

Instructions for multiple-choice questions in Section I of GENERAL MATHEMATICS paper

Instructions for answering multiple-choice questions

- Use the multiple-choice answer sheet.
- 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:

A B C D
 correct
 ↙

2007 Higher School Certificate Examination Paper General Mathematics

Section I

22 marks

Attempt Questions 1–22

Allow about 30 minutes for this section

- What is 0.000 000 326 mm expressed in scientific notation?
 (A) 0.326×10^{-6} mm (B) 3.26×10^{-7} mm
 (C) 0.326×10^6 mm (D) 3.26×10^7 mm
- Each student in a class is given a packet of lollies. The teacher records the number of red lollies in each packet using a frequency table.

Number of red lollies in each packet	Frequency
0	2
1	4
2	2
3	7
4	3
5	1

What is the relative frequency of a packet of lollies containing more than three red lollies?

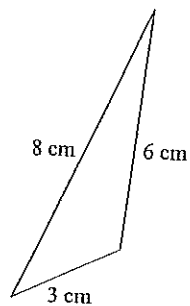
- (A) $\frac{4}{19}$ (B) $\frac{4}{15}$ (C) $\frac{11}{19}$ (D) $\frac{11}{15}$

- Joe is about to go on holidays for four weeks. His weekly salary is \$280 and his holiday loading is $17\frac{1}{2}\%$ of four weeks pay.

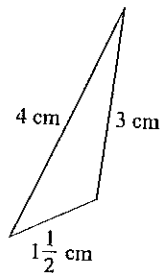
What is Joe's total pay for the four weeks holiday?

- (A) \$196 (B) \$329 (C) \$1169 (D) \$1316

4 What scale factor has been used to transform Triangle A to Triangle B?



Triangle A

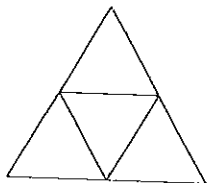


Triangle B

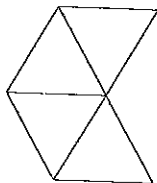
NOT TO SCALE

- (A) $\frac{1}{2}$ (B) $\frac{3}{4}$ (C) 2 (D) 3

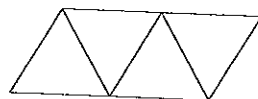
5 Which of the following nets can be folded to form a triangular pyramid?



I



II



III

- (A) I only (B) I and II
(C) I and III (D) II and III

6 The price of a CD is \$22.00, which includes 10% GST.

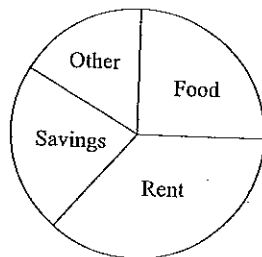
What is the amount of GST included in this price?

- (A) \$2.00 (B) \$2.20 (C) \$19.80 (D) \$20.00

7 Margaret has a weekly income of \$900 and allocates her money according to the budget shown in the sector graph.

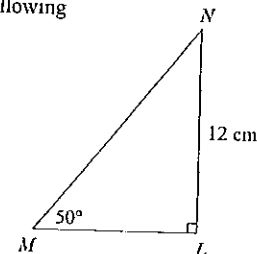
How long will it take Margaret to save \$3600?

- (A) 4 weeks
(B) 5 weeks
(C) 16 weeks
(D) 18 weeks



8 What is the length of the side MN in the following triangle, correct to two decimal places?

- (A) 9.19 cm
(B) 10.07 cm
(C) 15.66 cm
(D) 18.67 cm



NOT TO SCALE

9 Which of the following would be most likely to have a positive correlation?

- (A) The population of a town and the number of schools in that town
(B) The price of petrol per litre and the number of litres of petrol sold
(C) The hours training for a marathon and the time taken to complete the marathon
(D) The number of dogs per household and the number of televisions per household

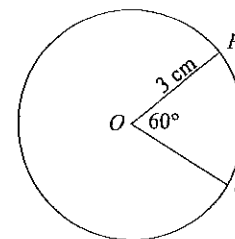
10 Each time she throws a dart, the probability that Mary hits the dartboard is $\frac{2}{7}$.

She throws two darts, one after the other.

What is the probability that she hits the dartboard with both darts?

- (A) $\frac{1}{21}$ (B) $\frac{4}{49}$ (C) $\frac{2}{7}$ (D) $\frac{4}{7}$

11 P and Q are points on the circumference of a circle with centre O and radius 3 cm.



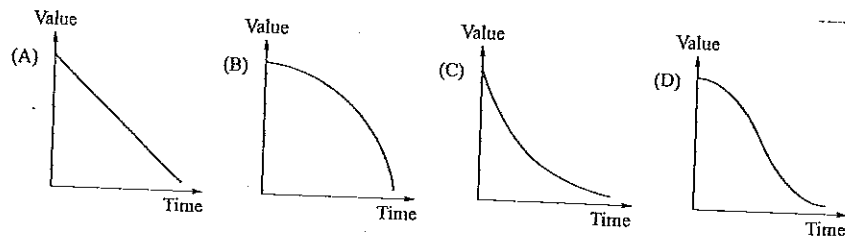
NOT TO SCALE

What is the length of the arc PQ , in centimetres, correct to three significant figures?

- (A) 1.57 (B) 3.14 (C) 4.71 (D) 18.8

- 12 The value of a car is depreciated using the declining balance method.

Which graph best illustrates the value of the car over time?



- 13 The positions of President, Secretary and Treasurer of a club are to be chosen from a committee of 5 people.

In how many ways can the three positions be chosen?

- (A) 3 (B) 10 (C) 60 (D) 125

- 14 Which expression is equivalent to $3x^2(x + 8) + x^2$?

- (A) $3x^3 + x^2 + 8$ (B) $3x^3 + 25x^2$
 (C) $4x^3 + 32x^2$ (D) $24x^3 + x^2$

- 15 If pressure (p) varies inversely with volume (V), which formula correctly expresses p in terms of V and k , where k is a constant?

- (A) $p = \frac{k}{V}$ (B) $p = \frac{V}{k}$ (C) $p = kV$ (D) $p = k + V$

- 16 Leanne copied a two-way table into her book.

	Male	Female	Total
Full-time work	279	356	635
Part-time work	187	439	716
Totals	466	885	1351

Leanne made an error in copying one of the values in the shaded section of the table.

- Which value has been incorrectly copied?
 (A) The number of males in full-time work
 (B) The number of males in part-time work
 (C) The number of females in full-time work
 (D) The number of females in part-time work

- 17 Ms Wigginson decided to survey a sample of 10% of the students at her school.

The school enrolment is shown in the table.

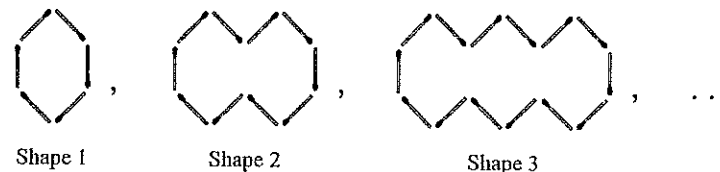
Year	7	8	9	10	11	12	Total
Number of students	225	232	233	230	150	130	1200

She surveyed the same number of students in each year group.

How would the numbers of students surveyed in Year 10 and Year 11 have changed if Ms Wigginson had chosen to use a stratified sample based on year groups?

- (A) Increased in both Year 10 and Year 11
 (B) Decreased in both Year 10 and Year 11
 (C) Increased in Year 10 and decreased in Year 11
 (D) Decreased in Year 10 and increased in Year 11

- 18 Chris started to make this pattern of shapes using matchsticks.



If the pattern of shapes is continued, which shape would use exactly 486 matchsticks?

- (A) Shape 96 (B) Shape 97 (C) Shape 121 (D) Shape 122

- 19 Which of the following correctly expresses T as the subject of $B = 2\pi \left(R + \frac{T}{2} \right)$?

- (A) $T = \frac{B}{\pi} - 2R$ (B) $T = \frac{B}{\pi} - R$
 (C) $T = 2R - \frac{B}{\pi}$ (D) $T = \frac{B}{4\pi} - \frac{R}{2}$

- 20 Kim lives in Perth (32°S, 115°E). He wants to watch an ice hockey game being played in Toronto (44°N, 80°W) starting at 10.00 pm on Wednesday.

What is the time in Perth when the game starts?

- (A) 9.00 am on Wednesday (B) 7.40 pm on Wednesday
 (C) 12.20 am on Thursday (D) 11.00 am on Thursday

21 This set of data is arranged in order from smallest to largest.

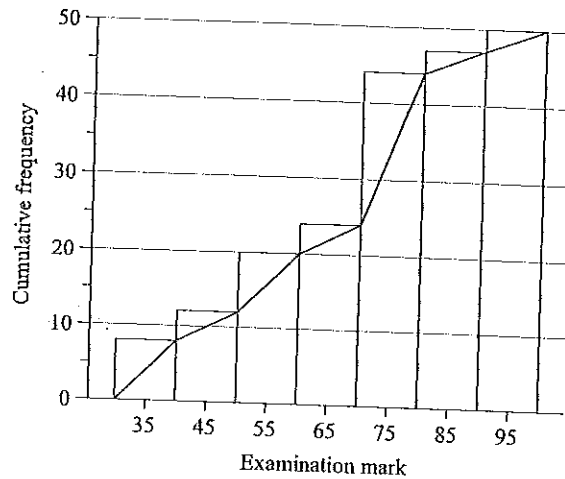
5, 6, 11, x , 13, 18, 25

The range is six less than twice the value of x .

Which one of the following is true?

- (A) The median is 12 and the interquartile range is 7.
- (B) The median is 12 and the interquartile range is 12.
- (C) The median is 13 and the interquartile range is 7.
- (D) The median is 13 and the interquartile range is 12.

22 A set of examination results is displayed in a cumulative frequency histogram and polygon (ogive).



Sanath knows that his examination mark is in the 4th decile.

Which of the following could have been Sanath's examination mark?

- (A) 37
- (B) 57
- (C) 67
- (D) 77

Section II

78 marks

Attempt Questions 23–28

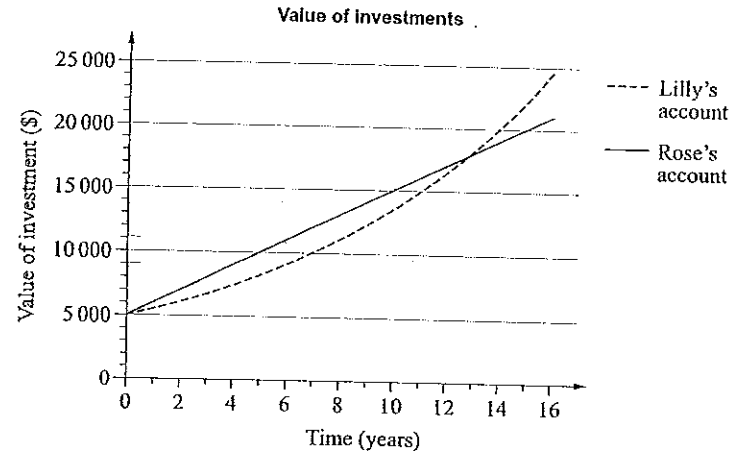
Allow about 2 hours for this section

Question 23 (13 marks)

Marks

(a) Lilly and Rose each have money to invest and choose different investment accounts.

The graph shows the values of their investments over time.

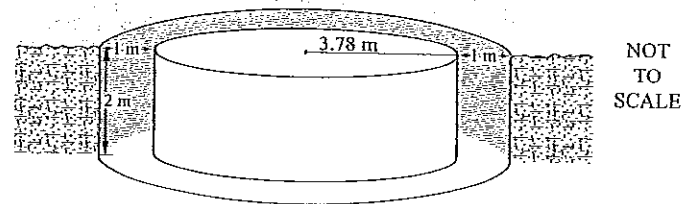


- (i) How much was Rose's original investment? 1
- (ii) At the end of 6 years, which investment will be worth the most and by how much? 2
- (iii) Lilly's investment will reach a value of \$20 000 first. 1

How much longer will it take Rose's investment to reach a value of \$20 000?

(b) A cylindrical water tank, of height 2 m, is placed in the ground at a school.

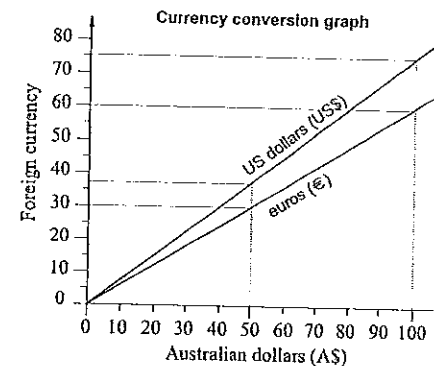
The radius of the tank is 3.78 metres. The hole is 2 metres deep. When the tank is placed in the hole there is a gap of 1 metre all the way around the side of the tank.



- (i) When digging the hole for the water tank, what volume of soil was removed? Give your answer to the nearest cubic metre. 3
- (ii) Sprinklers are used to water the school oval at a rate of 7500 litres per hour. The water tank holds 90 000 litres when full. For how many hours can the sprinklers be used before a full tank is emptied? 1
- (iii) Water is to be collected in the tank from the roof of the school hall, which has an area of 400 m². During a storm, 20 mm of rain falls on the roof and is collected in the tank. How many litres of water were collected? 2
- (c) A scientific study uses the 'capture-recapture' technique. In the first stage of the study, 24 crocodiles were caught, tagged and released. Later, in the second stage of the study, some crocodiles were captured from the same area. Eighteen of these were found to be tagged, which was 40% of the total captured during the second stage.
- (i) How many crocodiles were captured in total during the second stage of the study? 1
- (ii) Calculate the estimate for the total population of crocodiles in this area. 2

Question 24 (13 marks)

- (a) Consider the following set of scores:
3, 5, 5, 6, 8, 8, 9, 10, 10, 50.
- (i) Calculate the mean of the set of scores. 1
- (ii) What is the effect on the mean and on the median of removing the outlier? 2
- (b) The distance in kilometres (D) of an observer from the centre of a thunderstorm can be estimated by counting the number of seconds (t) between seeing the lightning and first hearing the thunder. 1
- Use the formula $D = \frac{t}{3}$ to estimate the number of seconds between seeing the lightning and hearing the thunder if the storm is 1.2 km away.
- (c) Sandy travels to Europe via the USA. She uses this graph to calculate her currency conversions.



- (i) After leaving the USA she has US\$150 to add to the A\$600 that she plans to spend in Europe. She converts all of her money to euros. How many euros does she have to spend in Europe? 3
- (ii) If the value of the euro falls in comparison to the Australian dollar, what will be the effect on the gradient of the line used to convert Australian dollars to euros? 1
- (d) Barry constructed a back-to-back stem-and-leaf plot to compare the ages of his students.

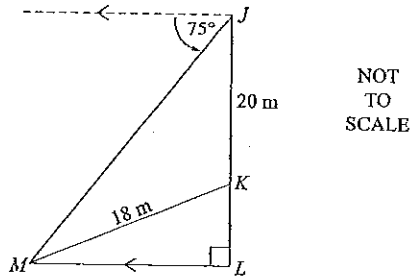
Ages of students attending Barry's Ballroom Dancing Studio

Females		Males
9	1	1 2 3
7	2	0 2 2 2 4 5
5	3	0 0 1 7
5	2	4 6 7
3	2	0 5 2
4	4	2 1 6 4 4

- (i) Write a brief statement that compares the distribution of the ages of males and females from this set of data. 1
- (ii) What is the mode of this set of data? 1
- (iii) Liam decided to use a grouped frequency distribution table to calculate the mean age of the students at Barry's Ballroom Dancing Studio. For the age group 30–39 years, what is the value of the product of the class centre and the frequency? 2
- (iv) Liam correctly calculated the mean from the grouped frequency distribution table to be 39.5. Caitlyn correctly used the original data in the back-to-back stem-and-leaf plot and calculated the mean to be 38.2. What is the reason for the difference in the two answers? 1

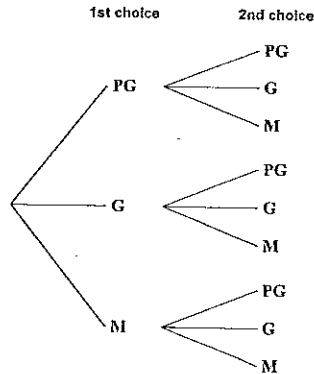
Question 25 (13 marks)

- (a) Give an example of an event that has a probability of exactly $\frac{3}{4}$. 1
- (b) The angle of depression from J to M is 75° . The length of JK is 20 m and the length of MK is 18 m. 3



Copy or trace this diagram into your writing booklet and calculate the angle of elevation from M to K . Give your answer to the nearest degree.

- (c) In a stack of 10 DVDs, there are 5 rated PG, 3 rated G and 2 rated M.
- (i) A DVD is selected at random. What is the probability that it is rated M? 1
- (ii) Grant chooses two DVDs at random from the stack. Copy or trace the tree diagram into your writing booklet. Complete your tree diagram by writing the correct probability on each branch. 2



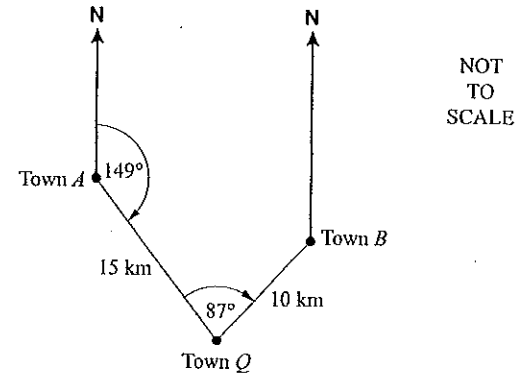
- (iii) Calculate the probability that Grant chooses two DVDs with the same rating. 2
- (d) The results of two class tests are normally distributed. The means and standard deviations of the tests are displayed in the table.

	Test 1	Test 2
Mean	60	58
Standard deviation	6.2	6.0

- (i) Stuart scored 63 in Test 1 and 62 in Test 2. He thinks that he has performed better in Test 1. Do you agree? Justify your answer using appropriate calculations. 2
- (ii) If 150 students sat for Test 2, how many students would you expect to have scored less than 64? 2

Question 26 (13 marks)

- (a) The diagram shows information about the locations of towns A , B and Q .



- (i) It takes Elina 2 hours and 48 minutes to walk directly from Town A to Town Q . Calculate her walking speed correct to the nearest km/h. 1
- (ii) Elina decides, instead, to walk to Town B from Town A and then to Town Q . Find the distance from Town A to Town B . Give your answer to the nearest km. 2
- (iii) Calculate the bearing of Town Q from Town B . 1
- (b) Myles is in his third year as an apprentice film editor.
- (i) Myles purchased film-editing equipment for \$5000. After 3 years it has depreciated to \$3635 using the straight-line method. Calculate the rate of depreciation per year as a percentage. 2
- (ii) Myles earns \$800 per week. Calculate his taxable income for this year if the only allowable deduction is the amount of depreciation of his film-editing equipment in the third year of use. 1
- (iii) Use this tax table to calculate Myles's tax payable. 2

Taxable income (\$)	Tax payable
\$0 – \$10 000	Nil
\$10 001 – \$28 000	Nil plus 25 cents for each \$1 over \$10 000
\$28 001 – \$50 000	\$4500 plus 30 cents for each \$1 over \$28 000
\$50 001 – \$100 000	\$11 100 plus 40 cents for each \$1 over \$50 000
over \$100 000	\$31 100 plus 60 cents for each \$1 over \$100 000

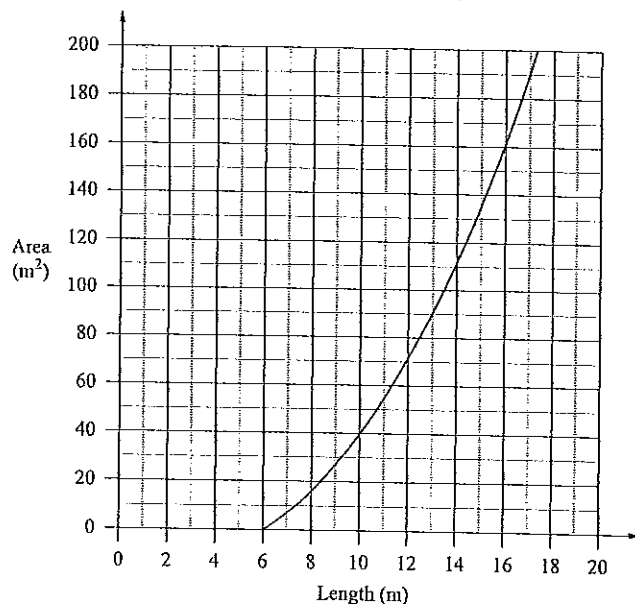
- (c) When Mina was born, and on every birthday after that, her grandparents deposited \$100 into an investment account. The interest rate on the account is fixed at 6% per annum, compounded annually. 4

Write an expression for the value of the investment immediately after her grandparents deposit \$100 on her 21st birthday and calculate the total interest earned on this investment.

Question 27 (13 marks)

- (a) A rectangular playing surface is to be constructed so that the length is 6 metres more than the width. 1
- (i) Give an example of a length and width that would be possible for this playing surface. 1
- (ii) Write an equation for the area (A) of the playing surface in terms of its length (l). 1

A graph comparing the area of the playing surface to its length is shown.



- (iii) Why are lengths of 0 metres to 6 metres impossible? 1
- (iv) What would be the dimensions of the playing surface if it had an area of 135 m²? 2

Company A constructs playing surfaces.

Company A charges	
Size of playing surface	Charges
Up to and including 150 m ²	\$50 000
Greater than 150 m ²	\$50 000 plus a rate of \$300 per square metre for the area in excess of 150 m ²

- (v) Draw a graph to represent the cost of using Company A to construct all playing surface sizes up to and including 200 m². 2

Use the horizontal axis to represent the area and the vertical axis to represent the cost.

- (vi) Company B charges a rate of \$360 per square metre regardless of size. 1
- Which company would charge less to construct a playing surface with an area of 135 m²? Justify your answer with suitable calculations.

- (b) A clubhouse uses four long-life light globes for five hours every night of the year. The purchase price of each light globe is \$6.00 and they each cost \$ d per hour to run. 2
- (i) Write an equation for the total cost ($\$c$) of purchasing and running these four light globes for one year in terms of d . 2
- (ii) Find the value of d (correct to three decimal places) if the total cost of running these four light globes for one year is \$250. 1
- (iii) If the use of the light globes increases to ten hours per night every night of the year, does the total cost double? Justify your answer with appropriate calculations. 1
- (iv) The manufacturer's specifications state that the expected life of the light globes is normally distributed with a standard deviation of 170 hours. 1
- What is the mean life, in hours, of these light globes if 97.5% will last up to 5000 hours?

Question 28 (13 marks)

- (a) Two unbiased dice, A and B , with faces numbered 1, 2, 3, 4, 5 and 6 are rolled. The numbers on the uppermost faces are noted. This table shows all the possible outcomes.

		Die A					
		1	2	3	4	5	6
Die B	1	1,1	1,2	1,3	1,4	1,5	1,6
	2	2,1	2,2	2,3	2,4	2,5	2,6
	3	3,1	3,2	3,3	3,4	3,5	3,6
	4	4,1	4,2	4,3	4,4	4,5	4,6
	5	5,1	5,2	5,3	5,4	5,5	5,6
	6	6,1	6,2	6,3	6,4	6,5	6,6

A game is played where the difference between the highest number showing and the lowest number showing on the uppermost faces is calculated.

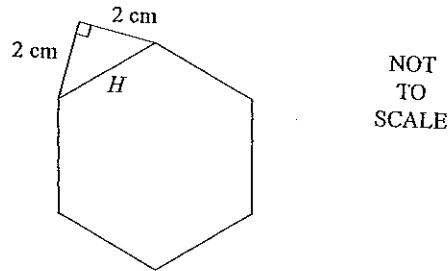
- (i) What is the probability that the difference between the numbers showing on the uppermost faces of the two dice is one? 1

In the game, the following applies.

Difference	Result
0	Win \$3.50
1	Lose \$5
2, 3, 4 or 5	Win \$2.80

- (ii) What is the financial expectation of the game? 3
 (iii) If Jack pays \$1 to play the game, does he expect a gain or a loss, and how much will it be? 1

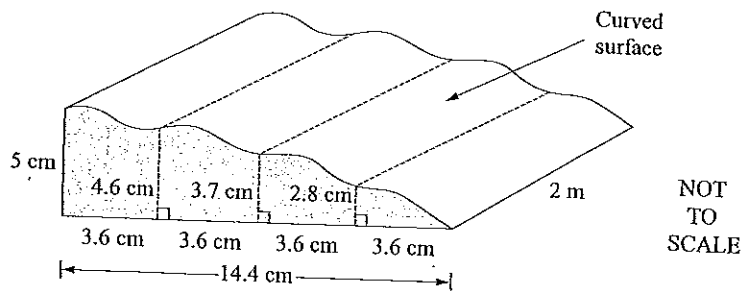
- (b) This shape is made up of a right-angled triangle and a regular hexagon. 3



The area of a regular hexagon can be estimated using the formula $A = 2.598H^2$ where H is the side-length.

Calculate the total area of the shape using this formula.

- (c) A piece of plaster has a uniform cross-section, which has been shaded, and has dimensions as shown.



- (i) Use two applications of Simpson's rule to approximate the area of the cross-section. 3
 (ii) The total surface area of the piece of plaster is 7480.8 cm^2 . 2
 Calculate the area of the curved surface as shown on the diagram.

End of paper

2007 Higher School Certificate Solutions General Mathematics

SECTION 1 Summary

1 B	7 D	13 C	18 C
2 A	8 C	14 B	29 A
3 D	9 A	15 A	20 D
4 A	10 B	16 D	21 D
5 C	11 B	17 C	22 B
6 A	12 C		

- 1 (B) $0.000\ 000\ 326 = 3.26 \times 10^{-7}$.
 2 (A) Total frequency = $2 + 4 + 2 + 7 + 3 + 1 = 19$
 Total packets containing more than 3 red = $3 + 1 = 4$
 \therefore Relative frequency = $\frac{4}{19}$.
 3 (D) 4 weeks' pay = $\$280 \times 4 = \1120
 Holiday loading = $\frac{17.5}{100} \times \$1120 = \$196$
 \therefore Total holiday pay = $\$1120 + \$196 = \$1316$.

4 (A) Scale factor = $\frac{4}{8}$ or $\frac{3}{6}$ or $\frac{1\frac{1}{2}}{3}$
 $= \frac{1}{2}$.

- 5 (C) I and III.

6 (A) 110% of original price = \$22
 10% of original price = $\$22 \div 11 = \2
 \therefore GST = \$2.

7 (D) Sector angle for savings = 80°
 (measured by protractor)
 \therefore Weekly savings = $\frac{80}{360} \times \$900 = \200
 \therefore Time to save = $\$3600 \div \$200 = 18$ weeks.

8 (C) $\sin 50^\circ = \frac{12}{MN}$
 $MN \times \sin 50^\circ = 12$
 $\therefore MN = \frac{12}{\sin 50^\circ} = 15.6648\dots \approx 15.66 \text{ cm (to 2 d.p.)}$.

- 9 (A) As the population of a town increases, the number of schools increases. (Note: A positive correlation means that both variables increase or both variables decrease.)
 (B) People will continue to buy the amount of petrol they need, irrespective of the price.
 (C) With more training the time to complete the marathon will decrease.
 (D) There is no relationship between these two variables.

10 (B) $P(2 \text{ hits}) = \frac{2}{7} \times \frac{2}{7}$
 $= \frac{4}{49}$

11 (B) Arc length $= \frac{\theta}{360} \times 2\pi r$
 Arc $PQ = \frac{60}{360} \times 2 \times \pi \times 3$
 $= 3.1415\dots$
 $\div 3.14 \text{ cm (to 3 sig. fig.)}$

12 (C) The correct graph must be a hyperbolic function, with the graph approaching but not touching the Time axis.

13 (C) 3 positions:

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 President Secretary Treasurer
 Number of arrangements
 $= 5 \times 4 \times 3$
 $= 60$.

14 (B) $3x^2(x+8) + x^2$
 $= 3x^3 + 24x^2 + x^2$
 $= 3x^3 + 25x^2$

15 (A) $p \propto \frac{1}{V}$
 $p = \frac{k}{V}$

16 (D)

Male	Female	Total
279	+ 359	635
187	+ 439	626
466	795	

The numbers in bold type do not match the figures in the table.
 \therefore The number of females in part-time work has been copied incorrectly.

17 (C) Sample size $= 10\% \times 1200$
 $= 120$ students
 Miss Wigginson surveyed the same number of students in each year group.
 \therefore There were $120 \div 6 = 20$ students from each year group.

A stratified sample would be:
 $\frac{230}{1200} \times 120 \div 23$ Year 10 students
 $\frac{150}{1200} \times 120 \div 15$ Year 11 students
 \therefore There would be more Year 10 students and fewer Year 11 students than in the original sample.

18 (C)

<i>S</i>	Shape	1	2	3	4	5
<i>M</i>	Number of matchsticks	6	10	14	18	22

$\underbrace{\quad\quad\quad}_{+4}$
 $\underbrace{\quad\quad\quad}_{+4}$
 $\underbrace{\quad\quad\quad}_{+4}$
 $\underbrace{\quad\quad\quad}_{+4}$

The value of *M* increases by 4.
 The formula is:
 $M = 4S + 2$
 When $M = 486$
 $486 = 4S + 2$
 $484 = 4S$
 $S = \frac{484}{4}$
 $= 121$.

\therefore Shape 121 would use 486 matchsticks.

19 (A) $B = 2\pi \left(R + \frac{T}{2} \right)$
 $\frac{B}{2\pi} = R + \frac{T}{2}$
 $\frac{B}{\pi} = 2R + T$
 $\therefore T = \frac{B}{\pi} - 2R$

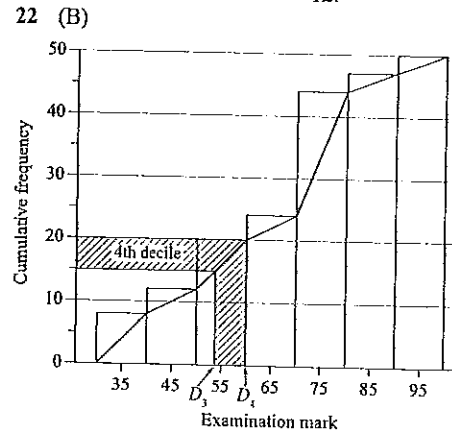
20 (D)

	Toronto	Perth	
W	80°	0°	115°
	E		

Difference in longitude $= 80^\circ + 115^\circ$
 $= 195^\circ$
 Time difference $= 195 \times 4$
 $= 780$ minutes
 $= 13$ hours

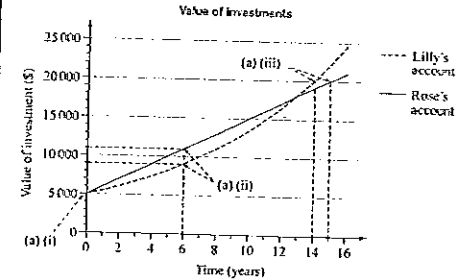
Toronto time = 10 pm Wednesday
 Perth is 13 hours ahead.
 \therefore Perth time = 10 pm Wednesday + 13 hours
 $= 11$ am Thursday.

21 (D) Range $= 25 - 5$
 $= 20$
 Range $= 2x - 6$
 $\therefore 2x - 6 = 20$
 $2x = 26$
 $x = 13$
 5 6 11 13 18 25
 ↓ ↓ ↓
 Q_1 Median Q_3
 Interquartile range $= Q_3 - Q_1$
 $= 18 - 6$
 $= 12$.



From cumulative frequency axis, total frequency = 50. Therefore deciles occur at $\frac{1}{10} \times 50 = 5$ unit intervals.
 The 4th decile is from D_3 to D_4 .
 From the polygon, $D_3 \div 54$, $D_4 \div 60$.
 Since Sanath's examination mark is in the 4th decile, it is between 54 and 60.
 \therefore The mark was 57.

Question 23



- (a) (i) Rose's original investment = \$5000
 (ii) Rose's investment after 6 years = \$11000
 Lilly's investment after 6 years = \$9000
 \therefore Rose's investment will be worth \$2000 more than Lilly's.
 (iii) Lilly's investment reaches \$20 000 after 14 years.
 Rose's investment reaches \$20 000 after 15 years
 \therefore It will take Rose's investment 1 year longer to reach \$20 000.

(b) (i) $V = \pi r^2 h$
 Radius of hole $= 3.78 + 1$
 $= 4.78$ m
 \therefore Volume of soil $= \pi \times 4.78^2 \times 2$
 $= 143.5607 \dots$
 $\div 144 \text{ m}^3$ (to the nearest m^3).

(ii) Time $= 90\,000 \div 7500$
 $= 12$ hours.

(iii) $V = Ah$
 where $A = 400 \text{ m}^2$,
 $h = 20 \text{ mm} = 0.02 \text{ m}$
 \therefore Volume of water collected $= 400 \times 0.02$
 $= 8 \text{ m}^3$
 \therefore 8000 L of water was collected (1 $\text{m}^3 = 1000 \text{ L}$).

- (c) (i) 40% of second stage total
 = 18 crocodiles
 1% = 18 ÷ 40
 100% = 18 ÷ 40 × 100
 = 45
 ∴ 45 crocodiles were captured in the second stage.

- (ii) Let the estimate for the total population of crocodiles be E .

$$\frac{18}{45} = \frac{24}{E}$$

$$18E = 24 \times 45$$

$$= 1080$$

$$\therefore E = 60$$

∴ The estimate for the total population of crocodiles is 60.

Question 24

(a) (i) Mean = $\frac{\text{sum of scores}}{\text{total number of scores}}$

$$= \frac{114}{10}$$

$$= 11.4$$

- (ii) If the outlier, 50, is removed,

$$\text{mean} = \frac{64}{9}$$

$$= 7.1$$

Media before outlier is removed:

3 5 5 6 (8 8) 9 10 10 50

$$\frac{8+8}{2} = 8$$

Median after outlier is removed:

3 5 5 6 (8) 8 9 10 10

∴ The mean will decrease and the median will remain the same.

(b) $D = \frac{t}{3}$

When $D = 1.2$ km,

$$1.2 = \frac{t}{3}$$

$$t = 3 \times 1.2$$

$$= 3.6 \text{ s.}$$

- (c) (i) **METHOD 1**
 From the conversion graph,
 US\$75 = A\$100
 US\$1 = A\$1.33 ...
 US\$150 = A\$200
 ∴ Total amount = A\$(200 + 600)
 = A\$800

From the conversion graph:

$$\text{A\$50} = \text{€30}$$

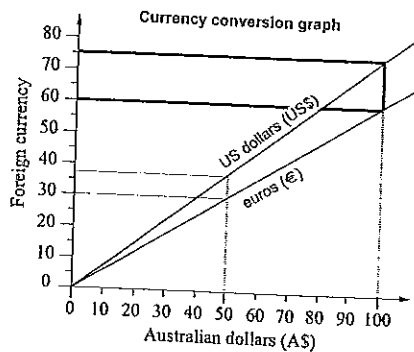
$$\text{A\$1} = \text{€0.6}$$

$$\text{A\$800} = \text{€}(0.6 \times 800)$$

$$= \text{€480}$$

∴ Total spending money is €480.

METHOD 2



$$\text{US\$75} = \text{€60}$$

$$\text{US\$150} = 2 \times \text{US\$75}$$

$$= 2 \times \text{€60}$$

$$= \text{€120}$$

$$\text{A\$600} = 6 \times \text{A\$100}$$

$$= 6 \times \text{€60}$$

$$= \text{€360}$$

$$\therefore \text{Total amount} = \text{€}(120 + 360)$$

$$= \text{€480.}$$

- (ii) If the value of the euro falls in comparison to the Australian dollar, the gradient of the line will increase.

- (d) (i) The ages of the males are positively skewed (towards lower values) while the ages of the females are negatively skewed (towards higher values).

- (ii) Mode = 64.

- (iii) For 30–39 years: Class centre

$$\text{Class centre} = \frac{30 + 39}{2}$$

$$= 34.5$$

$$\text{Frequency} = 5$$

$$\text{Product} = 5 \times 34.5$$

$$= 172.5.$$

- (iv) Liam's method of using class centres of class intervals only gives an estimate of the mean, while Caitlyn's use of the original data gives the actual mean.

Question 25

- (a) There are many possible correct solutions. Some examples might be:

- randomly drawing a blue marble from a bag containing 6 blue marbles and 2 red marbles:

$$P(\text{blue}) = \frac{6}{8} = \frac{3}{4}$$

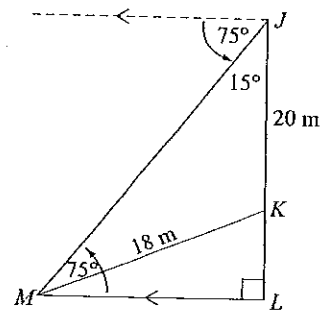
- randomly drawing a heart, diamond or spade from a standard pack of 52 playing cards:

$$P(\text{heart or diamond or spade})$$

$$= \frac{13}{52} + \frac{13}{52} + \frac{13}{52}$$

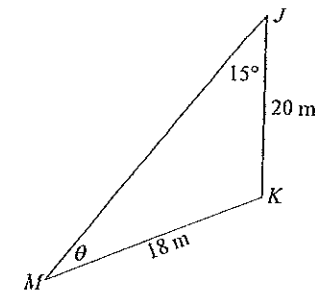
$$= \frac{39}{52} = \frac{3}{4}$$

- (b)



$$\angle MJK = 90^\circ - 75^\circ$$

$$= 15^\circ$$



Sine rule is

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

$$\therefore \frac{\sin \theta}{20} = \frac{\sin 15^\circ}{18}$$

$$\sin \theta = \frac{\sin 15^\circ}{18} \times 20$$

$$= 0.2875 \dots$$

$$\therefore \theta = 16.7129 \dots^\circ$$

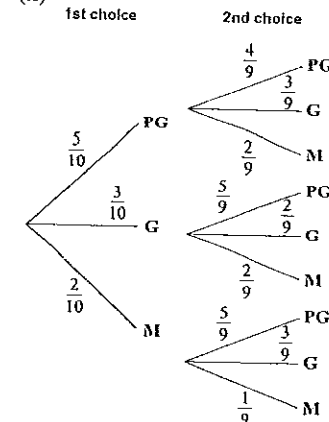
$$\approx 17^\circ$$

$\angle JML = 75^\circ$ (alternate angles in parallel lines; or the angle of elevation equals the angle of depression in $\triangle JML$)

∴ Angle of elevation from M to K
 = $\angle KML$
 = $75^\circ - 17^\circ$
 = 58° (to the nearest degree).

(c) (i) $P(\text{rated M}) = \frac{2}{10} = \frac{1}{5}$.

- (ii)



(iii)

P (same rating)

$$= P(\text{PG and PG}) + P(\text{G and G}) + P(\text{M and M})$$

$$= \frac{5}{10} \times \frac{4}{9} + \frac{3}{10} \times \frac{2}{9} + \frac{2}{10} \times \frac{1}{9}$$

$$= \frac{14}{45}$$

(d) (i) Test 1: $z = \frac{63-60}{6.2}$

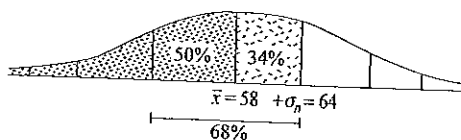
$$= 0.4838\dots$$

Test 2: $z = \frac{62-58}{6}$

$$= 0.6666\dots$$

\therefore No, we do not agree as his z -score was higher in Test 2.

(ii)



Percentage of students who scored less than 64 = 50% + 34% = 84%

$$\therefore 84\% \text{ of } 150 \text{ students} = \frac{84}{100} \times 150 = 126$$

\therefore It is expected that 126 students would have scored less than 64.

Question 26

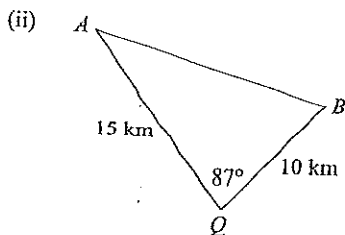
(a) (i) Speed = $\frac{\text{distance}}{\text{time}}$

$$= \frac{15 \text{ km}}{2 \text{ h } 48 \text{ min}}$$

$$= \frac{15 \text{ km}}{2.8 \text{ h}}$$

$$= 5.3571\dots \text{ km/h}$$

$$\doteq 5 \text{ km/h (to the nearest km)}$$



Cosine rule for $\triangle ABQ$ is

$$q^2 = a^2 + b^2 - 2ab \cos Q$$

$$\therefore AB^2 = 10^2 + 15^2 - 2 \times 10 \times 15 \times \cos 87^\circ$$

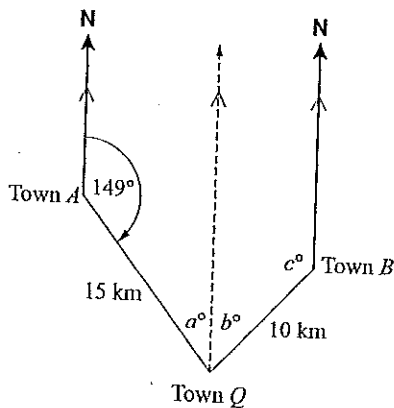
$$= 309.2992\dots$$

$$AB = \sqrt{309.2992\dots}$$

$$= 17.5869\dots$$

$$\doteq 18 \text{ km (to the nearest km)}$$

(iii)



$$a^\circ = 180^\circ - 149^\circ \text{ (cointerior angles between parallel lines)}$$

$$= 31^\circ$$

$$b^\circ = 87^\circ - 31^\circ \text{ (} a + b = 87^\circ \text{)}$$

$$= 56^\circ$$

$$c^\circ = 180^\circ - 56^\circ \text{ (cointerior angles between parallel lines)}$$

$$= 124^\circ$$

$$\therefore \text{Bearing of Town Q from Town B} = 360^\circ - 124^\circ = 236^\circ$$

(b) (i) $S = V_0 - Dn$

When $S = \$3635$, $V_0 = \$5000$, $n = 3$,

$$3635 = 5000 - D \times 3$$

$$-1365 = -3D$$

$$D = 455 \text{ (i.e. } \$455/\text{year)}$$

Depreciation percentage

$$= \frac{\$455}{\$5000} \times 100\%$$

$$= 9.1\%$$

(ii) Gross income = $\$800 \times 52 = \$41\,600$

Allowable deductions = $\$455$

$$\therefore \text{Taxable income} = \$41\,600 - \$455 = \$41\,145$$

(iii) Tax payable = $\$4500 + 0.30(\$41\,140 - \$28\,000) = \8443.50

(c) METHOD 1

Assuming the end of the first period is at birth, $M = \$100$, $r = 0.06$, $n = 22$.

$$A = M \left[\frac{(1+r)^n - 1}{r} \right]$$

$$= \$100 \left[\frac{1.06^{22} - 1}{0.06} \right]$$

$$= \$4339.23$$

Total paid into the account = $\$100 \times 22 = \2200

$$\therefore \text{Total interest earned} = \$4339.23 - \$2200 = \$2139.23$$

METHOD 2

Assuming the end of the first period is on the first birthday and compounding the deposit at birth, $M = \$100$, $r = 0.06$, $n = 21$

$$A = \$100 \left[\frac{1.06^{21} - 1}{0.06} \right] + \$100 \times 1.06^{21}$$

$$= \$3999.27 + \$399.96 = \$4339.23$$

$$\therefore \text{Total interest earned} = \$4339.23 - \$2200 = \$2139.23$$

Question 27

(a) (i) Any example where the length and width differ by 6 m, both are positive, and the length is the larger. For example, length = 10 m, width = 4 m.

(ii) length = l

$$\text{Area (A)} \quad \text{width} = (l - 6)$$

$$\therefore \text{Area} = \text{length} \times \text{width}$$

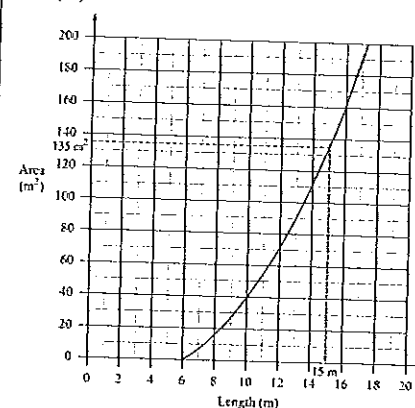
$$= l \times (l - 6)$$

$$= l(l - 6) \text{ or } l^2 - 6l$$

(iii) Any length less than or equal to 6 m is impossible because:

- the width would then be 0 m or negative, which is impossible
- the area would be 0 m or negative, which is impossible.

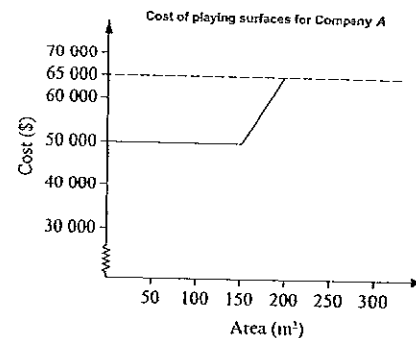
(iv)



\therefore The dimension of the playing surface with an area of 135 m^2 are 15 m \times 9 m, i.e. length = 15 m, width = 9 m.

(v) Area over 150 $\text{m}^2 = 200 - 150 = 50 \text{ m}^2$

$$\therefore \text{Cost to surface} = 50 \times 300 + 50\,000 = \$65\,000$$



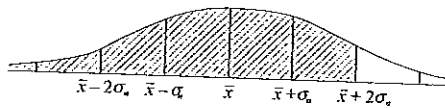
- (vi) Company A charge = \$50 000
 Company B charge = $\$360 \times 135$
 = \$48 600
 \therefore Company B would charge less.

- (b) (i) Number of hours used in the year
 = 5×365
 = 1825
 Cost to purchase and run one globe
 = $1825 \times d + 6$
 = $1825d + 6$
 \therefore Cost for 4 globes
 = $4 \times (1825d + 6)$
 = $4(1825d + 6)$ or $7300d + 24$
 $\therefore c = 7300d + 24$.

- (ii) For $c = \$250$,
 $250 = 7300d + 24$
 $7300d = 226$
 $d = 0.0309 \dots$
 $\doteq \$0.031$ (to 3 decimal places).

- (iii) For 10 hours per day, number of hours per year = 10×365
 = 3650
 Cost to purchase and run 4 globes
 = $4 \times (3650 \times 0.031 + 6)$
 = \$476.60
 \therefore No, the new total cost is not double \$250.

(iv)



97.5% is 2 standard deviations above the mean.

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

$$2 = \frac{5000 - \bar{x}}{170}$$

$$340 = 5000 - \bar{x}$$

$$\bar{x} = 5000 - 340$$

$$\bar{x} = 4660$$

\therefore Mean life = 4660 hours.

Note: Because 'purchasing' was not mentioned in (b) (ii) or (b) (iii), an alternative interpretation of the solutions, disregarding the purchase price of the globe, is provided below.

- (ii) For $C = \$250$
 $250 = 7300d$
 $d = 0.0342 \dots$
 $\doteq \$0.034$ (to 3 d.p.).

- (iii) Cost of running 4 globes
 = $4 \times 3650 \times 0.034$
 = \$500
 \therefore Yes, the total cost doubles.

Question 28

The sample space is shown in the table below with the differences calculated

(a) (i)

-	1	2	3	4	5	6
1	0	1	2	3	4	5
2	1	0	1	2	3	4
3	2	1	0	1	2	3
4	3	2	1	0	1	2
5	4	3	2	1	0	1
6	5	4	3	2	1	0

$$P(\text{difference} = 1) = \frac{10}{36} = \frac{5}{18}$$

(ii) Using the table above:

$$P(\text{difference} = 0) = \frac{6}{36} = \frac{1}{6}$$

$$P(\text{difference} = 1) = \frac{10}{36} = \frac{5}{18}$$

$$P(\text{difference} = 2, 3, 4 \text{ or } 5) = \frac{20}{36} = \frac{5}{9}$$

Financial expectation

$$= \frac{1}{6} \times \$3.50 + \frac{5}{18} \times (-\$5) + \frac{5}{9} \times \$2.80 = \$0.75$$

- (iii) He expects a loss of \$0.25, because his expected return will be \$0.75.

(b) Using Pythagoras' theorem,

$$H^2 = 2^2 + 2^2 = 8 \text{ cm}^2$$

Total area = area of triangle + area of hexagon

$$\doteq \frac{1}{2} \times 2 \times 2 + 2.598H^2$$

$$= 2 + 2.598 \times 8$$

$$= 22.784 \text{ cm}^2$$

(c) (i)

$$A \doteq \frac{h}{3}(d_f + 4d_m + d_l)$$

$$= \frac{3.6}{3}(5 + 4 \times 4.6 + 3.7) + \frac{3.6}{3}(3.7 + 4 \times 2.8 + 0)$$

$$= 32.52 + 17.88$$

$$= 50.4 \text{ cm}^2$$

- (ii) Surface area = front and back + left face + bottom face + curved surface

$$\text{Front and back} \doteq 2 \times 50.4$$

$$= 100.8 \text{ cm}^2$$

$$\text{Left face} = 5 \text{ cm} \times 2 \text{ m}$$

$$= 5 \text{ cm} \times 200 \text{ cm}$$

$$= 1000 \text{ cm}^2$$

$$\text{Bottom face} = 14.4 \text{ cm} \times 2 \text{ m}$$

$$= 14.4 \text{ cm} \times 200 \text{ cm}$$

$$= 2880 \text{ cm}^2$$

\therefore Curved surface

$$\doteq 7480.8 - 100.8 - 1000 - 2880$$

$$= 3500 \text{ cm}^2$$

End of General Mathematics solutions