- 6 Jenny takes out a flat rate loan of \$6500 and repays the loan with monthly repayments over 3 years. Interest is charged at 9% p.a. The total amount that Jenny must repay is:
- (A) \$229.31
(B) \$1755
(C) \$6500
(D) \$8255

7



Which of the following equations best describes the graph above?

- (A) $y = ax$
- (B) $y = ax^2$
- (C) $y = ax^3$
- (D) $y = \frac{a}{x}$

8 Five students were given a pre-test before starting a topic. Their scores appear below:

53 41 76 55 28

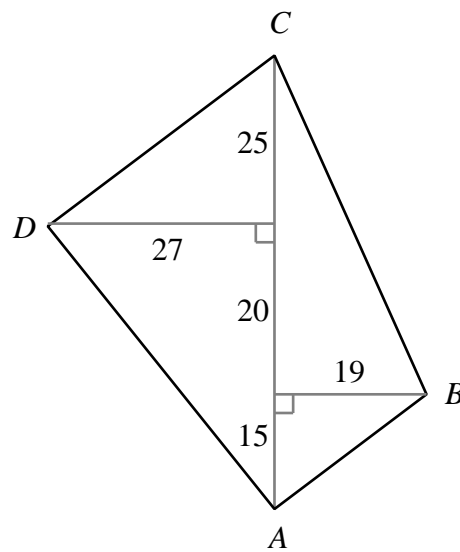
The same students were tested again at the end of the topic. Each student's mark in the second test was 20 more than their mark in the pre-test. Compared to the scores from the pre-test, the scores from the second test had:

- (A) the same mean and a larger standard deviation
- (B) a larger mean and a larger standard deviation
- (C) a larger mean and a smaller standard deviation
- (D) a larger mean and the same standard deviation

- 9 There are 800 students at a local high school. In Year 12 there are 120 students. If 100 students are chosen for a survey using stratified sampling, how many Year 12 students will need to be surveyed?

(A) 7
(B) 13
(C) 15
(D) 17

- 10 The diagram below shows a surveyor's sketch of an offset survey of a field $ABCD$. All dimensions are in metres.



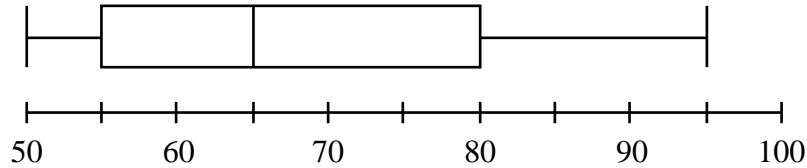
NOT
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SCALE

The area of the field, in square metres, is:

(A) 154
(B) 203
(C) 1380
(D) 2760

- 11 Bob buys a new filing cabinet for his office. The purchase price was \$279, but the value of the cabinet depreciates by 15% per year. The salvage value of the filing cabinet after 6 years is:
- (A) \$41.85
- (B) \$105.22
- (C) \$189.00
- (D) \$237.15

12



Julie and Bill make the following statements about the box-and-whisker plot above.

Julie: "The interquartile range is 15"

Bill: "The median is 65"

Which of the students made a correct statement?

- (A) Bill only
- (B) Julie only
- (C) Bill and Julie
- (D) Both statements were incorrect

- 13** Lana celebrates her 18th birthday by going with four of her friends to the theatre. They sit in five adjoining seats. Lana sits in the middle seat. The four friends then choose their seats at random.



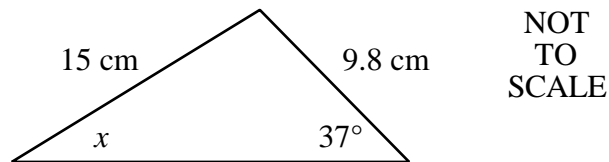
The probability that Clark sits next to Lana is:

- (A) $\frac{1}{5}$
- (B) $\frac{1}{4}$
- (C) $\frac{2}{5}$
- (D) $\frac{1}{2}$
- 14** The lengths of two pieces of timber are measured to be 1.6 m and 2.3 m respectively. What is the upper limit of their length when they are placed end to end?
- (A) 3.9 m
- (B) 3.95 m
- (C) 4.0 m
- (D) 4.1 m
- 15** \$2540 is invested for 3 years at 9% p.a. with interest compounded monthly. Which of the following expressions will give the value of the investment after 3 years?
- (A) $2540 \times 0.09 \times 3$
- (B) $2540(1 + 0.0075)^{36}$
- (C) $2540 \frac{(1 + 0.0075)^{36} - 1}{0.0075}$
- (D) $2540 \frac{(1 + 0.0075)^{36} - 1}{0.0075(1 + 0.0075)^{36}}$

- 16** An egg carton contains 5 brown eggs and 7 white eggs. Two eggs are chosen at random and placed on a table. What is the probability that both eggs are brown?

- (A) $\frac{5}{36}$
(B) $\frac{5}{33}$
(C) $\frac{1}{6}$
(D) $\frac{25}{144}$

17



In the diagram above, the value of x , correct to the nearest degree, is:

- (A) 23
(B) 44
(C) 59
(D) 67
- 18** The mean mark in the Half-Yearly Examination in General Mathematics was 68 and the standard deviation was 9. A z -score of 2 for this test would represent a mark of:
- (A) 50
(B) 66
(C) 70
(D) 86

- 19 At a particular school, the probability that a student travels to school by bus is 0.4, while the probability that a student wears the correct uniform is 0.8. If a student from the school is selected at random, then the probability that the student does **not** catch a bus but is in correct uniform is:
- (A) 12%
- (B) 32%
- (C) 48%
- (D) 80%

- 20 The following table shows the income tax rate for Australian residents for the 2005-06 financial year.

Taxable	Income	Tax Payable on Taxable Income
\$0 –	\$6000	Nil
\$6001 –	\$21 600	15¢ for each \$1 over \$6000
\$21 601 –	\$63 000	\$2340 plus 30¢ for each \$1 over \$21 600
\$63 001 –	\$95 000	\$14 760 plus 42¢ for each \$1 over \$63 000
Over	\$95 000	\$28 200 plus 47¢ for each \$1 over \$95 000

At the end of the last financial year Susan was required to pay income tax of \$21 251.94. Her taxable income was:

- (A) \$6491
- (B) \$15 457
- (C) \$78 457
- (D) \$109 783
- 21 For a normal working week of 38 hours, Brian is paid \$24.30 per hour. Any time worked over 38 hours is paid at time-and-a-half. Brian was paid \$1032.75 for his work last week. Find the number of overtime hours that Brian worked last week.
- (A) 1.5
- (B) 3
- (C) 4.5
- (D) 42.5

- 22** The area of a sector is given by the formula $A = \frac{\theta}{360} \times \pi r^2$. Rearranging this formula to make r the subject gives:

(A) $r = \sqrt{\frac{360A}{\pi\theta}}$

(B) $r = \frac{\sqrt{360A}}{\pi\theta}$

(C) $r = \sqrt{A - \frac{\pi\theta}{360}}$

(D) $r = \sqrt{360A - \pi\theta}$

Section II

78 marks

Attempt Questions 23–28

Allow about 2 hours for this section

Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

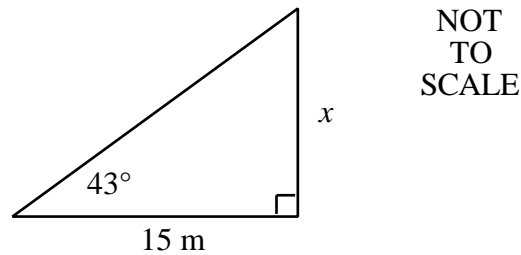
All necessary working should be shown in every question.

Question 23 (13 marks) Use a SEPARATE writing booklet.

Marks

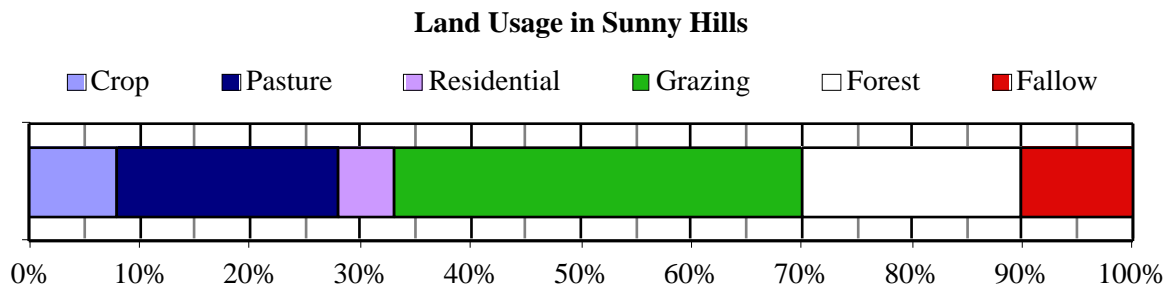
(a)

2



Find the value of x in the diagram above. Give your answer correct to 1 decimal place.

(b)



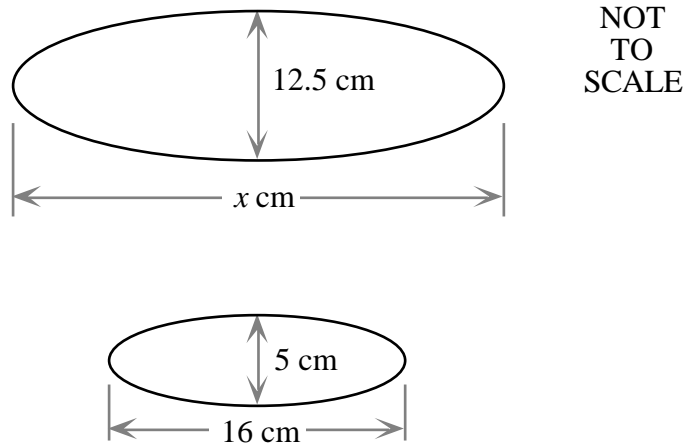
The divided bar graph above shows how land in the rural district of Sunny Hills is used for different purposes.

- (i) The district of Sunny Hills covers an area of 65 000 hectares. What area of land is dedicated to forests? **1**
- (ii) Phillip is on the local council and wishes to represent this data in another form. Which type of graph could he use? Justify your answer. **2**

Question 23 continues on Page 13

Question 23 (continued)**Marks**

(c)



The diagram above shows two similar ellipses.

- | | | |
|------|--|----------|
| (i) | Find the value of x . | 1 |
| (ii) | Find the area of the smaller ellipse. Give your answer correct to 1 decimal place. | 2 |
- (d) An investor decides to purchase 1000 shares in Telstra at a price of \$3.98 per share. There is a brokerage fee of 1% of the value of any purchase or sale of shares.
- | | | |
|-------|---|----------|
| (i) | Find the total cost of purchasing these shares. | 2 |
| (ii) | The company releases its dividend at 20¢ per share. How much will this investor receive in dividends? | 1 |
| (iii) | Calculate the dividend yield. Express your answer as a percentage, correct to 2 decimal places. | 2 |

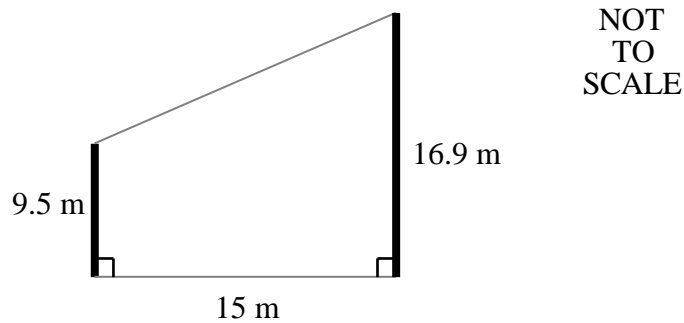
End of Question 23

Question 24 (13 marks) Use a SEPARATE writing booklet.

Marks

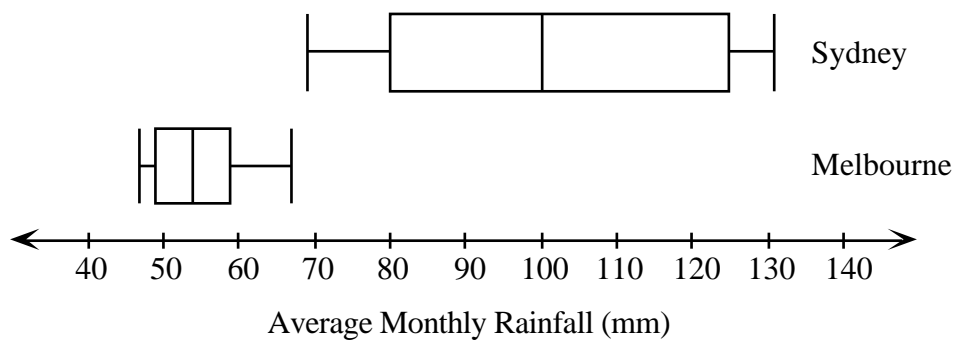
(a)

2



Two posts are 15 m apart. The posts are 16.9 m and 9.5 m high. Find the shortest length of string which could be used to join the tops of the two posts. Give your answer correct to the nearest metre.

- (b) A class studying statistics investigated the climatic data for Melbourne and Sydney. They found the average monthly rainfall in each of the two cities for every month of the year. Their results are summarised in the box-and-whisker plots below.



- (i) Which city received the least amount of rainfall? **1**
- (ii) What is the median average monthly rainfall for Sydney? **1**
- (iii) Compare and contrast the two data sets by examining the shape and skewness of the distribution and the measures of location and spread. **3**

Question 24 continues on Page 15

Question 24 (continued)**Marks**

- (c) In the forest region of Sunny Hills a number of rare native mammals have been sighted recently. The local ranger decides to investigate this using the capture-recapture method. She captures 5 of these mammals one night, tags them and releases them. The following night she returns and captures another 10 and notices that 2 of these are tagged. Find a reasonable estimate for the total number of these mammals in the forest region of Sunny Hills. **2**
- (d) Kurt is intending to take out a reducible balance loan for \$45 000. He can afford to repay the loan with monthly repayments of \$512. Interest will be charged at a rate of 14.4% p.a.
- (i) Show that the interest charged at the end of the first month is \$540. **1**
- (ii) How much will Kurt owe on the loan at the end of the first month, after the first repayment is made? **1**
- (iii) Based on the information in the question and your calculations in (i) and (ii), would you advise Kurt to take out this loan? Justify your decision. **2**

End of Question 24

Question 25 (13 marks) Use a SEPARATE writing booklet.

Marks

- (a) At the Year 9 Activity Camp students must choose one activity from each of the three sessions. The possible activities are listed in the table below:

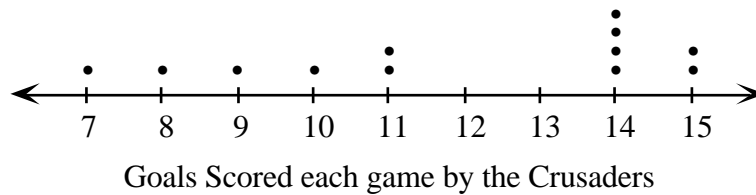
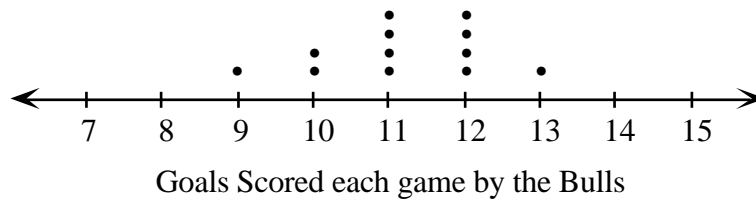
SESSION 1	SESSION 2	SESSION 3
Archery	Horse riding	Cooking
Rock climbing	Fishing	Abseiling
Bush walking	Canoeing	Sailing
Gymnastics		Swimming
Obstacle course		Flying fox
		Orienteering

- (i) Over one day, how many possible activity combinations are possible? **1**
- (ii) What is the probability that a person chooses archery, fishing and sailing? **1**
- (iii) What is the probability that a person does **not** choose canoeing or abseiling? **2**
- (b) The lengths of Atlantic Salmon at the Sunny Hills fish farm are found to be normally distributed with a mean length of 520 mm and a standard deviation of 30 mm.
- (i) Find the expected percentage of fish with lengths between 490 mm and 550 mm. **1**
- The fish farm rejects fish with a length which is more than two standard deviations below the mean length.
- (ii) What is the minimum length of salmon which the fish farm will accept? **1**
- (iii) What percentage of fish would you expect to be rejected by the fish farm? **1**

Question 25 continues on Page 17

Question 25 (continued)**Marks**

- (c) The Bulls and the Crusaders are two teams in a local district Australian Rules Football competition. At the end of the season they recorded the number of goals that they kicked in each game. The results are shown in the dot plots below:



- (i) The median number of goals kicked by the Bulls is 11, with a standard deviation of 1.1, correct to 1 decimal place. Determine the median number of goals and the standard deviation for the Crusaders. **2**
- (ii) Which team scored the greater number of goals? Support your answer with mathematical reasoning. **2**
- (iii) Which team is the more consistent scorer of goals? Use statistics to support your opinion. **2**

End of Question 25

Question 26 (13 marks) Use a SEPARATE writing booklet.

Marks

- (a) Young's rule can be used to calculate a child's medicine dose. Young's rule is:

$$C = \frac{nA}{n+12}$$

where C is the child's dose (in mL), n is the age of the child (in years) and A is the adult dose (in mL).

For a particular medicine, the adult dose is 24 mL.

- (i) What is the dose for a 4 year old child? **1**
- (ii) Find the age at which the dose is double that of the dose for a 4 year old. **3**
- (b) Carol wants to invest \$150 at the end of every month for the next 5 years so that her son, who is currently in Year 8, will have some money to help finance his university education.
- (i) Carol can invest at 5.4% p.a., compounded monthly. Show that her investment will grow to \$10 305.71 after 5 years. **2**
- (ii) If Carol could invest a single lump sum instead of making monthly contributions, what lump sum should she invest now to reach the same investment target over the same period of time? **2**
- (c) Magadan, Russia and Sydney, Australia have position co-ordinates ($59^\circ\text{N}, 151^\circ\text{E}$) and ($34^\circ\text{S}, 151^\circ\text{E}$) respectively.
- (i) Show that the angular distance between these two cities is 93° . **1**
- (ii) Find the distance, in nautical miles, between Magadan and Sydney. **1**
- (iii) Raymond is on a plane which flies at 360 knots on a direct path from Magadan to Sydney. How long will it take to complete the journey? **1**
- (iv) Raymond's aunt, Erin, is in Lusaka, Zambia, which is located at ($15^\circ\text{S}, 28^\circ\text{E}$). Erin wants to call Raymond for his birthday. If Raymond can take the call at 5 pm Sydney time, at what time will Erin need to make the call? **2**

End of Question 26

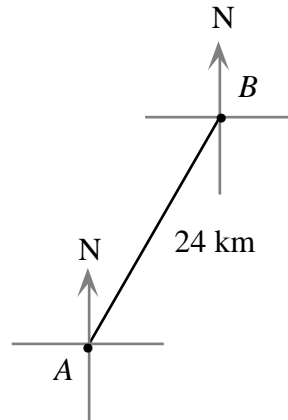
Question 27 (13 marks) Use a SEPARATE writing booklet.

Marks

(a) Solve: $\frac{4y-2}{2} + \frac{3y+4}{3} = 6$

3

- (b) Joelle sets out from her base camp at A on a bearing of 027° for 24 km to point B where she makes her camp.



- (i) How far due east of base camp A is Joelle when she reaches point B ? Give your answer correct to 1 decimal place.

1

The next day Joelle sets out from point B on a bearing of 100° for 15 km to point C .

- (ii) Copy the diagram above into your writing booklet. Complete the diagram, clearly showing all information about the journey from A to B and the journey from B to C .

1

- (iii) Explain why $\angle ABC = 107^\circ$.

1

- (iv) What is the length of the direct route from point C back to base camp at A ? Give your answer correct to the nearest kilometre.

3

- (c) Each time I dry my T-shirt in the clothes dryer it shrinks by 3%. How many times can the shirt be dried in the clothes dryer before it is less than 80% of its original size?

2

- (d) In a television game show, Carlos must choose one case out of the five cases on display. The cases contain the amounts \$15 000, \$10 000, \$1000, \$50 and \$1. It is not known which amount is in which case.

2



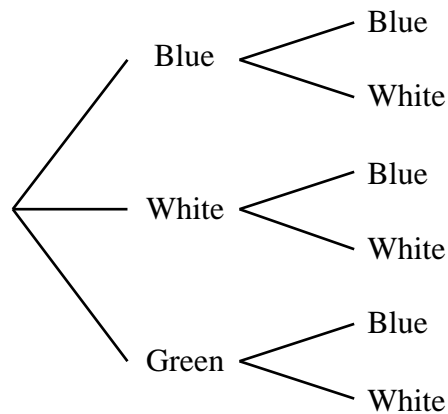
Calculate Carlos' financial expectation.

End of Question 27

Question 28 (13 marks) Use a SEPARATE writing booklet.**Marks**

- (a) Two bags each contain five coloured marbles. The first bag has 2 blue marbles, 2 green marbles and 1 white marble. The second bag has 3 blue marbles and 2 white marbles. One marble is chosen from each bag.

- (i) Copy the following tree diagram into your writing booklet. Complete the tree diagram by writing the correct probability on each branch. 2



- (ii) Calculate the probability of drawing at least one white marble. 2

- (b) The following table gives the payment per period which is required for an ordinary annuity to reach a future value of \$1 at different interest rates and different periods of time.

Periodic Payment for an Ordinary Annuity with a Future Value of \$1

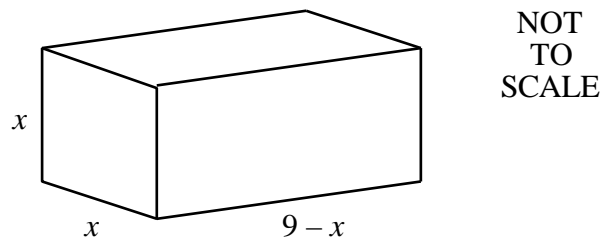
Number of Periods	Interest Rate (% per period)					
	2%	4%	6%	8%	10%	12%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	0.4950	0.4902	0.4854	0.4808	0.4762	0.4717
3	0.3268	0.3203	0.3141	0.3080	0.3021	0.2963
4	0.2426	0.2355	0.2286	0.2219	0.2155	0.2092
5	0.1922	0.1846	0.1774	0.1705	0.1638	0.1574

- (i) Use this table to determine the payment required at the end of each year, so that the annuity is worth \$18 000 after 3 years when interest is paid at 8% p.a. 1
- (ii) Calculate the interest earned in this annuity. 2

Question 28 continues on Page 21

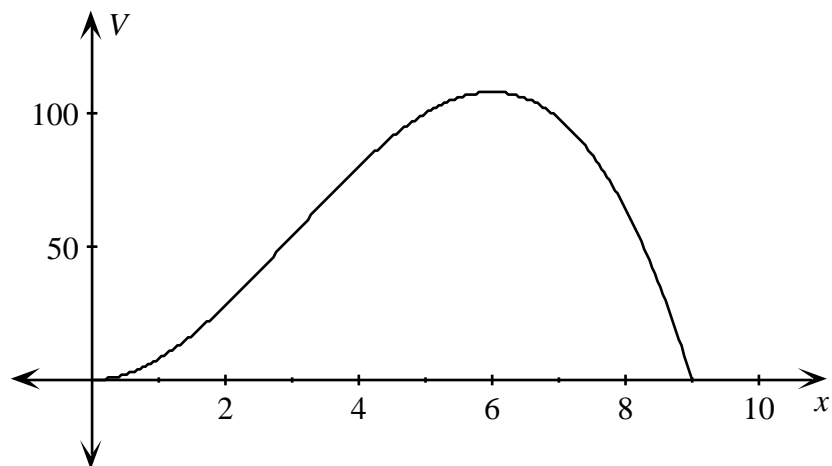
Question 28 (continued)**Marks**

- (c) A packing carton is to be constructed as shown in the diagram below. All dimensions are in centimetres.



- (i) Show that the surface area (S) of the carton is $S = 36x - 2x^2$. **2**
- (ii) Explain why the formula is only valid for values of x from $x = 0$ to $x = 9$. **1**

The diagram below shows the graph of the volume (V) of the carton for values of x from $x = 0$ to $x = 9$. The dimensions of the carton are chosen so that its volume is a maximum.



- (iii) Find the value of x for which the carton has maximum volume. **1**
- (iv) Find the surface area of the carton when it has maximum volume. **2**

END OF PAPER