CATHOLIC SECONDARY SCHOOLS ASSOCIATION OF NEW SOUTH WALES

2010
TRIAL HIGHER SCHOOLCERTIFICATE EXAMINATION

General Mathematics

Morning Session
Monday 9 August 2010

General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using blue or black pen
- Calculators may be used
- Use Multiple Choice Answer Sheet provided
- A separate Formula Sheet is provided
- Write your Centre Number and Student Number at the top of this page

Total marks: 100

| Section I | Pages 2–9 |

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

| Section II | Pages 10–20 |

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

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 What is the size of angle θ in this triangle?
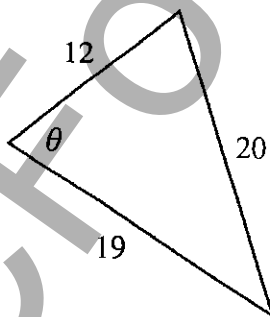
Not to Scale

(A) $51°$

(B) $59°$

(C) $72°$

(D) $77°$

4
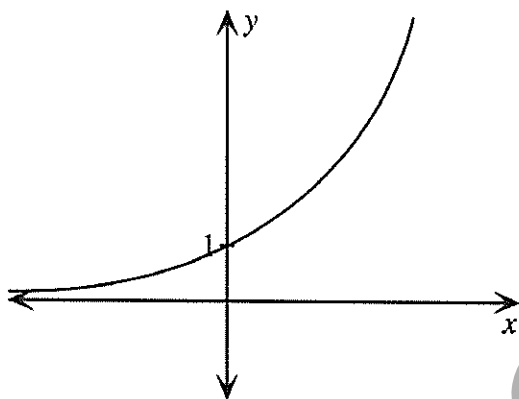
Which equation best represents the graph shown above?

(A) $y = x^2$

(B) $y = \dfrac{2}{x}$

(C) $y = 2^x$

(D) $y = x^3$

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%

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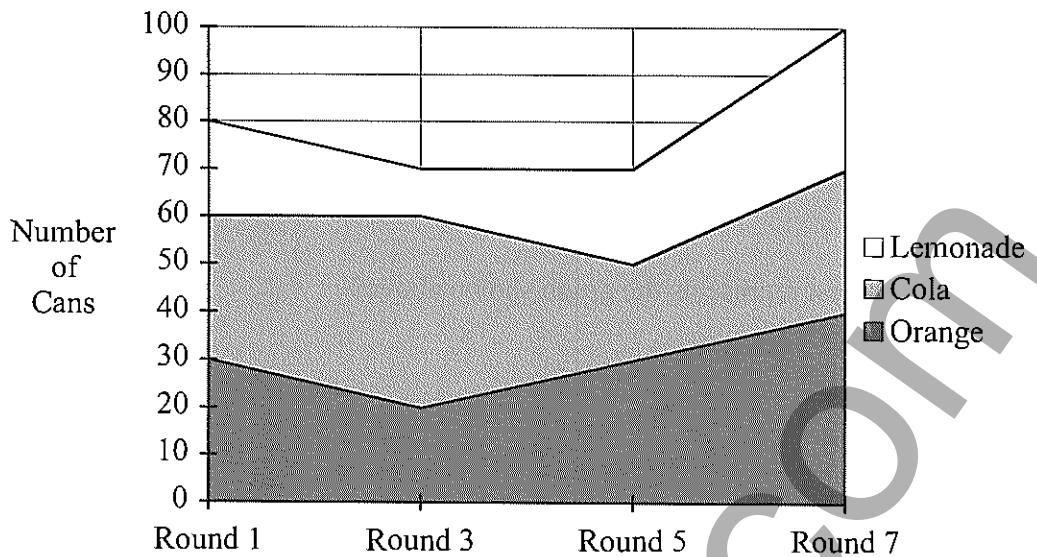
Over the four home games, the club sold 120 cans of orange flavour. How many cans of lemonade were sold over the four home games?

(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 per share. 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, tagged them and then released 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.
What estimate should the ranger give for the number of galahs present in the area based on the use of the 'capture-recapture' technique?

(A) 13

(B) 183

(C) 399

(D) 115 413

12 Declan borrows $540 to buy a washing machine. The simple interest rate of the loan is 12% p.a. The amount is to be repaid in 24 equal monthly repayments. What is Declan's monthly repayment?

(A) $22.50

(B) $25.20

(C) $26.10

(D) $27.90

2.5 m

DOOR

1 m   2 m   1 m
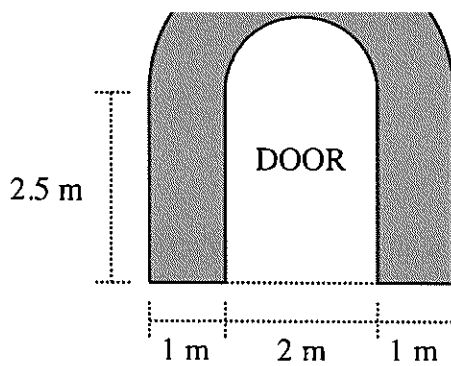
What is the area of the new door, correct to the nearest square metre?

(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

6

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 over the 2 years 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.
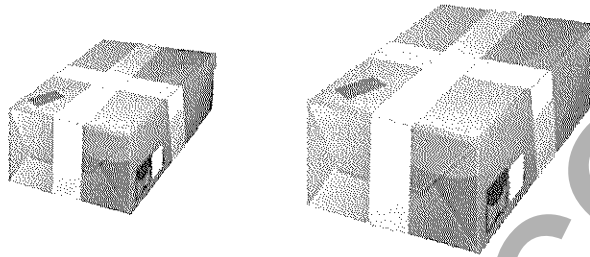
Value of Kitchen Equipment
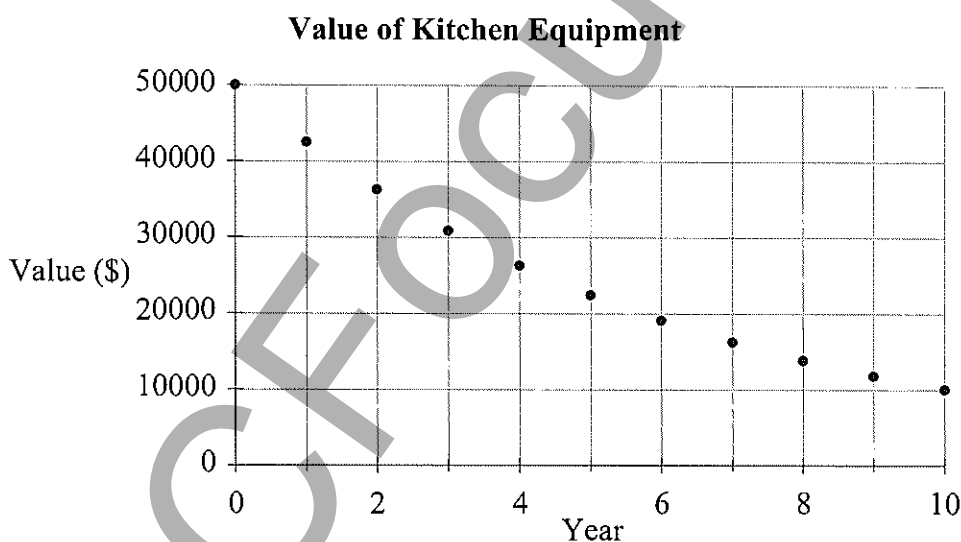
Which of the following statements is true?

(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 decreases over time.

(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 fail before the end of the guarantee period?

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

(B) 5%

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

(D) 95%

21 On a scatterplot Orla graphed the Trial HSC Examination marks against the Half-Yearly Examination marks for each member in her class. Five points plotted were:

$$(88,94) \quad (86,80) \quad (79,91) \quad (88,80) \quad (81,81)$$

The co-ordinates of the median point for these five points are

(A) (79,91)

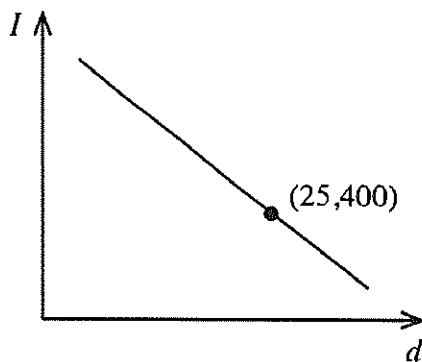(B) (81,81)

(C) (86,80)

(D) (86,81)

22 The intensity of light (I) varies inversely as the square of the distance (d metres) between the light source and the observer. This relationship can be represented as $I = \dfrac{k}{d^2}$, where k is a constant. When a particular light source is 5 metres away it has an intensity of 400 units.

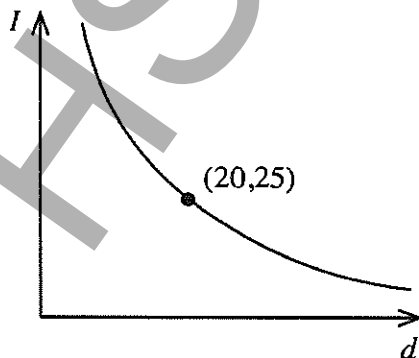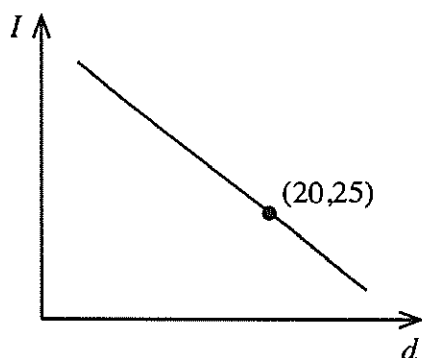Which of the graphs below correctly represents this information?

(A)
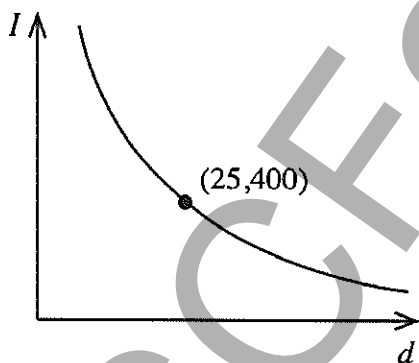
(B)

(C)

(D)

Answer each question in the SPECIAL General Mathematics 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.

(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.

River Bank

16 m   20 m   18 m   14 m   16 m   Not to
Scale

River Bank

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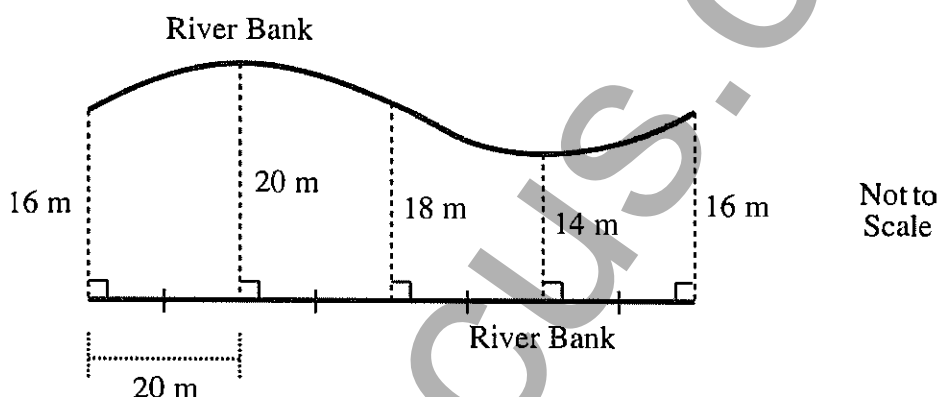
(i) Use two applications of Simpson's rule to find approximate area of this section of   **2**
the river.

(ii) The river is 3 metres deep. Using your answer to (i), determine the amount of   **2**
water 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**

10

(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	39	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) Nathan hits a ball from a small platform in a golf competition. It lands on the ground 6 seconds later. The ball's height, h metres, after t seconds is modelled by the equation:
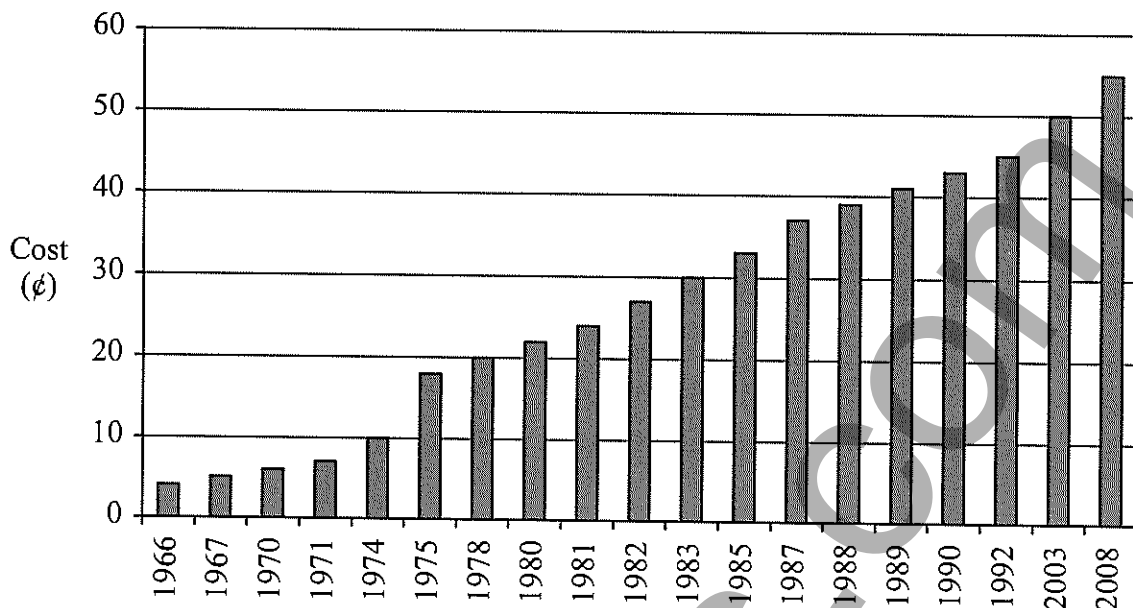$$h = -t^2 + 5.8t + 1.2$$
The graph of this equation is shown below.
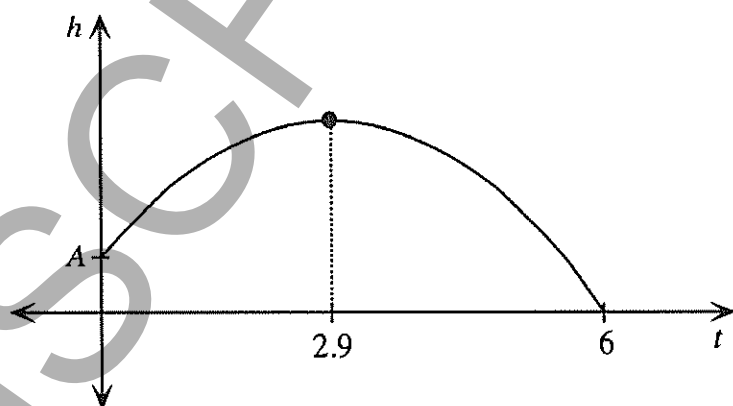
   (i)   Calculate the maximum height reached by the ball.   **1**

  (ii)   Calculate the value of A, the intercept of the curve with the vertical axis.   **1**

 (iii)   Briefly explain what the vertical intercept of the curve means in this context.   **1**

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, Claire 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) Claire 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 17 days later. Calculate the total amount (including interest) she will pay for her coat. **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 one extra dessert is offered, how many more combinations of courses are possible? **1**

12

Question 24 (continued)

(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**

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

| 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

End of Question 24
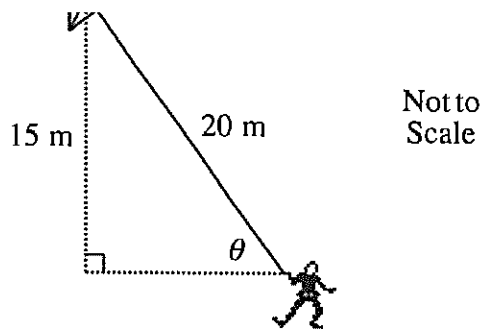
Tim is flying a kite that is attached to a string of length 20 metres. The kite is flying 15 metres above Tim's hand. Calculate the angle of elevation, θ, of the kite. Give your answer correct to the nearest degree.

(b) The *frustum* of a cone is formed by slicing off the top portion of a cone parallel to the base of the cone. The portion which is removed is a smaller cone. The portion remaining is called a *frustum*.

3
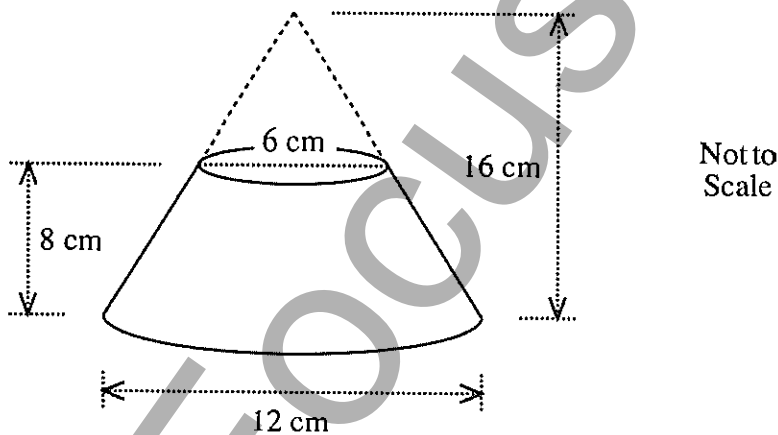
In the diagram above, a cone of height 16 cm has its top section removed to leave a frustum of height 8 cm. What is the volume of this frustum if the base diameter is 12 cm and the diameter of the top is 6 cm? Give your answer correct to the nearest cubic centimetre.

(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 school. 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

Sydney

Melbourne
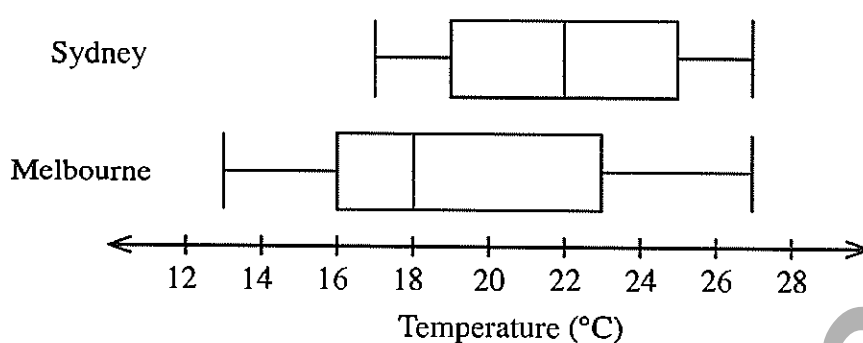
Temperature (°C)

(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 Julie are going to purchase a home unit valued at $250 000. The interest rate on their loan is 7% p.a. 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 Julie 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

(c)

Fuel
Consumption
(L/100 km)
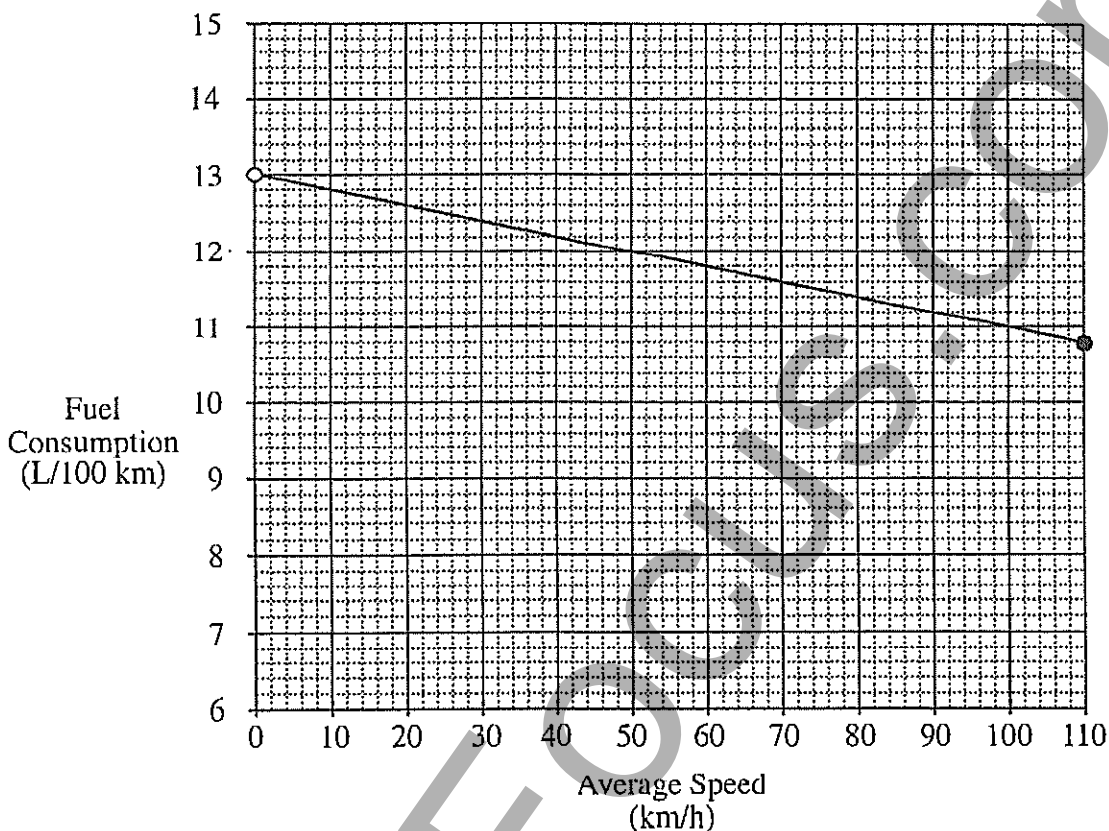
Average Speed
(km/h)

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   1
      of 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
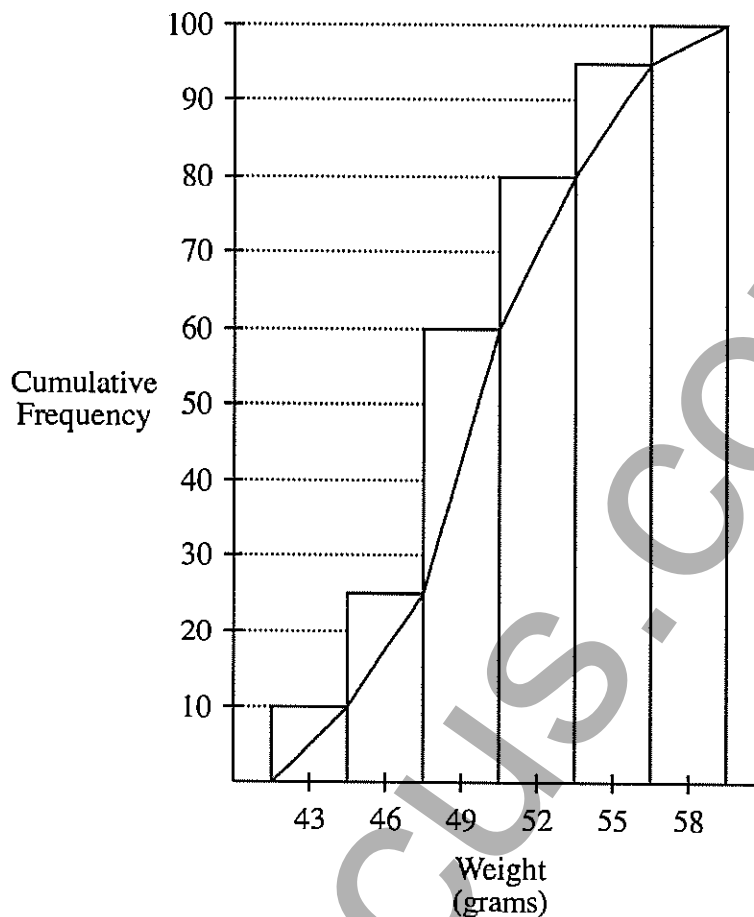
(i)   What is the modal class of this set of measurements?   1

(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   1
      42kg? 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   3
     now. 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?

(d)   In a science experiment, a tennis ball is dropped from the school verandah onto the playground. The height (h metres) of the ball after n bounces is modelled by the equation $h = 12(0.7)^n$.

   (i)   What is the dependent variable in this equation?   **1**

   (ii)   Calculate the height of the school verandah.   **1**

   (iii)   On which bounce will the ball first fail to reach a height of 1 metre?   **2**

   (iv)   What are the limitations of this model for large values of n?   **1**

End of Question 27

(i) If the Opening Ceremony starts in New Delhi at 5:00pm on 3rd October, what time would you need to watch television in Sydney to see a live broadcast of the start of this event?

1

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 2pm on 3rd October. What is the latest time he could leave Sydney?

3

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

2

(c) A bushwalker sets out from a point A and walks for 4 km on a bearing of 125° to a point B. He then continues on a bearing of 230° until he is due south of his starting point.

(i) Draw a neat sketch showing the above information.

1

(ii) Using the sine rule, determine how far south the bushwalker is from his starting point. Give your answer correct to 1 decimal place.

3

(d) Denise has either tea or coffee at morning break. If she has tea one morning, the 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?

3

End of Question 28

EXAMINERS

Bill Waddell (Convenor)   St Patrick's Marist College, Dundas
Vicki Attard   Marian College, Kenthurst
Patrick Curteis   Kambala, Rose Bay
Neila Darrough   Bethany College, Hurstville
Tim Hildebrandt   Oakhill College, Castle Hill