Centre Number

Student Number

CATHOLIC SECONDARY SCHOOLS
ASSOCIATION OF NEW SOUTH WALES

2004
TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

General Mathematics

Morning Session
Monday 9 August 2004

Total marks – 100

General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using blue or black pen
- Board-approved calculators may be used
- A separate formulae sheet is provided
- Use Multiple Choice Answer Sheet provided

Section I Pages 3-11

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

Section II Pages 12-23

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

Section I

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

Use the Multiple Choice Answer Sheet provided

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1 Simplify: $4a(a + 3)$

(A) $4a^2 + 3a$

(B) $4a^2 + 12a$

(C) $4a^2 + 3$

(D) $4a^2 + 12$

2 Ms Lauren gives a quick quiz at the beginning of each Mathematics class. The quiz is made up of three true or false questions. How many different ways are there of answering the quiz?

(A) 1

(B) 3

(C) 6

(D) 8

3 In his business Tom purchased a photocopier for $12 200. It depreciates by 15% of its original value each year. What is its value after 3 years?

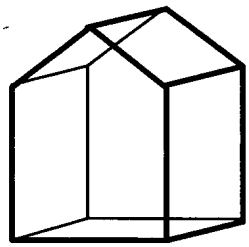
(A) $1830

(B) $5490

(C) $6710

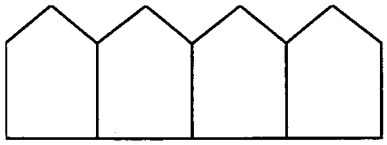
(D) $10370

4

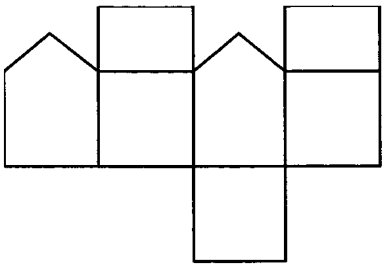


Which one of the following nets can form the solid shown above?

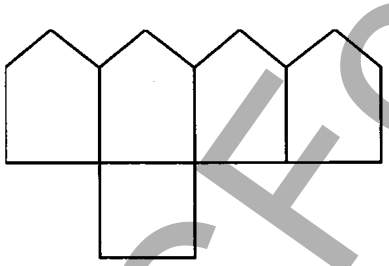
(A)



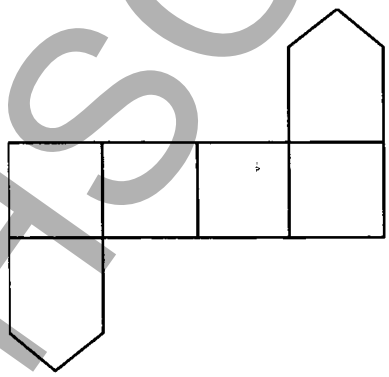
(B)



(C)



(D)



5 Peng surveyed 120 students in his year group about their favourite fruit. The results are displayed in the table below:

Type of Fruit	Number of Students
Apples	43
Bananas	20
Oranges	33
Lemons	8
Strawberries	16

When Peng constructs a sector graph to represent this information, what will be the size of the angle in the sector which represents strawberries?

(A) 13°

(B) 16°

(C) 39°

(D) 48°

6 In NSW, postcodes consist of four digits, with the first number always a '2'. The number of distinct possible postcodes is given by:

(A) 2^4

(B) $2 \times 10 \times 9 \times 8$

(C) 10^3

(D) 10^4

7 The table below shows the future value of an investment of \$1 in an ordinary annuity.

Period	Interest Rate per Period				
	1%	2%	3%	4%	5%
1	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500
3	3.0301	3.0604	3.0909	3.1216	3.1525
4	4.0604	4.1216	4.1836	4.2465	4.3101
5	5.1010	5.2040	5.3091	5.4163	5.5256
6	6.1520	6.3081	6.4684	6.6330	6.8019
7	7.2135	7.4343	7.6625	7.8983	8.1420
8	8.2857	8.5830	8.8923	9.2142	9.5491

Mario invests \$3000 at the end of each year for 5 years at 4% p.a. Using the table above, find the value of his annuity at the end of 5 years.

(A) \$12 739.50

(B) \$12 930.30

(C) \$16 248.90

(D) \$16 576.80

8 A square has side length of 25 cm. The area of the square is 6.25×10^a m^2.
The correct value of a is:

(A) –2

(B) –1

(C) 1

(D) 2

9 A set of examination results are found to follow a normal (symmetrical) distribution. 95% of all the results lie between 68 and 92. Which of the following would represent the mean and standard deviation of the distribution?

(A) Mean = 68, Standard deviation = 6

(B) Mean = 68, Standard deviation = 12

(C) Mean = 80, Standard deviation = 6

(D) Mean = 80, Standard deviation = 12

10 Maria has a credit card with interest charged at a rate of 0.05% per day and no interest-free period. On 14 April she makes a $240 purchase with the card. On 20 May she repaid the credit card account balance in full. What is the total amount, including interest, she paid?

(A) $4.32

(B) $244.32

(C) $432

(D) $672

11 The age of the universe is estimated to be 1.2×10^{10} years. Humans have existed on the Earth for approximately 100 000 years. For what percentage of the age of the universe have humans inhabited the Earth?

(A) 0.0000083%

(B) 0.00083%

(C) 1200%

(D) 12000000%

12 A Hospitality class was given a short topic test. The mean mark in the test was 71 and the standard deviation was 12. A z-score of -2 for this test would represent a mark of:

(A) 47

(B) 69

(C) 73

(D) 95

13 The daily costs of running a small factory is $800 for staff wages and $25 per hour to run the machinery. The total daily cost in dollars (C) can be expressed in terms of the number of hours (h) that the machinery operates. Which equation best represents this information?

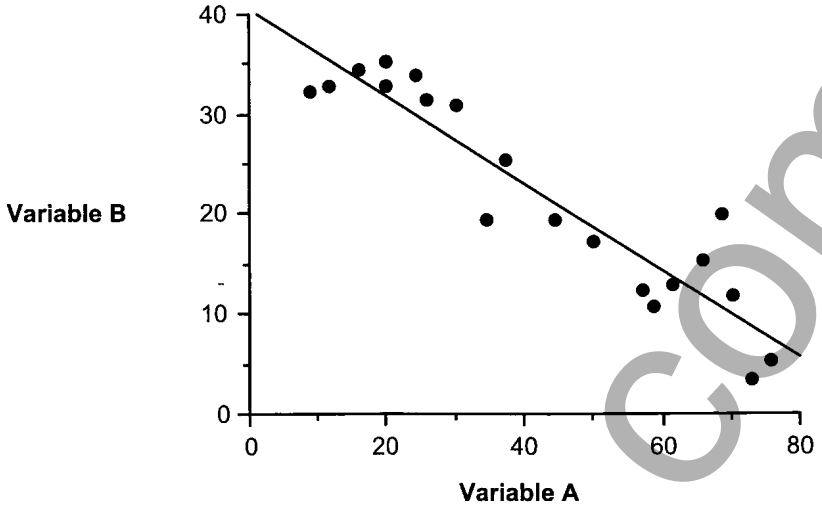
(A) $C = 825h$

(B) $C = 800 + 25h$

(C) $C = 25h$

(D) $C = 825$

14 The diagram below is a scatterplot of points which shows a relationship between two different variables. The line of best fit for the data points has been included. Which of the following correlation coefficients would best represent this set of data points?



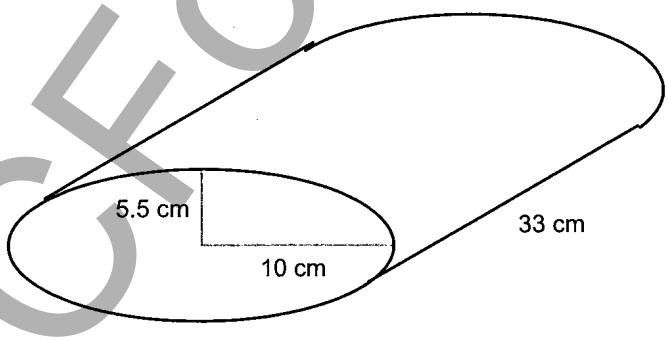
(A) $r = -0.8$

(B) $r = -0.1$

(C) $r = 0.1$

(D) $r = 0.8$

15 A car muffler is in the shape of an elliptical prism, as shown in the diagram below:



The volume of the muffler, correct to the nearest cubic centimetre, is:

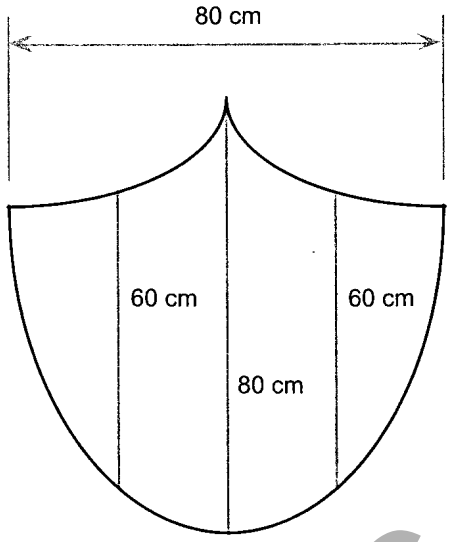
(A) 3136 cm^3

(B) 5701 cm^3

(C) 5702 cm^3

(D) 10 367 cm^3

16 The local Primary School wishes to have a new banner made for the regional music competition. Which expression for the area of this banner, in square centimetres, would be obtained from two applications of Simpson's Rule?



(A) $\frac{20}{3}(4 \times 60 + 80) + \frac{20}{3}(80 + 4 \times 60)$

(B) $\frac{80}{3}(4 \times 60 + 80) + \frac{80}{3}(80 + 4 \times 60)$

(C) $\frac{20}{3}(60 + 4 \times 80 + 60)$

(D) $\frac{80}{3}(60 + 4 \times 80 + 60)$

17 A gym has 179 female and 46 male members. A sample of the gym membership that is stratified according to gender should include:

(A) every member of the 6 am circuit weights session

(B) as close as possible to 20% females and 80% males

(C) as close as possible to 50% females and 50% males

(D) as close as possible to 80% females and 20% males

18 Belgrade and Warsaw lie on the same meridian of longitude. The two cities are 420 nautical miles apart and Warsaw is north of Belgrade. Which of the following could be the possible position co-ordinates for the two cities?

(A) Belgrade (21°N,52°E) and Warsaw (21°N,45°E)

(B) Belgrade (21°N,45°E) and Warsaw (21°N,52°E)

(C) Belgrade (52°N,21°E) and Warsaw (45°N,21°E)

(D) Belgrade (45°N,21°E) and Warsaw (52°N,21°E)

19 Youla wants to invest $8000 for 12 years. Which of the following provides the best financial return for her?

(A) Simple interest at 12% p.a.

(B) Interest compounded annually at 12% p.a.

(C) Interest compounded quarterly at 12% p.a.

(D) Interest compounded monthly at 12% p.a.

20 In a washing basket of socks, there are 7 school socks and 6 sports socks. Grant selects two socks at random from the basket. The probability that they are a matching pair is:

(A) $\left(\frac{7}{13}\times\frac{6}{12}\right)+\left(\frac{6}{13}\times\frac{5}{12}\right)$

(B) $\left(\frac{7}{13}\times\frac{7}{13}\right)+\left(\frac{6}{12}\times\frac{6}{12}\right)$

(C) $\left(\frac{7}{13}\times\frac{6}{13}\right)+\left(\frac{6}{13}\times\frac{5}{13}\right)$

(D) $\left(\frac{7}{13}\times\frac{7}{13}\right)+\left(\frac{6}{13}\times\frac{6}{13}\right)$

21 Each year the number of birds observed in a certain sanctuary doubles on what was observed in the previous year. If this pattern were to continue, which of the following predictions would be **incorrect**?

(A) The number of birds observed in 2 years would be 4 times greater than the number of birds observed now.

(B) The number of birds observed in 5 years would be 10 times greater than the number of birds observed now.

(C) The number of birds observed last year will be one quarter of the number of birds observed next year.

(D) The number of birds observed can be modelled using an exponential function.

22 Sei Sei wins a jackpot prize in the lottery. She wishes to invest an amount of this money in an investment account so she can withdraw $4000 every 3 months for the next 10 years. Interest on the account is compounded quarterly at a rate of 12% p.a. At the end of 10 years nothing will be left in the account. How much money does Sei Sei need to invest now?

(A) $22 600.89

(B) $32 443.58

(C) $79 171.09

(D) $92 459.09

Section II

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

Answer each question in a SEPARATE writing booklet.

All necessary working should be shown in every question.

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

(a) Consider the table below which describes the contents of a box of chocolates:

	Milk Chocolate	Dark Chocolate
Soft-centred	8	5
Hard-centred	4	6

(i) How many chocolates are in the box? **1**

(ii) How many soft-centred chocolates are in the box? **1**

(iii) What is the probability of choosing a soft-centred milk chocolate from the box? **1**

(b) Give an example of an event that has equally likely outcomes. **1**

(c) The repayment schedule for a reducing balance loan, with interest compounded monthly, is shown in the table below.

Amount of Loan = $50 000
Annual Interest Rate = 7.8%
Monthly Repayment (R) = $600

Period	Principal (P)	Interest (I)	P + I	P + I – R
1	$50 000.00	50000 x **0.0065** = $325.00	$50 325.00	$49 725.00
2	$49 725.00	$323.21	$50 048.21	$49 448.21
3	$49 448.21	**A**	**B**	$49 169.62
4	$49 169.62	$319.60	$49 489.22	$48 889.22
5	$48 889.22	$317.78	$49 207.00	$48 607.00

(i) Explain why the number 0.0065 is used in calculating the monthly interest. **1**

(ii) Calculate the values of **A** and **B** in the table. **2**

Question 23 continues on page 13

Marks

(d) At the start of 2001, Wayne buys a new tractor for \$80 000. To calculate its depreciation and salvage value he uses a declining balance method with a rate of 16% p.a.

(i) At the end of the first year, how much depreciation can he claim as a tax deduction? **1**

Wayne would like to know the year in which the value of the tractor falls below \$20 000. He uses a "guess and check" method to estimate the number of years (n) in the following equation:

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

Here is his working:

> Try $n = 4$:
> $S = 80000(1 - 0.16)^4$
> $= 39829.71$
> Hence $n = 4$ is too small.

(ii) Wayne's next guess is $n = 6$. Show Wayne's working for this guess, including the calculations and the conclusion. **1**

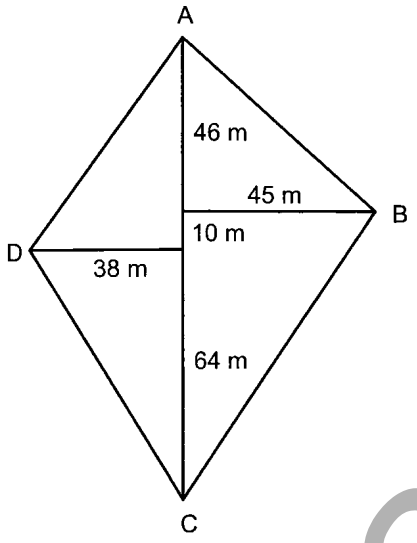
(iii) Using this method, or otherwise, during which year will the value of the tractor fall below \$20 000? Use mathematics to support your answer. **2**

(e) Solve the equation: $\frac{x-2}{3} - 4 = 5x$ **2**

End of Question 23

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

(a) A field is to be converted into an olive grove. A surveyor's sketch diagram of the field is shown below.

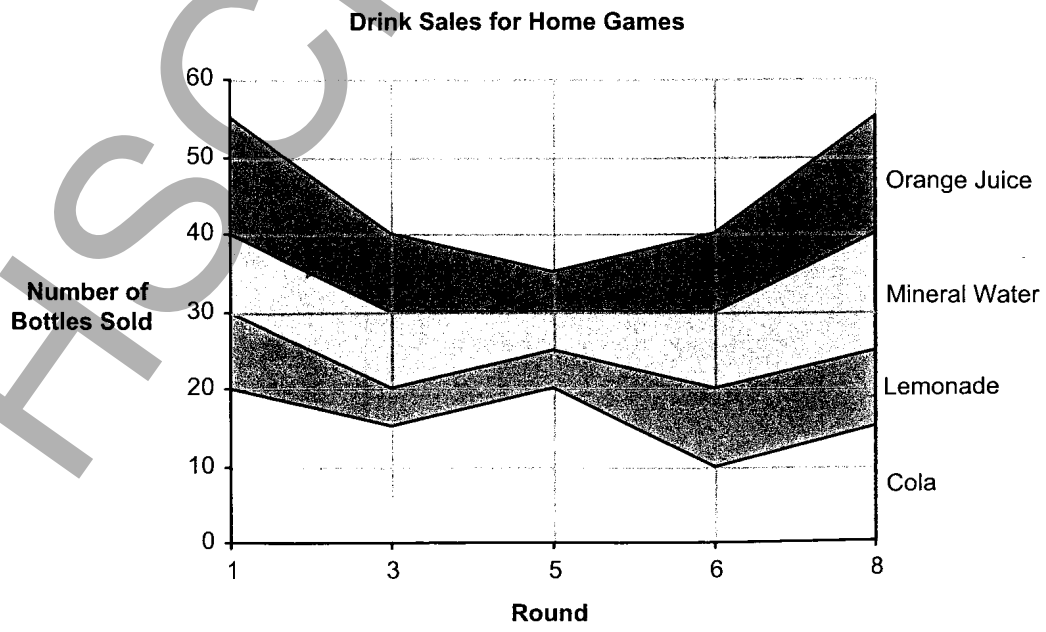


(i) Calculate the area of the field. **2**

(ii) Each olive tree needs an area of 15 m^2 to obtain maximum growth potential. What is the maximum number of trees that can be planted in the field? **1**

(iii) If a scale diagram of the field is drawn using a scale of 1:1000, what would be the length of AC on the scale diagram? **1**

(b) The Waratah Cheetahs are a rugby league team which play in a country club competition. The area graph below shows the sales of drinks at the kiosk at their first five home games this season.



Question 24 continues on page 15

(b) (i) How many bottles of cola were sold during Round 1? **1**

(ii) How many bottles of mineral water were sold during Round 5? **1**

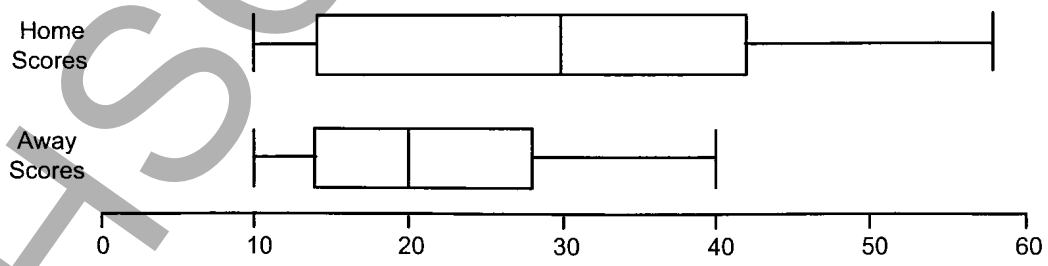
(iii) Which drink had the greatest sales over the five home games? **1**

(c) The Cheetahs played 12 home games and 12 away games. The "home" scores are the scores that the Cheetahs made while playing at their home ground, and the "away" scores are the scores that the Cheetahs made while playing at an opponent's ground.

	Home Scores	Away Scores
	10	10
	12	12
	12	12
	16	16
	18	16
	26	18
	34	22
	36	24
	40	26
	44	30
	45	38
	58	40
Mean:	29.25	
Standard Deviation:	15.15	

(i) Calculate the mean score and standard deviation for the Cheetahs' away scores. **2**

The information from the table is represented in the following box-and-whisker plot.



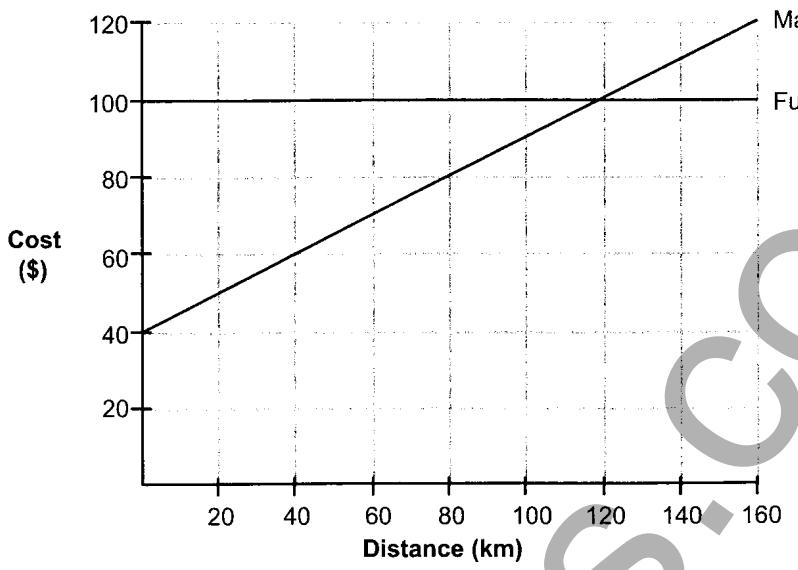
(ii) Write down the interquartile range for the Cheetahs' home scores. **1**

(iii) Compare and contrast the Cheetahs' home and away scores. In your answer, comment on the shape and skewness of the distributions, measures of location and spread. **3**

End of Question 24

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

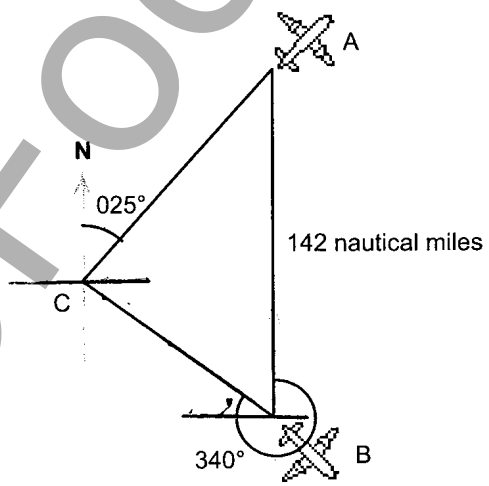
(a) The costs of hiring a car from two different rental companies, Mavis Rentals and Fudget Hire, are shown in the graph below.



(i) Using d to represent the total distance travelled and C to represent the total hiring cost, write the equation which represents the cost of hiring a car from Mavis Rentals. **2**

(ii) Explain why the line for Fudget Hire is horizontal. **1**

(b)



The diagram above shows the position of two planes, A and B, relative to an aircraft carrier, C. Plane A is due north of Plane B. The bearing of Plane A from the aircraft carrier is 025°. The bearing of the aircraft carrier from Plane B is 340°. The two planes are 142 nautical miles apart.

(i) Show that the size of $\angle ACB$ is 135°. **1**

(ii) Find the distance of Plane A from the aircraft carrier. Give your answer correct to the nearest nautical mile. **2**

Question 25 continues on page 17

(c) Two car companies are selling the same model car but on different terms as indicated below:

	Cash Price	Terms
Company A	$22 000	15% deposit plus 36 equal monthly repayments of $770
Company B	$23 000	$2300 deposit plus 36 equal monthly repayments of $786

(i) Calculate the deposit required by Company A. **1**

(ii) Calculate the interest charged by Company A. **2**

(iii) Calculate the flat rate of interest charged by Company A. Give your answer correct to 1 decimal place. **2**

(iv) If you had to buy on terms, which company would provide the best buy? **2**
Use mathematical calculations to justify your answer.

End of Question 25

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

(a) The stem-and-leaf plot below shows the results of an assessment task for a class of 25 students.

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

These results were compiled into the following grouped frequency distribution table.

Class	Class Centre	Frequency	Cumulative Frequency
40 – 49	44.5	3	3
50 – 59	55.5	5	8
60 – 69	65.5	9	17
70 – 79	75.5	7	24
80 – 89	85.5	**B**	24
90 – 99	95.5	1	25

(i) If the median score on the task was 64, write down the value of **A** in the stem-and-leaf plot. **1**

(ii) Write down the value of **B** in the frequency distribution table. **1**

(iii) If the outlier score is removed from the set of results, comment on the effect that this will have on the mean mark and standard deviation. **2**

(b) The fuel consumption of a car varies inversely with the speed of the car. Fuel consumption is usually measured in litres used per 100 km travelled. When the car is travelling at a speed of 20 km/h it has a fuel consumption of 12 L/100 km.

(i) Write an expression in the form $y = \frac{a}{x}$ to represent this situation. **2**

(ii) By using the expression from (i), or otherwise, find the fuel consumption of the car when it is travelling at a speed of 50 km/h. **1**

Question 26 continues on page 19

(c) A weather balloon was released into the atmosphere on a clear day. The balloon sent back information about its height above the ground and the air temperature and air pressure at that height. The following information was recorded:

Height (feet)	Air Pressure (hPa)	Air Temperature (°C)
Ground Level	1013	18
1000	980	16
2000	947	14
3000	913	12
4000	880	10
5000	847	8
6000	813	6
7000	920	4
8000	747	2
9000	713	0
10000	680	–2

(i) Describe the relationship between the change in air temperature and the change in the balloon's height above the ground. **1**

(ii) At 7000 feet, the air pressure reading was 920 hPa. This appears to be an incorrect reading. What reading for air pressure would you expect at this height? **1**

(iii) Using the information in the table, predict what the air pressure would be at a height of 12000 feet above the ground. **1**

(iv) Construct an algebraic expression which can be used to relate the air temperature (T) with the height (h) of the balloon above the ground. **2**

(v) If this balloon had been released on a day where the temperature at ground level was only 10°C, then based on the above information, what would you expect the temperature to be at a height of 10 000 feet above the ground? **1**

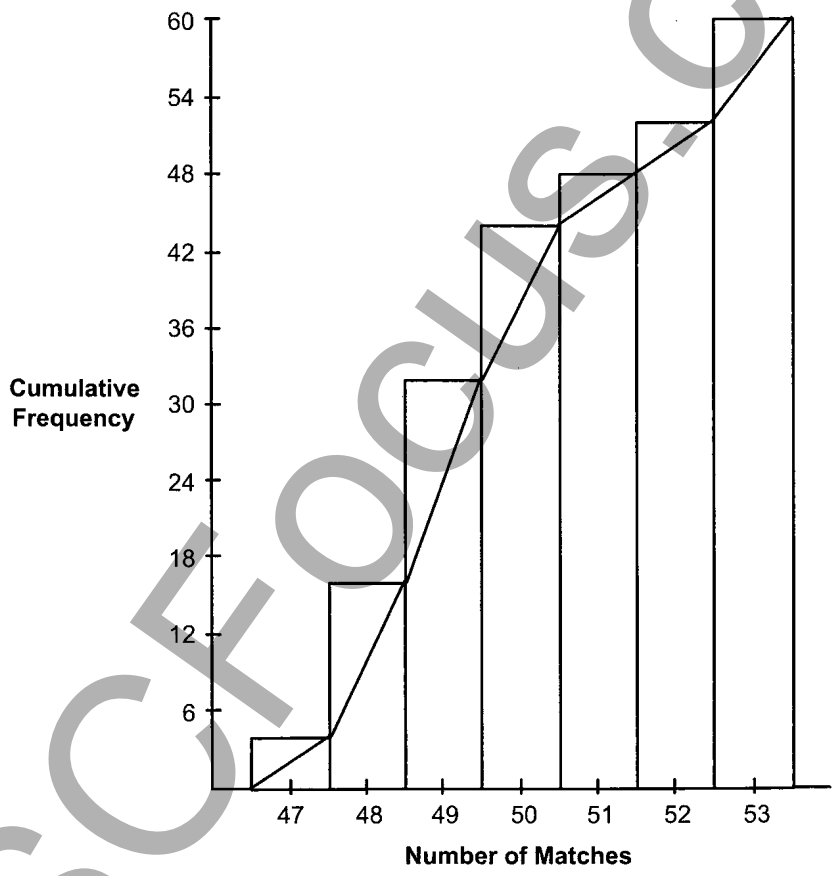
End of Question 26

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

(a) (i) If it is 6:00 am on Monday in Nauru (3°N,161°E), what time and day will it be on Phoenix Island (5°S,174°W)? **3**

(ii) What is the distance, in nautical miles, from Phoenix Island (5°S,174°W) to Pago Pago (17°S,174°W)? **1**

(b) A match factory performed a quality control test on the number of matches in a sample of matchboxes. Sixty matchboxes were selected at random. The number of matches in each box was recorded and the results are displayed in the cumulative frequency histogram and polygon below.



(i) What is the most effective sampling method which could be used to select the 60 matchboxes to be checked? **1**

(ii) By examining the histogram and/or polygon above, or otherwise, write down the five number summary for this set of results. **2**

(iii) In a carton of 500 boxes of matches, how many boxes would you expect to find that contained less than 50 matches? **1**

Question 27 continues on page 21

(c) The Income Tax rates for the 2003-2004 financial year are shown in the table below.

Taxable Income	Tax on Taxable Income
$1 – $6000	Nil
$6001 – $21600	17¢ for each $1 over $6000
$21601 – $52000	$2652 plus 30¢ for each $1 over $21600
$52001 – $62500	$11772 plus 42¢ for each $1 over $52000
$62501 – and over	$16182 plus 47¢ for each $1 over $62500

Kay has a total income of $65 500. Her tax payable is $11 898.

(i) Determine her taxable income. **2**

(ii) How much did Kay claim as allowable tax deductions? **1**

PAYG Payment Summary - Individual Non Business

Payment Summary for year ending 30 June2004

Payer's Name SMITHS INDUSTRIES	Payee's Tax File Number 123-123-123
Signature of Authorised Person J M SMITH 29/6/2003 Payer's ABN Number 12-123-123-123	FBT Year 1 April to 30 March Reportable fringe benefits amount
Payee's Surname, Given Name and Address KAY JONES 11/234 CHEETAH ROAD WARATAH NSW 2298	Gross Payments (Whole Dollars) 65 500
Union Fees, etc — Name of Organisation — Amount (Whole Dollars)	Allowances (Whole Dollars)
Period during which Payments were made From 10/07/2003 To 24/06/2004	Lump Sum Payments (Whole Dollars)
Total Tax Withheld - Whole Dollars Only (in words) Thousands: TWELVE — Hundreds: TWO — Tens: ZERO — Units: ZERO Total Tax Withheld (Whole Dollars): 12 200	CDEP Salary (Whole Dollars) Other Income (Whole Dollars)

The Payment Summary above shows information about Kay's total income for the financial year, and the total amount of her PAYG deductions. Kay must also pay a Medicare Levy of $768.

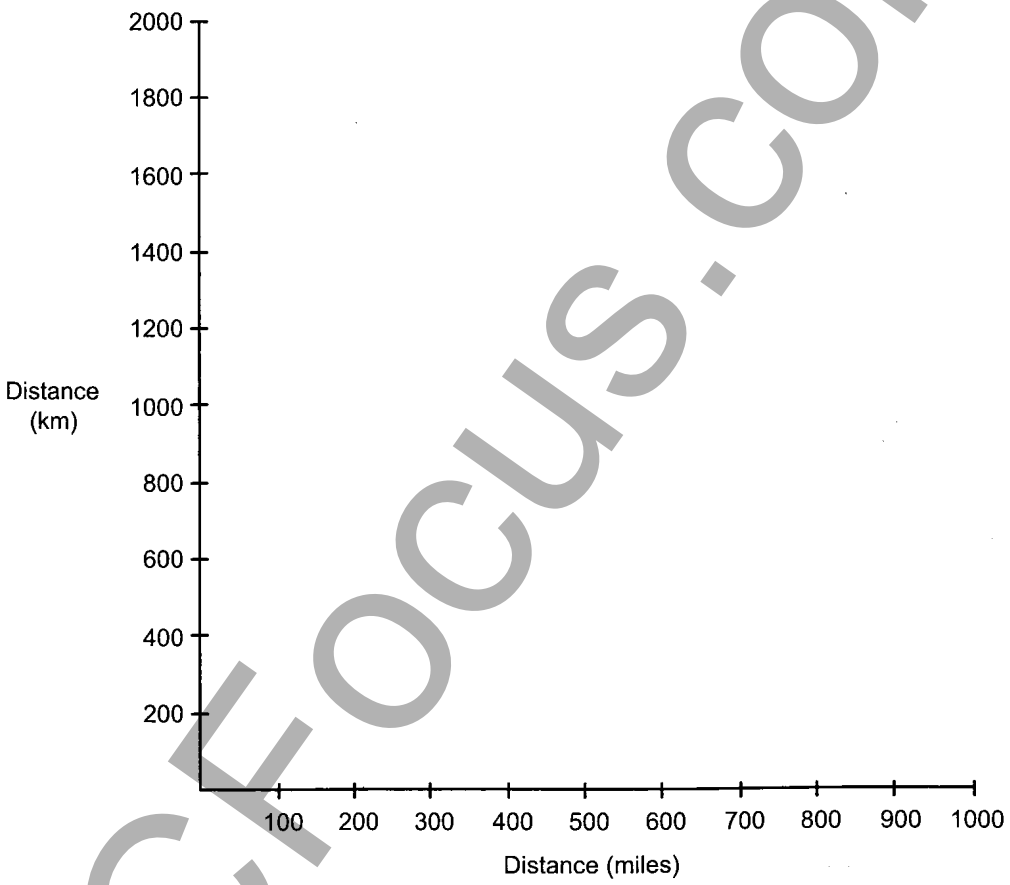
(iii) Use the information above to calculate the additional amount of tax that Kay must pay. **2**

End of Question 27

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

(a) A man visiting the United States was confused when trying to convert the distance he had travelled in miles to kilometres. He was able to establish that to get a measurement in kilometres he needed to multiply the number of miles by 1.61. For example, 100 miles = 161 km.

(i) Copy the axes below into your answer booklet, and complete a conversion graph that the man could use to calculate a distance travelled from miles to kilometres. **2**

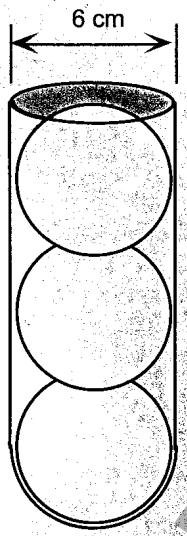


(ii) One day the man travelled 800 miles. Use your graph to convert this distance into kilometres. **1**

(b) The Victoria Parks Corporation conducted a survey on the population of koalas in the Otway National Park. In January 2003, in a particular region of the park, Simon caught and tagged 56 koalas. In January this year, in the same region of the park, Simon caught 42 koalas and discovered that 13 of them had been tagged in the previous year. Estimate the total population of koalas in the national park. **2**

Question 28 continues on page 23

(c) A plastic container for three tennis balls is designed with a hemispherical base and a cylindrical body. Three balls are to fit snugly inside the container. Each ball has a diameter of 6 cm. If a lid is placed on top of the container it will just touch the top tennis ball. **3**



Find the total surface area of plastic which will be required to make the container (without the lid). Give your answer correct to 1 decimal place.

(d) In a classroom experiment, a game is played involving the rolling of two dice. The score is obtained by finding the difference between the numbers on the uppermost faces of the dice, as shown on the table below:

		1st Die					
		1	**2**	**3**	**4**	**5**	**6**
2nd Die	**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

(i) List all the possible outcomes. **1**

(ii) What is the probability of scoring a difference of 2. **1**

(iii) The rules of the game state that the teacher wins if a score of 0, 1 or 2 is obtained and the students win if a score of 3, 4 or 5 is obtained. Is the chance of winning equal for both the teacher and the students? If not, how could the rules be adjusted to give both the teacher and students an equal chance of winning? Use mathematics to support your answer. **3**

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