KAMBALA

MATHEMATICS

2 UNIT GENERAL

YEAR 12 TRIAL HSC EXAMINATION

AUGUST 2010

Time Allowed: $2\frac{1}{2}$ hours
Reading Time: 5 minutes

INSTRUCTIONS

- **Section I** (22 marks) contains 22 Multiple Choice questions. Answer all questions on the Answer Sheet provided.

- **Section II** (78 marks) contains 6 questions of equal value. Answer each question in a *separate* writing booklet.

- Calculators (including graphic calculators) and geometrical instruments may be used.

- Show all necessary working in Section II.

- Marks will be deducted for careless or badly arranged work.

Section I

Use the multiple-choice answer sheet.

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1 Expand and simplify: $3 - 2(x - 4)$

    (A) $x - 4$

    (B) $-2x - 1$

    (C) $-2x - 5$

    (D) $11 - 2x$

2 Sarah plays the position of goal shooter in her school's netball team. In her last 40 attempts at goal she scored 31 times. Which of the following statements is true?

    (A) It is unlikely that Sarah will score a goal with her next shot.

    (B) There is a fifty-fifty chance that Sarah will score a goal with her next shot.

    (C) It is likely that Sarah will score a goal with her next shot.

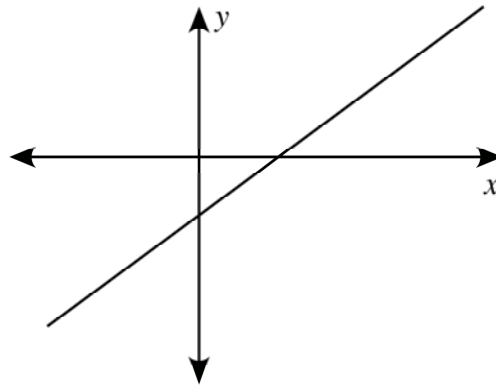   (D) It is certain that Sarah will score a goal with her next shot.

3
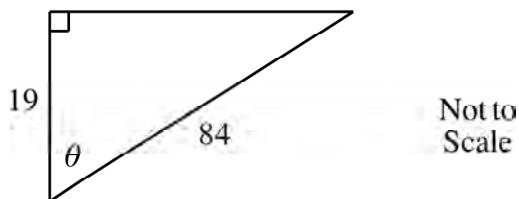
In the diagram above, the angle θ is closest to

    (A) $51°$

    (B) $53°$

    (C) $72°$

    (D) $77°$

4

Which equation best represents the graph shown above?

(A) $y = -2x - 1$

(B) $y = -2x + 1$

(C) $y = 2x - 1$

(D) $y = 2x + 1$

5 An investment of $10 000 earns interest at 10% p.a., compounding half-yearly. Which of the following expressions gives the value of this investment after 5 years?

(A) $10\,000 \times 0.10 \times 5$

(B) $10\,000 \times 0.05 \times 10$

(C) $10\,000 \times 0.05^{10}$

(D) $10\,000 \times 1.05^{10}$

6 An archer has a 70% chance of scoring a bulls-eye with each arrow he fires. What is the probability that he scores a bulls-eye with two consecutive arrows?

(A) 0.49%

(B) 1.4%

(C) 49%

(D) 70%

7 During this year's football season, a football club decided to sell cans of soft drink at their home games. They sold Cola, Lemonade and Orange flavours. Their Treasurer kept a record of the number of cans of soft drink sold and presented the data in the area graph shown below.
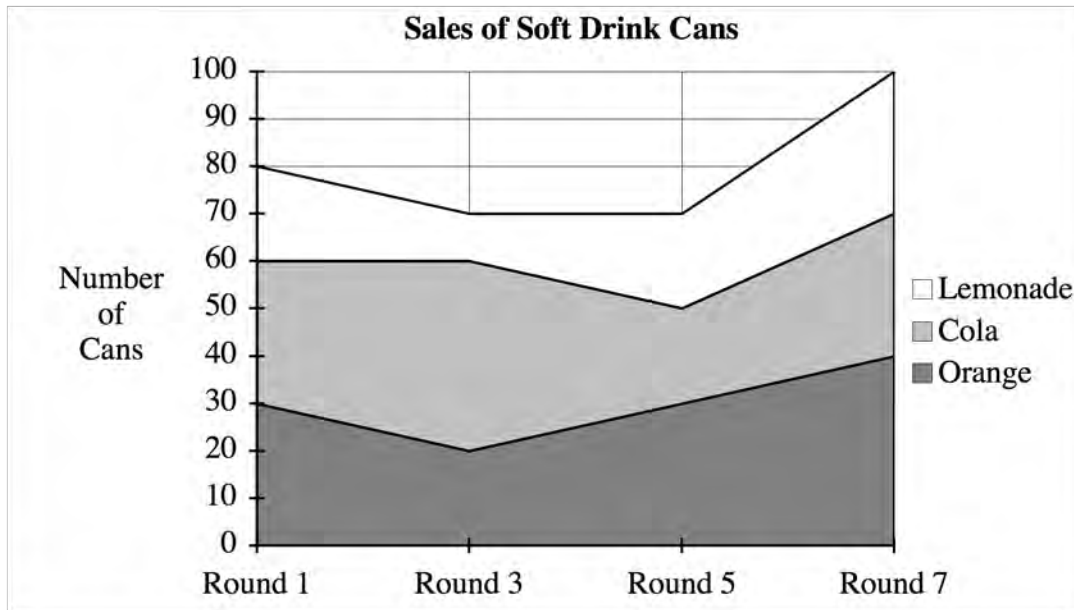

Over the four home games, the club sold 120 cans of orange flavour. How many cans of lemonade were sold over the four home games?

(A) 80

(B) 100

(C) 200

(D) 320

8 Consider the set of scores 15, 12, 17, 5, 5, 8, 13, 5. If a score of 10 is added to this set then which of the following measures will change?

(A) Mean

(B) Median

(C) Mode

(D) None of these

9 A small aeroplane takes off and climbs at a constant rate of 750 metres every 5 minutes. Approximately how long would it take the aeroplane to reach a height of 2000 metres?

(A) 3 minutes

(B) 13 minutes

(C) 150 minutes

(D) 400 minutes

10 An investor has 300 shares with a current market value of $3.65. The company declares a dividend yield of 18%. What is the dividend on this investment?

(A) $0.66

(B) $65.70

(C) $197.10

(D) $19 710

11 The NSW National Parks & Wildlife Service needs to know the approximate number of galahs in the Botany Bay National Park. In January this year a ranger caught 73 galahs at La Perouse and tagged them. A month later another ranger returned to the same area and caught 93 galahs. He discovered that 17 of them had been tagged in January. A good estimate for the number of galahs in this area is

(A) 13

(B) 183

(C) 399

(D) 115 413

12 Declan borrows $540 to buy a washing machine. The simple interest rate is 12% p.a. He takes out the loan over 2 years. What is Declan's monthly payment?

(A) $22.50

(B) $25.20

(C) $26.10

(D) $27.90

**13** A new door is to be fitted in the space inside an arched door frame, as shown in the diagram below.
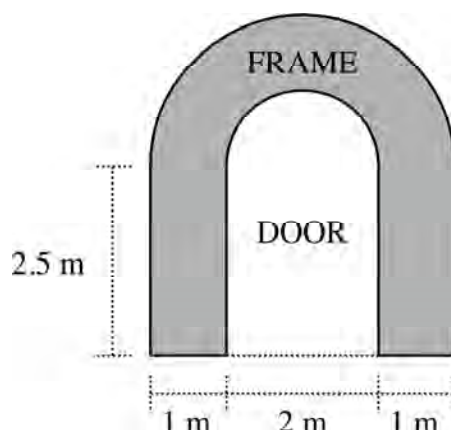
The area of the new door, correct to the nearest square metre, is

(A) 5 m^2

(B) 6 m^2

(C) 7 m^2

(D) 8 m^2

14 Which of the following is **not** an example of an ordered selection?

(A) Eight competitors are placed according to their finishing position in a race.

(B) From a group of eight volleyball players, a captain and a vice-captain are chosen to represent the team.

(C) From a group of eight students, two are selected to participate in the public speaking competition.

(D) 1st place and 2nd place in a Mathematics competition are awarded among a group of eight students.

15 Town *A* and Town *B* both lie on the same line of longitude. Town *A* lies 56° north of the equator and Town *B* lies 12° south of the Equator. What is the distance between the two towns?

(A) 2640 nautical miles

(B) 4080 nautical miles

(C) 4914 nautical miles

(D) 7595 nautical miles

16 Kaitlin is saving to go to Africa when she finishes school in 2 years. She estimates the cost of her trip to be $4500. She has found an investment account which will pay her 6% p.a. interest, compounded monthly. What amount will she need to deposit each month so that she will have enough to cover the cost of her trip?

(A) $88.56

(B) $176.94

(C) $199.44

(D) $4358.56

17 A restaurant purchases new kitchen equipment worth $50 000. The value of the equipment depreciates over time according to the declining balance method. The value of the equipment at the end of each year for 10 years is shown in the graph below.

Value of Kitchen Equipment
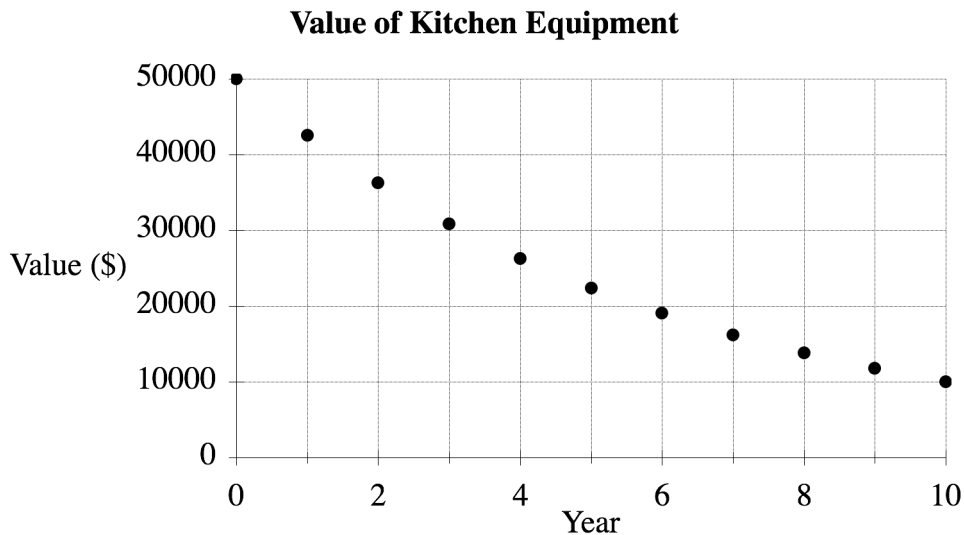
Which of the following statements is true?

(A) The equipment depreciates by $4000 per year.

(B) At the end of 5 years the value of the equipment is less than $20 000.

(C) The amount the equipment depreciates by each year decreases over time.

(D) The annual depreciation rate increases over time.

18 A hot air balloon is designed to have a maximum volume (V) of 1000 m³. Using the formula

$$r = \sqrt[3]{\frac{3V}{4\pi}}$$

the radius (r) of the balloon at maximum volume is approximately

(A) 2.9 metres

(B) 6.2 metres

(C) 13.3 metres

(D) 15.5 metres.

19

In the illustration above the dimensions of the large box are 20% more than the dimensions of the smaller box. What is the percentage increase in volume?

(A) 0.08%

(B) 20%

(C) 60%

(D) 72.8%

20 The lifetime of a certain brand of car battery is normally distributed, with an average lifetime of 170 weeks and a standard deviation of 7 weeks. The company guarantees the battery for 3 years. What percentage of car batteries sold would be expected to be returned before the end of the guarantee period?

(A) $2\frac{1}{2}$%

(B) 5%

(C) $47\frac{1}{2}$%

(D) 95%

21 Ten students complete an assessment task. The mean score was 72 and the standard deviation was 9. Another student completed the same task at a later date and received a score of 77. When this mark is included in the statistics

(A) the mean will increase and the standard deviation will increase.

(B) the mean will increase and the standard deviation will decrease.

(C) the mean will decrease and the standard deviation will increase.

(D) the mean will decrease and the standard deviation will decrease.

22
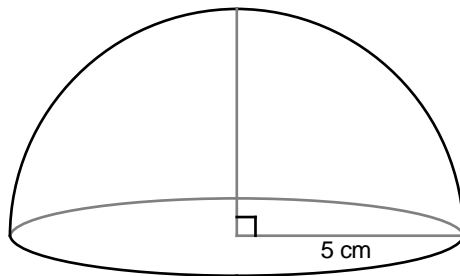
A snow-dome is in the shape of a hemisphere, with a radius of 5 cm, as shown in the diagram above. Eloise is giving the snow-dome as a gift and has to choose the most appropriate size wrapping paper. Which of the following sizes of wrapping paper is the smallest that will cover the gift?

(A) 13 cm × 13 cm

(B) 15 cm × 15 cm

(C) 26 cm × 26 cm

(D) 30 cm × 30 cm

Section II

78 marks
Attempt Questions 23–28
Allow about 2 hours for this section

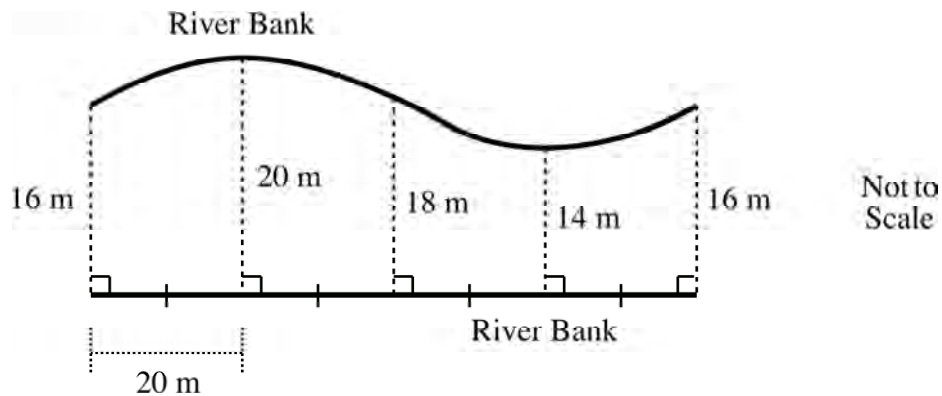Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.

All necessary working should be shown in every question.

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

(a)   The price of a drum kit is $4312, which includes 10% GST. What amount of GST   **1**
      included in this price?

(b)   The diagram below shows an aerial view of a section of a river.

    (i)   Use two applications of Simpson's rule to find approximate area of this section of   **2**
        the river.

    (ii)   The river is 3 metres deep. Using your answer to (i), determine the amount of water   **2**
        in this section of the river. Give your answer correct to the nearest litre.
   *[Note: 1 m³ = 1000 L]*

Question 23 continues on Page 11

(c) A cinema surveyed each customer at a recent screening of a new movie. Results are shown in the two-way table below.

	Male	Female	Total
Children	15	35	50
Adults	*X*	51	75
Total		*Y*	125

(i) Find the value of *X* and *Y* in the table above. **2**

(ii) What percentage of customers in the movie were children? **1**

(iii) What percentage of children in the movie were female? **1**

(iv) If a customer is selected at random, what is the probability that it will be a female child. **1**

(d)
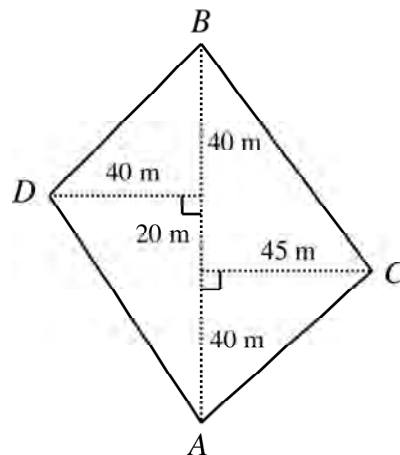
The diagram above is a scale diagram of a park.

(i) Use Pythagoras' Theorem to calculate the length of *BD*. Give your answer correct to 1 decimal place. **2**

(ii) Using measurement, find the scale used in the diagram. **1**

End of Question 23

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

(a) The graph below shows the price of posting a standard letter in Australia at the end of each of the years when the price changed.

STANDARD POSTAGE RATE
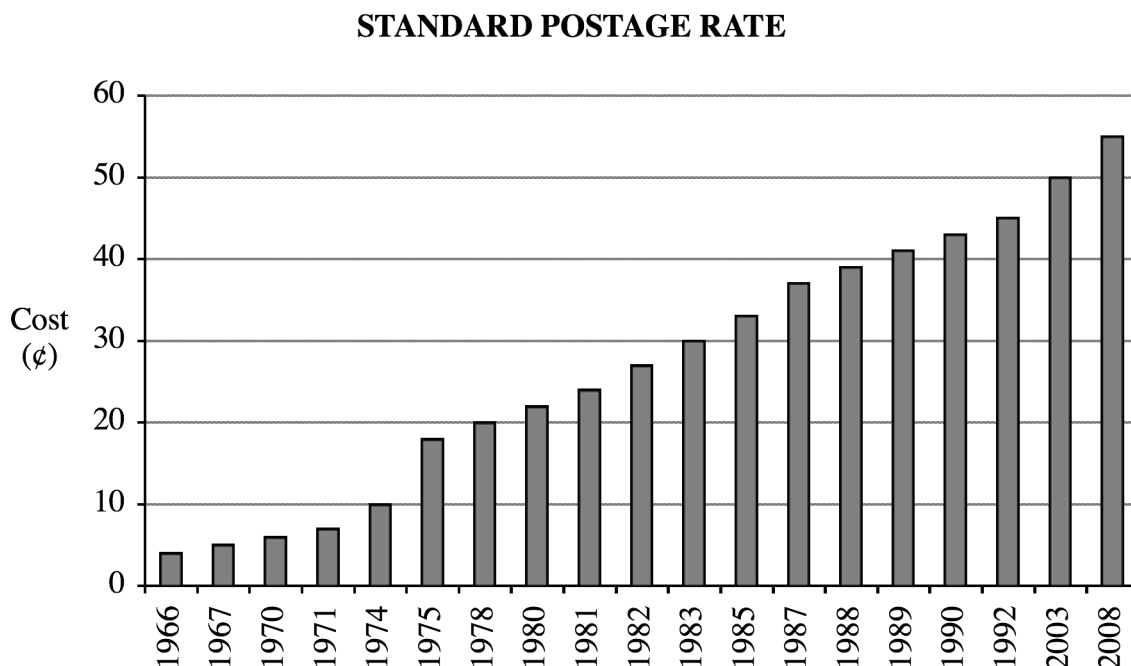
(i) What was the cost of posting a standard letter in Australia at the end of 1983? **1**

(ii) During which year did the standard postage rate increase by the largest amount? **1**

(iii) Andrew believes that this is an example of a misleading graph. Give ONE brief reason which supports his claim. **1**

(b) (i) At a sale, Clair buys a new coat with a sale price of $118.95. The original marked price was $195. Calculate the percentage discount on the coat. **1**

(ii) Clair paid for the coat on her credit card. It has no interest free period. The interest rate on her credit card is 18.75% p.a. She pays the amount owing in 17 days. Calculate the total amount she will need to pay. **2**

(c) A restaurant menu offers a choice of 3 entrées, 6 main courses and 4 desserts.

(i) How many different three course meals can be chosen from the menu? **1**

(ii) If one extra main course and dessert is offered, how many more combinations of courses are possible? **1**

(d) Maggie has a weekly gross income of $784. She has allowable annual deductions of $3674.

    (i)   Calculate Maggie's gross annual income. **1**

    (ii) Calculate her taxable income. **1**

Taxable Income	Tax Payable on Taxable Income
$0 – $6000	Nil
$6001 – $35000	15¢ for each $1 over $6000
$35001 – $80000	$4350 plus 30¢ for each $1 over $35000
$80001 – $180000	$17850 plus 38¢ for each $1 over $80000
Over $180000	$55850 plus 45¢ for each $1 over $180000

    (iii) Using the tax table above, calculate Maggie's net weekly income. **3**

End of Question 24

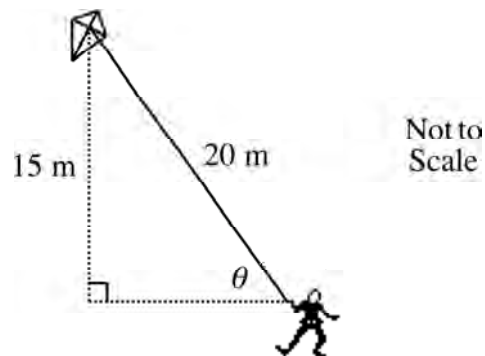**Question 25** (13 marks) Use a SEPARATE writing booklet.   **Marks**

(a)   **2**

Tim is flying a kite that is attached to a string of length 20 metres. The kite is flying 15 metres above Tim's hand. Calculate the angle of elevation of the kite. Give your answer correct to the nearest degree.

(b) The *frustum* of a cone is formed by slicing off the top portion of a cone parallel to the   **3**
base of the cone. The portion which is removed is a smaller cone. The portion remaining is called a *frustum*.
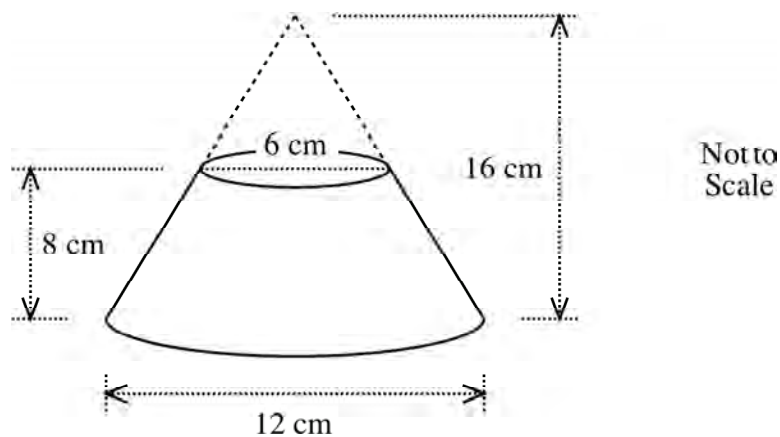
In the diagram above, a cone of height 16 cm has its top section removed to leave a frustum of height 8 cm. What is the volume of this frustum if the base diameter is 12 cm and the diameter of the top is 6 cm? Give your answer correct to the nearest cubic centimetre.

(c) (i) Write down the number which is halfway between 148 and 164. **1**

For her research project, Amanda collected data on the heights of all female Year 7 students in her town. When the data was tabulated she observed that the heights were normally distributed. 68% of the heights were between 148 cm and 164 cm.

(ii) Write down the mean and standard deviation for this set of data. **2**

(iii) Calculate the z-score which corresponds to a height of 170 cm from this distribution. **1**

Amanda heard that a new student would be joining the Year 7 students in her school. The new student was reported to be very tall, with a height of 183 cm. Amanda looked at her data and stated that this was impossible.

(iv) Do you agree with Amanda's statement? Use the above information to justify your answer. **2**

(d) Lauren was given five bank notes by her grandmother; a $100 note, a $50 note, a $20 note, a $10 note and a $5 note. Her little brother Kenny asked to have two of Lauren's notes. Lauren allowed him to select two notes at random.

(i) How many possible combinations of notes could Kenny take? **1**

(ii) List the combinations of notes that Kenny can take so that he will have more money than Lauren. **1**

End of Question 25

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

(a) Tiff recorded the average monthly maximum temperatures for Sydney and Melbourne and displayed them on the box-and-whisker plot below.
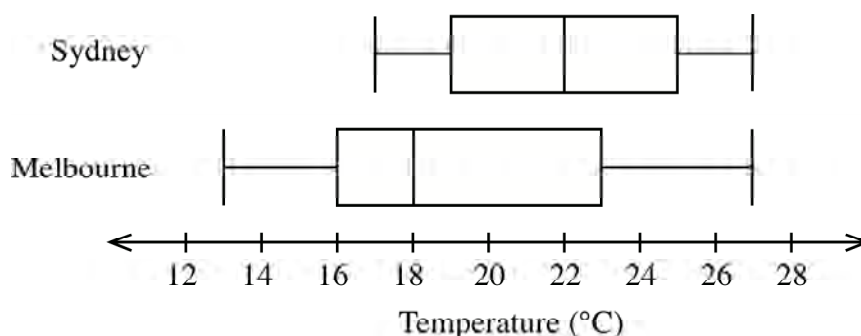
(i) Write down the interquartile range of temperatures for Melbourne.   **1**

(ii) What percentage of months in Sydney have an average maximum temperature greater than 25°C?   **1**

(iii) Briefly describe the skewness of the average monthly maximum temperatures for Melbourne.   **1**

(b) The table below shows the monthly repayments on a loan of $1000 at various interest rates over various periods.

**Monthly Repayments on a loan of $1000**

Years	5%	6%	7%	8%	9%	10%
10	$10.61	$13.14	$13.63	$14.14	$14.65	$15.17
15	$7.91	$8.44	$8.99	$9.56	$10.14	$10.75
20	$6.60	$7.16	$7.75	$8.36	$9.00	$9.65
25	$5.85	$6.44	$7.07	$7.72	$8.39	$9.09

Patrick and Mina are going to purchase a home unit valued at $250 000. The interest rate on their loan is 7% p.a., calculated on a reducing balance loan. They will repay the loan over 20 years with equal monthly repayments.

(i) Using the table above, calculate the amount of their monthly repayment.   **1**

(ii) Calculate the total they will pay over the length of the loan.   **1**

(iii) Calculate the interest they will pay over the length of the loan.   **1**

(iv) Would it be better for Patrick and Mina to repay the loan over 15 years at the same interest rate? Explain your answer using appropriate reasoning.   **2**

Question 26 continues on Page 17

16

(c)
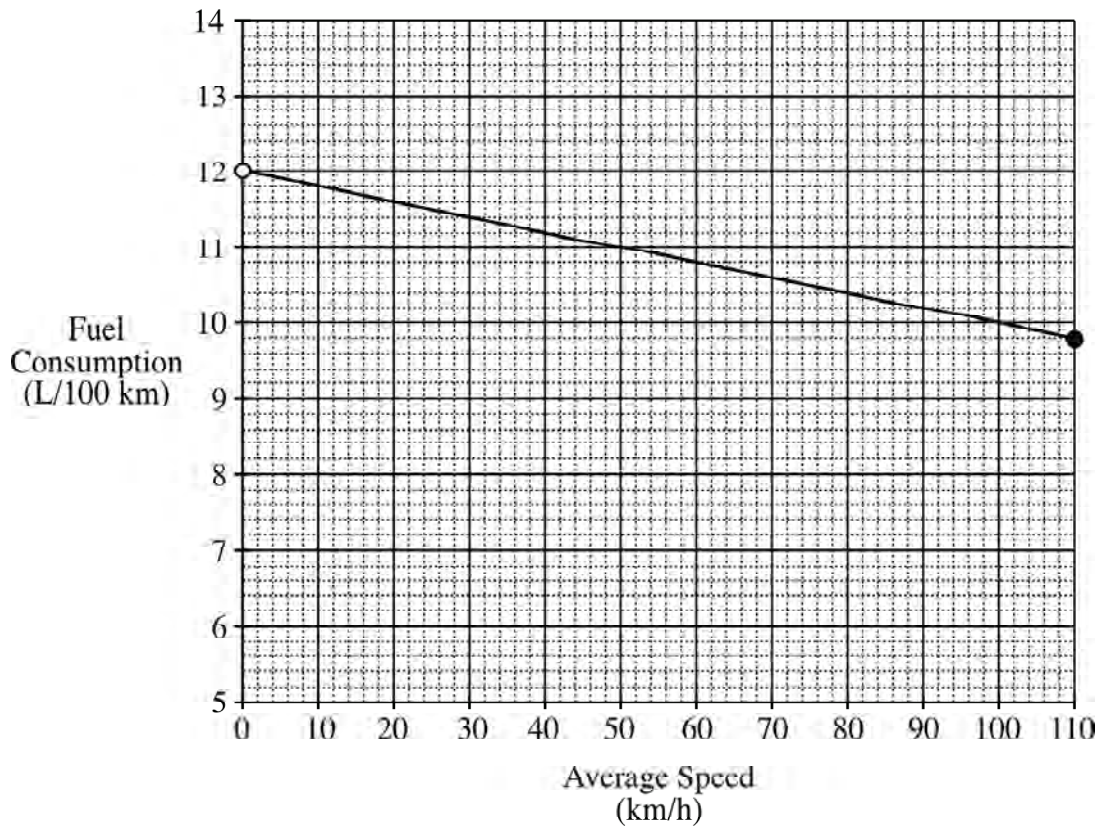
The graph above shows the amount of petrol (in litres per 100 km) used by a particular car for average speeds up to 110 km/h.

(i) Calculate the value of the gradient of the line.   1

(ii) Using F for fuel consumption and s for average speed, write down the equation of   1
the straight line in the graph above.

(d) Solve the equation: $\dfrac{x+3}{5} - \dfrac{x-5}{3} = 2$ 3

End of Question 26

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

(a) One hundred healthy laboratory mice were weighed at the beginning of an ethical
     experiment. Their weights, correct to the nearest gram, were recorded and displayed
     in the grouped cumulative frequency histogram and polygon below.
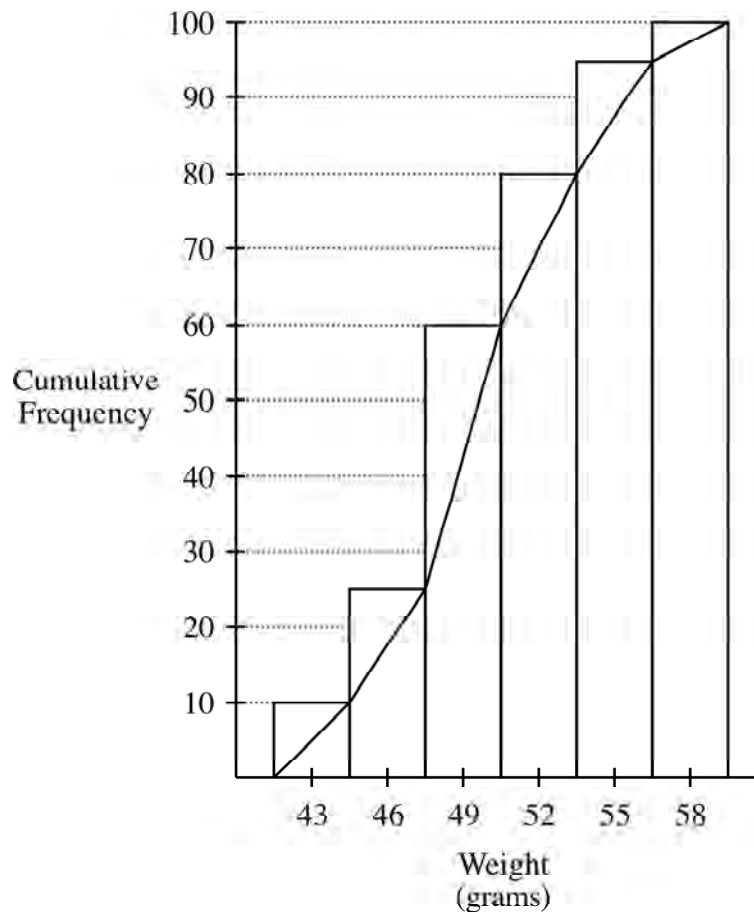
    (i)   What is the modal class of this set of measurements?   **1**

    (ii) Write down an estimate for the median weight of the laboratory mice.   **1**

    (iii) From the graph above, can you be sure that the minimum weight recorded was 42 g?   **1**
         Briefly explain your answer.

(b) A player tosses two coins. If the result is "two tails" you win $3. If the result is "exactly   **2**
     one head" you lose $2. If the result is "two heads" you win $3. Calculate the financial
     expectation for this game.

(c) Rachelle's superannuation account has a future value of $480 000 in 24 years from now.   **3**
     The interest rate is 5% p.a. and is calculated quarterly. What single amount would
     Rachelle need to invest now to achieve the same amount over the same time period at
     the same interest rate?

Question 27 continues on Page 19

Question 27 (continued) **Marks**

(d) Nick is considering a home loan. The following table is part of a home loan simulator that Nick obtained from Goats Home Loan providers.

Amount borrowed (P) = $100 000				
Interest rate per month (r) = 1%				
Repayment per month (R) = $1100				
N	Principal (P)	Interest (I)	$P + I$	$P + I - R$
1	$100 000.00	$1000.00	$101 000.00	$99 900.00
2	$99 900.00	$999.00	$100 899.00	$99 799.00
3	$99 799.00	$997.99	$100 796.99	$99 696.99
4	$99 696.99	$996.97	$100 693.96	$99 593.96
5	$99 593.96	A	B	C
...	...	...	...	...
237	$5324.70	$53.25	$5377.95	$4277.95
238	$4277.95	$42.78	$4320.73	$3220.73
239	$3220.73	$32.21	$3252.93	$2152.93
240	$2152.93	$21.53	$2174.46	$1074.46
241	$1074.46	$10.74	$1085.21	$0.00

(i) Calculate the amounts at *A*, *B* and *C*.   **3**

(ii) The loan is repaid after 241 instalments. Calculate the total amount repaid.   **1**

(iii) Calculate the total amount of interest that has been paid.   **1**

End of Question 27

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

(a) The 2010 Commonwealth Games will be held in New Delhi. New Delhi is located at (29°N, 76°E) and Sydney is located at (34°S, 151°E).

   (i)   The opening ceremony will start in New Delhi at 5:00pm on 3rd October. **1**
What time would you need to watch television in Sydney to see a live broadcast of the start of this event?

Tony is going to New Delhi for the Commonwealth Games. He has tickets for the opening ceremony. The distance from Sydney to New Delhi is 5600 nautical miles and the average speed of the plane 400 knots.

   (ii)   Tony needs to arrive in New Delhi by 2:00 pm on 3rd October. What is the latest **3**
time he could leave Sydney?

(b) A car is valued at $36 000 when purchased new. It depreciates at 25 cents for every **2**
kilometre travelled. How far will the car have travelled before it depreciates to a value of $10 000?

(c) Cubes of foam packaging have a mass M grams, given by the formula $M = 0.019x^3$, where x is the length of the side of the cube in centimetres.

   (i)   What is the mass in kilograms of 1 m^3 of foam? **2**

   (ii)   A manufacturer uses the foam to wrap its products when sending them by airfreight. **1**
The foam packaging accounts for 35% of the cargo mass. How many kilograms of foam are included in 4.78 tonnes of cargo mass?
[Note: 1 tonne = 1000 kg]

   (iii)   By referring to your answers in (i) and (ii), what is the volume of this foam **1**
packaging? Give your answer correct to the nearest cubic metre.

(d) Denise has either tea or coffee at morning break. If she has tea one morning, the **3**
probability that she has tea the following morning is 0.4. If she has coffee one morning, the probability that she has coffee the following morning is 0.3. Denise has coffee on a Monday morning. What is the probability that she has tea on the following Wednesday?

END OF EXAMINATION

Year 12 General Mathematics
Answers to 2010 Trial HSC Examination

Section I

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

Section II

Question 23

(a) $392

(b) (i) 1360 m^2

    (ii) 4 080 000 litres

(c) (i) $X = 24$, $Y = 86$

    (ii) 40%

    (iii) 70%

    (iv) $\frac{7}{25}$

(d) (i) 56.6 m

    (ii) 1:2000

Question 24

(a) (i) 30¢

    (ii) 1975

    (iii) The years given on the horizontal axis change by varying amounts. This gives the impression that prices always increase and does not show when prices remain the same over long periods of time.

(b) (i) 39%

    (ii) $119.99

(c) (i) 72

    (ii) 105

(d) (i) $40 768

    (ii) $37 094

    (iii) $688.27

Question 25

(a) 49°

(b) 528 cm^3

(c) (i) 156

    (ii) Mean = 156 cm
        Standard deviation = 8

    (iii) 1.75

    (iv) Amanda is not correct. A height of 183 cm is extremely unlikely but not impossible.

(d) (i) 10

    (ii) {$100,$50}, {$100,$20}, {$100,$10}, {$100,$5}

Question 26

(a) (i) 7

    (ii) 25%

    (iii) Slight positive skew

(b) (i) $1937.50

    (ii) $465 000

    (iii) $215 000

    (iv) It would be better for Patrick and Mina to repay the loan over 15 years. While the monthly repayments will be higher, in the long run they will pay much less interest.

(c) (i) –0.02

    (ii) $F = -0.02S + 12$

(d) $x = 2$

Year 12 General Mathematics
Answers to 2010 Trial HSC Examination

Question 27

(a) (i) 48-50 grams

   (ii) 50 grams

   (iii) Because this is a grouped frequency display we cannot be sure that the minimum weight was 42 g. We know that there were 10 mice with weights of 42 g, 43 g or 44 g. They could be all 42 g, all 44 g or a mixture of the three weights.

(b) +$0.50

(c) $145 652.58

(d) (i) $A = \$995.94$
      $B = \$100\,589.90$
      $C = \$99\,489.90$

   (ii) $265 085.21

   (iii) $165 085.21

Question 28

(a) (i) 10pm

   (ii) 5am on 3rd October

(b) 104 000 km

(c) (i) 19 kg

   (ii) 1673 kg

   (iii) 88 m^3

(d) $\frac{49}{100}$