

For profit to be \$1500,
 income = \$3100 + \$1500
 = \$4600.
 \therefore Ticket price = $\frac{\$4600}{200}$
 = \$23.

METHOD 2

From the graph, the current profit
 for 200 people = \$4000 - \$3100
 = \$900.
 Need \$600 more overall, so extra charge
 per ticket = $\frac{\$600}{200}$
 = \$3.
 \therefore Ticket price = \$20 + \$3
 = \$23.

METHOD 3

Fixed costs per person = $\frac{(1500 + 700)}{200}$
 = \$11.
 Refreshment cost per person = \$12.
 \therefore Total cost per person = \$11 + \$12
 = \$23.

END OF GENERAL MATHEMATICS SOLUTIONS

2004 HIGHER SCHOOL CERTIFICATE
 EXAMINATION PAPER
 GENERAL MATHEMATICS

Section I

22 marks

Attempt Questions 1 – 22

Allow about 30 minutes for this section

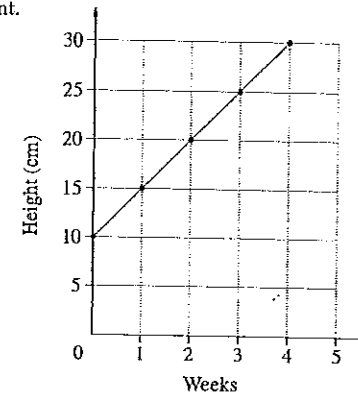
1 Which fraction is equal to a probability of 25%?

- (A) $\frac{1}{25}$ (B) $\frac{1}{4}$ (C) $\frac{1}{3}$ (D) $\frac{1}{2}$

2 Susan drew a graph of the height of a plant.

What is the gradient of the line?

- (A) 1
 (B) 5
 (C) 7.5
 (D) 10



3 If $K = Ft^3$, $F = 5$ and $t = 0.715$, what is the value of K correct to three significant figures?

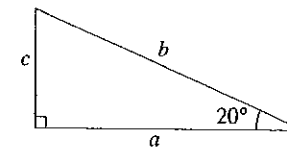
- (A) 1.82 (B) 1.827 (C) 1.828 (D) 1.83

4 A real estate agent sells a house for \$400 000. From the selling price he earns \$10 000 for his services. Which term is used to describe the money he earns?

- (A) Commission (B) Income tax (C) Royalty (D) Superannuation

5 What is the correct expression for $\tan 20^\circ$ in this triangle?

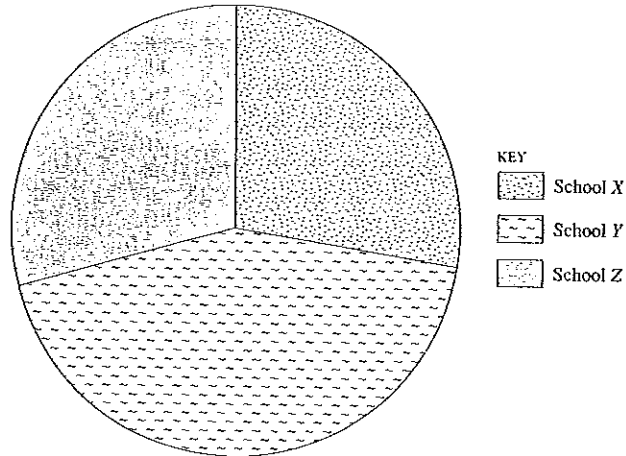
- (A) $\frac{a}{b}$
 (B) $\frac{a}{c}$
 (C) $\frac{c}{b}$
 (D) $\frac{c}{a}$



NOT TO SCALE

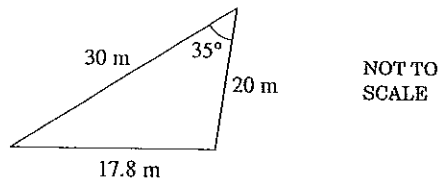
Use the set of scores 1, 3, 3, 3, 4, 5, 7, 7, 12 to answer Questions 6 and 7.

- 6 What is the range of the set of scores?
 (A) 6 (B) 9 (C) 11 (D) 12
- 7 What are the median and the mode of the set of scores?
 (A) Median 3, mode 5 (B) Median 3, mode 3 (C) Median 4, mode 5 (D) Median 4, mode 3
- 8 This sector graph shows the distribution of 116 prizes won by three schools: X, Y, and Z.



How many prizes were won by School X?
 (A) 26 (B) 32 (C) 81 (D) 99

- 9 What is the area of the triangle to the nearest square metre?
 (A) 102 m²
 (B) 153 m²
 (C) 172 m²
 (D) 178 m²

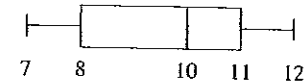


10 Using the tax table, determine the tax payable on a taxable income of \$47 000.

Taxable income	Tax on this income
\$0 – \$6 000	NIL
\$6 001 – \$22 000	16 cents for each \$1 over \$6 000
\$22 001 – \$45 000	\$2 560 plus 25 cents for each \$1 over \$22 000
\$45 001 – \$60 000	\$8 310 plus 40 cents for each \$1 over \$45 000
\$60 001 and over	\$14 310 plus 48 cents for each \$1 over \$60 000

- (A) \$8 310-40 (B) \$9 109-60 (C) \$9 110-00 (D) \$10 310-40

- 11 If $d = 6t^2$, what is a possible value of t when $d = 2400$?
 (A) 0.05 (B) 20 (C) 120 (D) 400
- 12 This box-and-whisker plot represents a set of scores.



What is the interquartile range of this set of scores?
 (A) 1 (B) 2 (C) 3 (D) 5

13

How much air do you breathe?

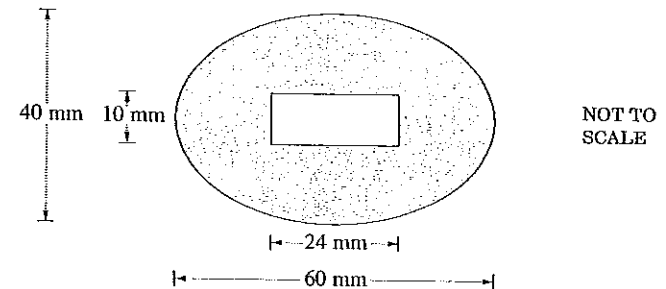
100 litres per minute while exercising

6 litres per minute while resting

During a ten-minute period, Kath is exercising and Jim is resting.
 How much more air would Kath breathe than Jim during this time?
 (A) 40 litres (B) 94 litres (C) 940 litres (D) 1060 litres

- 14 Mike plays a game in which he has:
- $\frac{1}{10}$ chance of winning \$20
 - $\frac{1}{2}$ chance of winning \$1
 - $\frac{2}{5}$ chance of losing \$2.
- What is Mike's financial expectation when playing this game?
 (A) \$1.70 (B) \$3.30 (C) \$17.00 (D) \$19.00

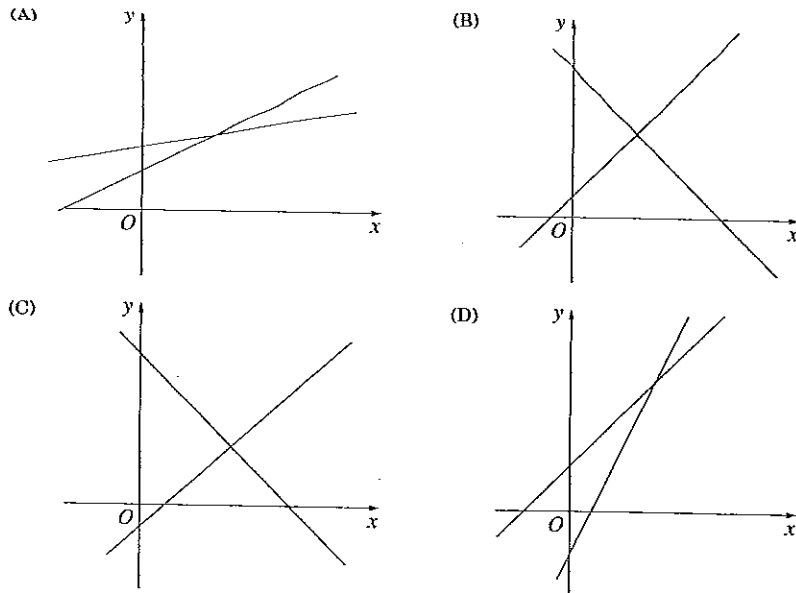
15 The figure shows an ellipse and a rectangle.



What is the area of the shaded part of the figure to the nearest square millimetre?
 (A) 1645 mm² (B) 2160 mm² (C) 3530 mm² (D) 7300 mm²

16 George drew a correct diagram that gave the solution to the simultaneous equations $y = 2x - 5$ and $y = x + 6$.

Which diagram did he draw?



17 Rita purchased a camera for \$880 while on holidays in Australia. This price included 10% GST. When she left Australia she received a refund of the GST.

What was Rita's refund?

- (A) \$80 (B) \$88 (C) \$792 (D) \$800

18 Two dice are rolled. What is the probability that only one of the dice shows a six?

- (A) $\frac{5}{36}$ (B) $\frac{1}{6}$ (C) $\frac{5}{18}$ (D) $\frac{11}{36}$

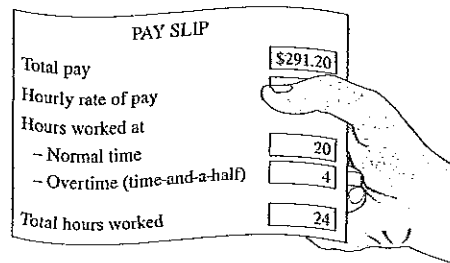
19 Kerry has a credit card. She is charged 0.05% compound interest per day on outstanding balances. How much interest is Kerry charged on an amount of \$250, which is outstanding on her credit card for 30 days?

- (A) \$3.75 (B) \$3.78 (C) \$253.75 (D) \$253.78

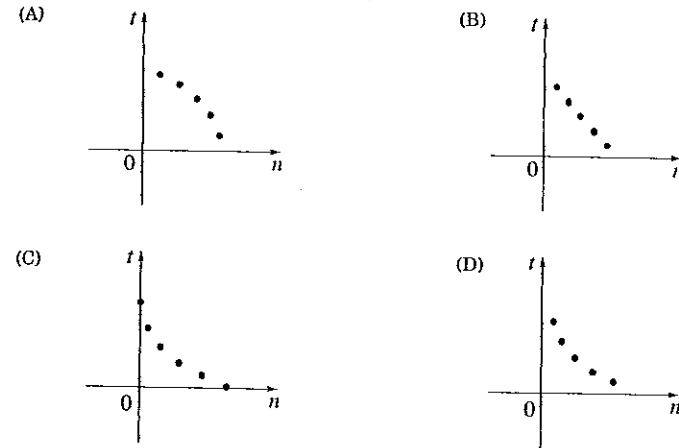
20 Stan worked for 24 hours as shown on his pay slip.

What was his hourly rate of pay?

- (A) \$11.20
(B) \$12.13
(C) \$14.56
(D) \$18.20



21 The time (t) taken to clean a house varies inversely with the number (n) of people cleaning the house. Which graph represents this relationship?



22 John knows that

- one Australian dollar is worth 0.62 euros
- one Vistabella dollar (\$) is worth 1.44 euros.

John changes 25 Australian dollars to Vistabella dollars.

How many Vistabella dollars will he get?

- (A) \$V10.76 (B) \$V22.32 (C) \$V28.00 (D) \$V58.06

Section II

78 marks

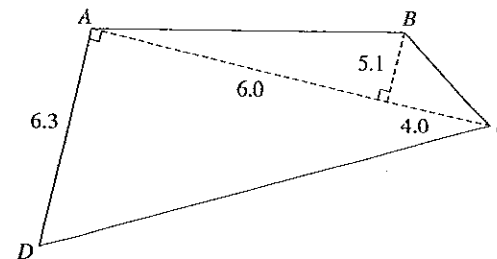
Attempt Questions 23 – 28

Allow about 2 hours for this section

Question 23 (13 marks)

Marks

(a) The diagram shows the shape of Carmel's garden bed. All measurements are in metres.

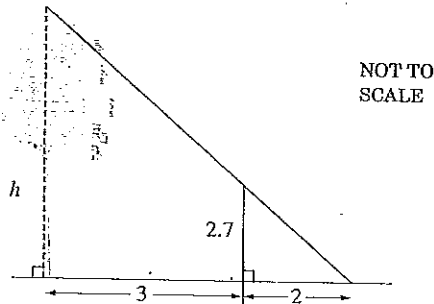


NOT TO SCALE

- (i) Show that the area of the garden bed is 57 square metres. 2
- (ii) Carmel decides to add a 5 cm layer of straw to the garden bed. Calculate the volume of straw required. Give your answer in cubic metres. 2

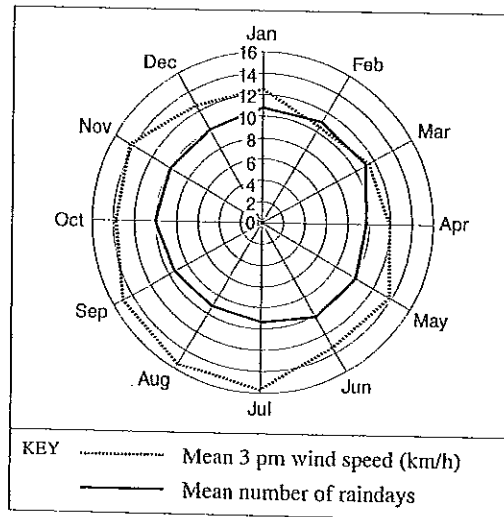
Marks

- (iii) Each bag holds 0.25 cubic metres of straw. How many bags does she need to buy? 2
 - (iv) A straight fence is to be constructed joining point A to point B. Find the length of this fence to the nearest metre. 2
- (b) Kirbee is shopping for computer software. *Novirus* costs \$115 more than *Funmaths*. Let x dollars be the cost of *Funmaths*.
- (i) Write an expression involving x for the cost of *Novirus*. 1
 - (ii) *Novirus* and *Funmaths* together cost \$415. Write an equation involving x and solve it to find the cost of *Funmaths*. 2
- (c) Calculate the height (h metres) of the tree in the diagram. All measurements are in metres. 2



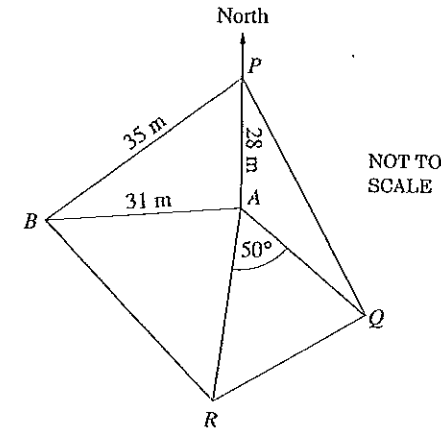
Question 24 (13 marks)

- (a) The following graphs have been constructed from data taken from the Bureau of Meteorology website. The information relates to a town in New South Wales. The graphs show the mean 3 pm wind speed (in kilometres per hour) for each month of the year and the mean number of days of rain for each month (raindays).

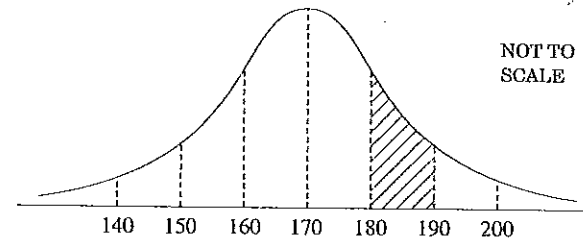


Marks

- (i) What is the mean 3 pm wind speed for September? 1
 - (ii) Which month has the lowest mean 3 pm wind speed? 1
 - (iii) In which three-month period does the town have the highest number of raindays? 1
 - (iv) Briefly describe the pattern relating wind speed with the number of raindays for this town. Refer to specific months. 2
- (b) The diagram shows a radial survey of a piece of land.



- (i) Q is south-east of A . What is the size of angle PAQ ? 1
 - (ii) What is the bearing of R from A ? 1
 - (iii) Find the size of angle PAB to the nearest degree. 3
- (c) The normal distribution shown has a mean of 170 and a standard deviation of 10.

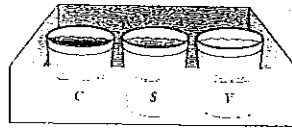


- (i) Roberto has a raw score in the shaded region. What could his z -score be? 1
- (ii) What percentage of the data lies in the shaded region? 2

Question 25 (13 marks)

- (a) Tai uses the declining balance method of depreciation to calculate tax deductions for her business. Tai's computer is valued at \$6500 at the start of the 2003 financial year. The rate of depreciation is 40% per annum.
- (i) Calculate the value of her tax deduction for the 2003 financial year. 1
 - (ii) What is the value of her computer at the start of the 2006 financial year? 2

- (b) Joe sells three different flavours of ice-cream from three different tubs in a cabinet. The flavours are chocolate, strawberry and vanilla.



Marks

- (i) In how many different ways can he arrange the tubs in a row? Show working to justify your answer. 2
- (ii) Paul buys an ice-cream from Joe on two different days. He chooses the flavour at random. What is the probability that he chooses chocolate on both days? 1
- (iii) Mei-Ling buys an ice-cream from Joe and chooses any two different flavours at random. What is the probability that she chooses chocolate first and then strawberry? 3

- (c) Lie detector tests are not always accurate. A lie detector test was administered to 200 people. The results were:

- 50 people lied. Of these, the test indicated that 40 had lied;
- 150 people did NOT lie. Of these, the test indicated that 20 had lied.

- (i) Copy the table and complete it using the information above. 2

	Test indicated a lie	Test did not indicate a lie	Total
People who lied			50
People who did NOT lie			150

- (ii) For how many of the people tested was the lie detector test accurate? 1
- (iii) For what percentage of the people tested was the test accurate? 1
- (iv) What is the probability that the test indicated a lie for a person who did NOT lie? 1

Question 26 (13 marks)

- (a) (i) The number of bacteria in a culture grows from 100 to 114 in one hour. What is the percentage increase in the number of bacteria? 1
- (ii) The bacteria continue to grow according to the formula $n = 100(1.14)^t$, where n is the number of bacteria after t hours. What is the number of bacteria after 15 hours? 1

Time in hours (t)	0	5	10	15
Number of bacteria (n)	100	193	371	?

- (iii) Use the values of n from $t = 0$ to $t = 15$ to draw a graph of $n = 100(1.14)^t$. Use about half a page for your graph and mark a scale on each axis. 4
- (iv) Using your graph or otherwise, estimate the time in hours for the number of bacteria to reach 300. 1
- (b) The location of Sorong is $1^\circ\text{S } 131^\circ\text{E}$ and the location of Darwin is $12^\circ\text{S } 131^\circ\text{E}$.
- (i) What is the difference in the latitudes of Sorong and Darwin? 1
- (ii) The radius of Earth is approximately 6400 km. One nautical mile is approximately 1.852 km.

- (1) Show that the great circle distance between Sorong and Darwin is approximately 1200 km. 2
- (2) A group of tourists can travel on a yacht at an average speed of 15 knots, from Darwin to Sorong. They need to complete this trip in 48 hours or less. Will this be possible? Use suitable calculations, with appropriate units, to justify your answer. 3

Question 27 (13 marks)

- (a) Aaron decides to borrow \$150 000 over a period of 20 years at a rate of 7.0% per annum.

MONTHLY REPAYMENT TABLE						
Principal and interest per \$1000 borrowed						
Interest rate (pa)	Term of loan - years					
	5	10	15	20	25	30
6.5%	19.57	11.35	8.71	7.46	6.75	6.32
7.0%	19.80	11.61	8.99	7.75	7.07	6.65
7.5%	20.04	11.87	9.27	8.06	7.39	6.99
8.0%	20.28	12.13	9.56	8.36	7.72	7.34

- (i) Using the Monthly Repayment Table, calculate Aaron's monthly repayment. 2
- (ii) How much interest does he pay over the 20 years? 2
- (iii) Aaron calculates that if he repays the loan over 15 years, his total repayments would be \$242 730. How much interest would he save by repaying the loan over 15 years instead of 20 years? 2

- (b) David is paid at these rates:

Weekday rate	\$18.00 per hour
Saturday rate	Time-and-a-half
Sunday rate	Double time

His time sheet for last week is:

	Start	Finish	Unpaid break
Friday	9.00 am	1.30 pm	30 minutes
Saturday	9.00 am	4.00 pm	1 hour
Sunday	8.00 am	2.00 pm	1 hour

- (i) Calculate David's gross pay for last week. 3
- (ii) David decides not to work on Saturdays. He wants to keep his weekly gross pay the same. How many extra hours at the weekday rate must he work? 1
- (c) Sajeev starts saving for a holiday that he wants to take when he finishes his TAFE course. He decides to invest \$200 per month, at the end of each month, by placing it into an account earning 6% per annum compounded monthly. He will do this for four years. Will Sanjeev reach his goal of \$10 500? By how much will he fall short of or exceed his goal? 3

Question 28 (13 marks)

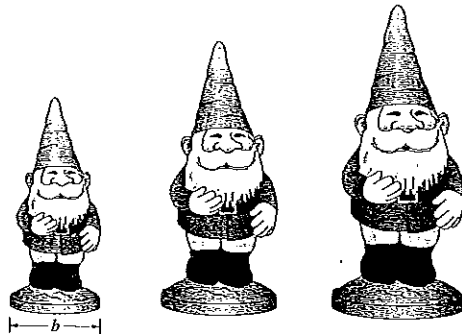
Marks

- (a) A health rating, R , is calculated by dividing a person's weight, w , in kilograms by the square of the person's height, h , in metres.
- (i) Fred is 150 cm and weighs 72 kg. Calculate Fred's health rating.
 - (ii) Over several years, Fred expects to grow 10 cm taller. By this time he wants his health rating to be 25. How much weight should he gain or lose to achieve his aim? Justify your answer with mathematical calculations.

1

2

(b)



A set of garden gnomes is made so that the cost (\$ C) varies directly with the cube of the base length (b centimetres). A gnome with a base length of 10 cm has a cost of \$50.

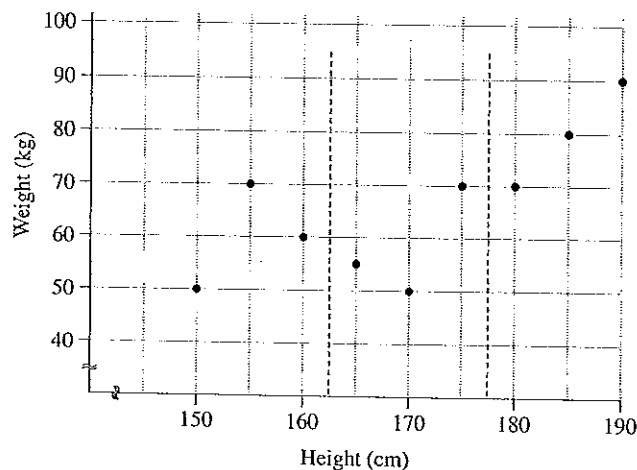
- (i) Write an equation relating the variables C and b , and a constant k .
- (ii) Find the value of k .
- (iii) Felicity says, 'If you double the base length, you double the cost.' Is she correct? Justify your answer with mathematical calculations.

1

1

2

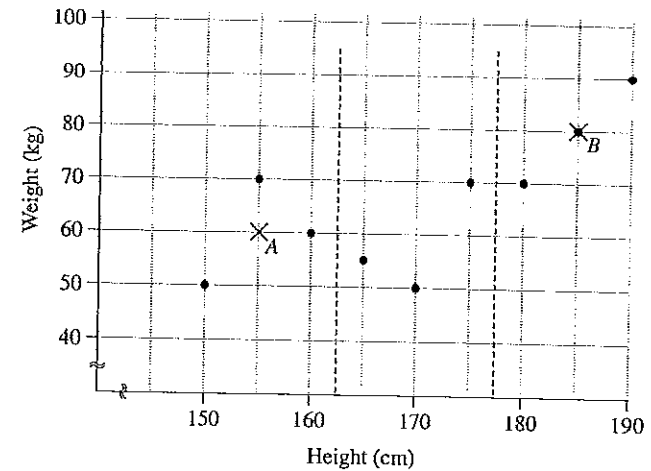
- (c) Jill has collected data about the height and weight of nine adults. This is shown in the scatterplot below. Using a ruler and pencil, Jill is preparing to fit a median regression line to the data. As a first step she divides the data into three sections as shown.



Marks

- (i) In the second step, Jill calculates the points A and B as shown in the diagram below. What are the coordinates of the corresponding point C in the middle section?

2



- (ii) In the third step, Jill draws a line through A and B . What is the fourth and final step needed to complete her construction of the median regression line?
- (iii) The equation of the median regression line for the data may be approximated by

2

$$\text{weight in kg} = \frac{2}{3}(\text{height in cm}) - 50.$$

- (1) Use this model to predict the height of a person who weighs 75 kg.
- (2) Give ONE limitation of this model for predicting weights from heights.

1

1

End of paper

2004 HIGHER SCHOOL CERTIFICATE SOLUTIONS GENERAL MATHEMATICS

SECTION I SUMMARY

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

1. (B) $25\% = \frac{25}{100} = \frac{1}{4}$.
2. (B) Using the points (0, 10) and (4, 30):
 Gradient = $\frac{\text{vertical rise}}{\text{horizontal run}} = \frac{30-10}{4-0} = \frac{20}{4} = 5$.
3. (D) $K = Ft^3 = 5 \times (0.715)^3 = 1.827\ 629\ 375 \dots \div 1.83$ (3 significant figures).
4. (A) Real estate agents receive a *commission* for selling property.
5. (D) $\tan 20^\circ = \frac{\text{opposite}}{\text{adjacent}} = \frac{c}{a}$.
6. (C) Range = highest score - lowest score = $12 - 1 = 11$.
7. (D) 1, 3, 3, ④, 5, 7, 7, 12
 ↑
 Median is the middle score for an odd set of scores. Median = 4.
 Mode is the score with the highest frequency. Mode = 3.
8. (B) Sector angle for school X = 100° .
 Number of prizes won by school X = $\frac{100}{360} \times 116 = 32.2222 \dots \div 32$.

\therefore School X won 32 prizes (number of prizes must be a whole number).

9. (C) Area = $\frac{1}{2} ab \sin C = \frac{1}{2} \times 30 \times 20 \times \sin 35^\circ = 172.072\ 930\ 9 \dots \div 172\ \text{m}^2$ (nearest m^2).
10. (C) Tax payable = $\$8310 + 0.4 \times (\$47\ 000 - \$45\ 000) = \9110.00 .
11. (B) $d = 6t^2$
 $\frac{2400}{6} = \frac{6t^2}{6}$
 $400 = t^2$
 $t = \pm \sqrt{400}$
 $t = \pm 20$.
 $\therefore t = 20$ is a possible value.
12. (C) Interquartile range = upper quartile - lower quartile = $11 - 8 = 3$.
13. (C) Kath breathes $10 \times 100\ \text{L} = 1000\ \text{L}$.
 Jim breathes $10 \times 6\ \text{L} = 60\ \text{L}$.
 Difference = $1000\ \text{L} - 60\ \text{L} = 940\ \text{L}$.
14. (A) Financial expectation = $\frac{1}{10} \times \$20 + \frac{1}{2} \times \$1 + \frac{2}{5} \times (-\$2) = \$1.70$.
15. (A) Shaded area = area of ellipse - area of rectangle.
 For the ellipse: $a = \frac{1}{2} \times 60 = 30$, $b = \frac{1}{2} \times 40 = 20$.
 For the rectangle: $L = 24$, $B = 10$.
 \therefore Area = $\pi ab - LB = \pi \times 30 \times 20 - 24 \times 10 = 1644.955\ 592 \dots \div 1645\ \text{mm}^2$ (nearest mm^2).

16. (D) Both linear equations are of the form $y = mx + b$ where $m =$ gradient, $b =$ y-intercept.
 \therefore The graph of $y = 2x - 5$ has a gradient of 2 and a y-intercept of -5.
 \therefore The graph of $y = x + 6$ has a gradient of 1 and a y-intercept of 6.
 (D) is the only diagram that shows 2 lines, both having positive gradient, one line with a positive y-intercept and the other line with a negative y-intercept.

17. (A) **METHOD 1**
 110% of original price = \$880.
 So $10\% = \$880 \div 11$
 \therefore GST refund = \$80.

- METHOD 2**
 110% of original price = \$880.
 $1\% = \$880 \div 110$
 $1\% = \$8$.
 So $10\% = \$80$
 \therefore GST refund = \$80.

18. (C)

	1	2	3	4	5	6
1	•	•	•	•	•	(1, 6)
2	•	•	•	•	•	(2, 6)
3	•	•	•	•	•	(3, 6)
4	•	•	•	•	•	(4, 6)
5	•	•	•	•	•	(5, 6)
6	(6, 1)	(6, 2)	(6, 3)	(6, 4)	(6, 5)	•

There are 36 possible outcomes when 2 dice are rolled.

$$P(\text{only one dice shows } 6) = \frac{10}{36} = \frac{5}{18}$$

19. (B) $A = P(1+r)^n$ where $A =$ final amount
 $P = 250$
 $r = 0.05\%$
 $= \frac{0.05}{100}$ per day
 $n = 30$ days.
 $A = 250 \times \left(1 + \frac{0.05}{100}\right)^{30} = 253.777\ 314\ 8 \dots$
 Final value = \$253.78 (to nearest cent).
 \therefore Interest charged = $\$253.78 - \$250 = \$3.78$.

20. (A) **METHOD 1**
 Equivalent normal hours worked = $20 + 4 \times 1.5 = 26$.
 So hourly rate = $\$291.20 \div 26 = \11.20 .

METHOD 2

Let hourly rate be h .

$$20 \times h + 4 \times 1.5 \times h = 291.20$$

$$20h + 6h = 291.20$$

$$26h = 291.20$$

$$\therefore h = \frac{291.20}{26}$$

$$= 11.2$$

\therefore Hourly rate is \$11.20.

21. (D) Relationship is of the form $t = \frac{k}{n}$, where k is a constant.

A graph of this relationship would be a hyperbola. Note that a hyperbola is a curve that approaches each axis but has no point on either axis.

22. (A) One Australian dollar = 0.62 euros

ie. to convert Australian dollars to euros multiply by 0.62.

\therefore Number of euros in 25 Australian dollars = $25 \times 0.62 = 15.5$ euros.

One Vistabella dollar = 1.44 euros

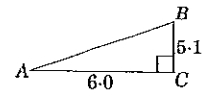
ie. to convert euros to Vistabella dollars divide by 1.44.

\therefore Number of Vistabella dollars in 15.5 euros = $15.5 \div 1.44 = 10.763\ 888\ 89 \dots = \10.76 .

SECTION II

Question 23

- (a) (i) Garden area = area of $\triangle ABC$ + area of $\triangle ADC$
 $= \frac{1}{2} \times 10 \times 5.1 + \frac{1}{2} \times 10 \times 6.3 = 57\ \text{m}^2$.
- (ii) $V = Ah$ where $A = 57\ \text{m}^2$, $h = 5\ \text{cm} = 0.05\ \text{m}$
 \therefore Volume of straw = $57 \times 0.05 = 2.85\ \text{m}^3$.
- (iii) Number of bags = $2.85 \div 0.25 = 11.4 \div 12$ (rounded up).
 \therefore Carmel needs 12 bags of straw.

- (iv)
- 
- $AB^2 = 5.1^2 + 6.0^2$ (Pythagoras' theorem)
 $= 62.01$.

$$AB = \sqrt{62.01}$$

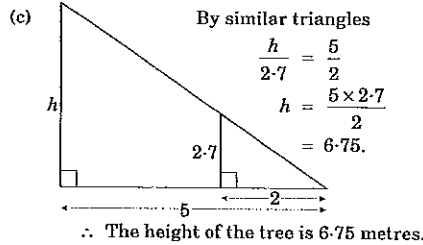
$$= 7.874\ 642\ 849 \dots$$

$$\doteq 8 \text{ m.}$$

\therefore Length of the fence = 8 m (to the nearest metre).

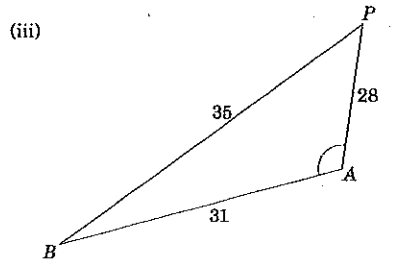
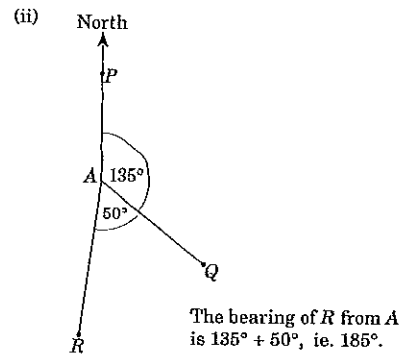
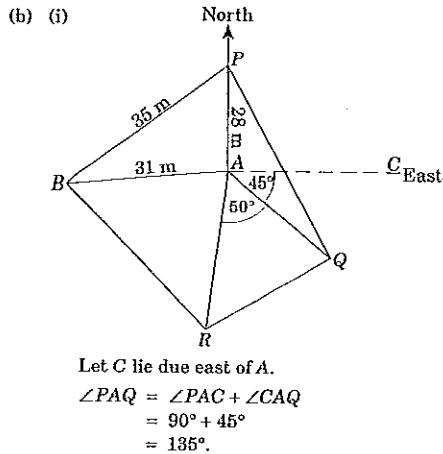
- (b) (i) Cost of *Novirus* = $x + 115$.
 (ii) The equation is $x + x + 115 = 415$
 $2x + 115 = 415$
 $2x = 300$
 $x = 150$.

The cost of *Funmaths* is \$150.00.



Question 24

- (a) (i) The mean 3 pm wind speed for September is 15 km/h.
 (ii) The month with the lowest 3 pm wind speed is February.
 (iii) The highest number of raindays occur in the three-month period January, February, March.
 (iv) When the wind speed is high, as in July, August and September, the number of raindays is low. When the wind speed is low, as in February and March, the number of raindays is high.



Using the cosine rule

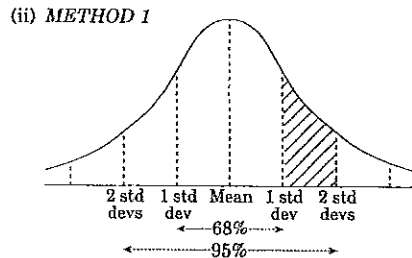
$$\cos \angle PAB = \frac{p^2 + b^2 - a^2}{2pb}$$

$$= \frac{31^2 + 28^2 - 35^2}{2 \times 31 \times 28}$$

$$= 0.299\ 539\ 17 \dots$$

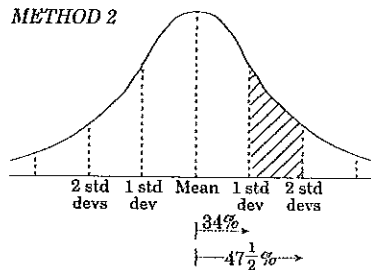
$\therefore \angle PAB = 72.570\ 073\ 25 \dots$
 $\doteq 73^\circ$ (correct to nearest degree).

- (c) (i) Roberto's score is on the line between 180 and 190 (below the shaded area). It is a score between 1 and 2 standard deviations above the mean, so his z-score is a number between 1 and 2.



For a normal distribution:
 68% of scores lie within 1 standard deviation of the mean.
 95% of scores lie within 2 standard deviations of the mean.

\therefore shaded area = $\frac{1}{2} \times (95\% - 68\%)$
 $= 13.5\%$.



- For a normal distribution:
 68% of scores lie within 1 standard deviation of the mean.
 \therefore 34% of scores lie within the mean and 1 standard deviation above the mean.
 95% of scores lie within 2 standard deviations of the mean.
 \therefore $47\frac{1}{2}\%$ of scores lie within the mean and 2 standard deviations above the mean.
 \therefore shaded area = $47\frac{1}{2}\% - 34\%$
 $= 13\frac{1}{2}\%$.

Question 25

- (a) (i) **METHOD 1**
 2003 tax deduction = 40% of \$6500
 $= 0.4 \times \$6500$
 $= \$2600$.

METHOD 2
 $S = V_0(1-r)^n$, $V_0 = 6500$
 $r = 40\% = 0.40$
 $n = 1$
 The value of the computer after one year is
 $S = 6500 \times (1 - 0.40)^1$
 $= \$3900$.

\therefore The tax deduction = $\$6500 - \3900
 $= \$2600$.

- (ii) After 3 years, $S = 6500 \times (1 - 0.40)^3$
 $= \$1404$.

\therefore The value of her computer at the start of the 2006 financial year is \$1404.

- (b) (i) **METHOD 1**
 The arrangements are: CSV, CVS
 VSC, VCS
 SVC, SCV

\therefore There are 6 different ways of arranging the tubs in a row.

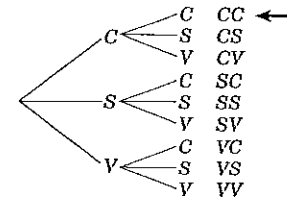
METHOD 2

There are 3 choices for 1st tub, 2 for 2nd tub, 1 for 3rd tub.
 Number of choices = $3 \times 2 \times 1 = 6$.
 \therefore There are 6 different ways of arranging the tubs in a row.

- (ii) **METHOD 1**

$P(\text{choosing chocolate on one day}) = \frac{1}{3}$
 $P(\text{choosing chocolate on both days}) = \frac{1}{3} \times \frac{1}{3}$
 $= \frac{1}{9}$.

METHOD 2



$\therefore P(\text{choosing chocolate on both days}) = \frac{1}{9}$.

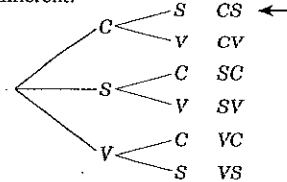
- (iii) **METHOD 1**

The two flavours in this case must be different. There are 3 choices for the first flavour, 2 choices for the second flavour.
 $P(\text{selecting chocolate as first flavour}) = \frac{1}{3}$.

$P(\text{selecting strawberry as second flavour}) = \frac{1}{2}$
 $\therefore P(\text{selecting chocolate first then strawberry}) = \frac{1}{3} \times \frac{1}{2}$
 $= \frac{1}{6}$.

METHOD 2

The two flavours in this case must be different.



$\therefore P(\text{chocolate first, then strawberry}) = \frac{1}{6}$.

	Test indicated a lie	Test did not indicate a lie	Total
People who lied	40	10	50
People who did not lie	20	130	150

(ii) Number of people tested where lie-detector test was accurate = $40 + 130 = 170$.

✓	□
□	✓

 from table

(iii) Percentage of people tested where the test was accurate = $\frac{170}{200} \times 100\% = 85\%$.

Note: Denominator is 200 as required percentage is based on all the people tested.

(iv) Note: In this case only referring to the people who did not lie, so initial denominator will be 150.

$$P(\text{test indicated a lie for a person who did not lie}) = \frac{20}{150} = \frac{2}{15}$$

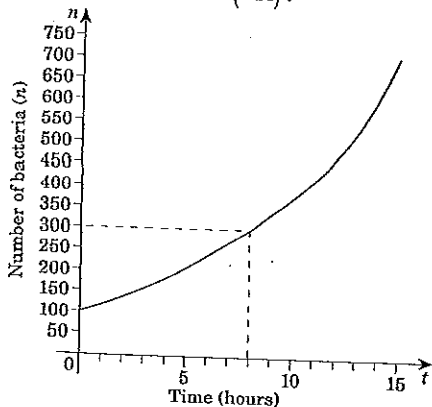
Question 26

(a) (i) Percentage increase = $\frac{14}{100} \times 100\% = 14\%$.

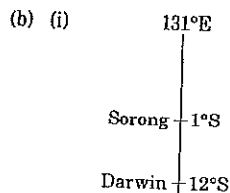
(ii) Given that $n = 100(1.14)^t$.
When $t = 15$, $n = 100(1.14)^{15} = 713.793\ 797\ 8 \dots \div 714$.

∴ There are 714 bacteria after 15 hours.

(iii) Graph of $n = 100(1.14)^t$.



(iv) From the graph, $n = 300$ when $t \div 8$ so the population is 300 after 8 hours.
An alternative method is to use 'guess and check' to solve $300 = 100(1.14)^t$.



Difference in latitude = $12^\circ - 1^\circ = 11^\circ$.

(ii) (1) **METHOD 1**

An angular distance of 1° on a great circle equals 60 nautical miles.
Distance = 11×60 nautical miles
= $11 \times 60 \times 1.852$ km
= 1222.32 km
 $\div 1200$ km.

METHOD 2

The arc length formula can be used.
 $\ell = \frac{\theta}{360} 2\pi r$ where $\theta = 11$
 $r = 6400$

Distance = $\frac{11}{360} \times 2 \times \pi \times 6400$
= 1228.711 793 ...
 $\div 1200$ km.

(2) **METHOD 1**

Assuming the tourists travel in a straight line, the distance is approximately 1200 km, or $1200 \div 1.852 \div 647.95$ nautical miles. At a speed of 15 nautical miles per hour (ie. 15 knots) this would take $647.95 \div 15 \div 43.2$ hours

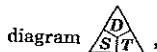
$$\left(\text{since time} = \frac{\text{distance}}{\text{speed}} \right)$$

So they would complete the trip in less than 48 hours.

METHOD 2

Distance = $11 \times 60 = 660$ nautical miles.

Using speed = $\frac{\text{distance}}{\text{time}}$, or the



time taken = $\frac{660}{15} = 44$ hours.

So they would complete the trip in less than 48 hours.

METHOD 3

At 15 knots = 15 nautical miles per hour.
Distance travelled in 48 hours = $15 \times 48 = 720$ nautical miles
= 720×1.852 km
= 1333.44 km.
So they would be able to travel the distance of 1200 km in less than 48 hours.

Question 27

(a) (i) $150\ 000 = 150 \times 1000$

From the table:
Monthly repayments = $7.75 \times 150 = \$1162.50$.

(ii) Total repayments = $\$1162.50 \times 20 \times 12 = \$279\ 000$.

Total interest repaid = $\$279\ 000 - \$150\ 000 = \$129\ 000$.

(iii) **METHOD 1**

Interest paid if loan is paid after 15 years is: Interest = $\$242\ 730 - \$150\ 000 = \$92\ 730$.

∴ Savings in interest is:
Difference in interest = $\$129\ 000 - \$92\ 730 = \$36\ 270$.

METHOD 2

The interest is the difference between the total payments.

So difference in interest = $\$279\ 000 - \$242\ 730 = \$36\ 270$.

(b) (i) Hours worked:

Friday: 4 hours at $\$18.00$ per hour
Saturday: 6 hours time-and-a-half (6×1.5)
Sunday: 5 hours double time (5×2)
∴ Total pay = $(4 \times \$18) + (6 \times 1.5 \times \$18) + (5 \times 2 \times \$18) = \$414$.

(ii) **METHOD 1**

David's Saturday pay = $6 \times 1.5 \times \$18 = \162 .

Number of hours needed to work at the weekday rate ($\$18/h$) = $\$162 \div \$18 = 9$ hours.

METHOD 2

On a Saturday David works 6 hours time-and-a-half.
Equivalent weekday hours = $6 \times 1.5 = 9$ hours.

(c) The future value of $\$200$ per month at 6% pa compounded monthly over 4 years is found using the 'Future value of an annuity' formula.

In this case, $M = \$200$

$$r = \frac{0.06}{12} = 0.005 \text{ per month}$$

$$n = 12 \times 4 = 48 \text{ months.}$$

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

$$= \$200 \left[\frac{(1+0.005)^{48} - 1}{0.005} \right]$$

$$= \$10\ 819.57.$$

∴ Sanjeev will reach his goal of $\$10\ 500$ with $\$319.57$ in excess.

Question 28

(a) (i) In this case, $R = \frac{w}{h^2}$.

Substitute $w = 72$, $h = 1.50$ (in metres).

$$R = \frac{72}{(1.5)^2} = 32.$$

Fred's health rating is 32.

(ii) Substitute $R = 25$, $h = 1.60$ (in metres)

$$25 = \frac{w}{(1.6)^2}$$

$$w = 25 \times (1.6)^2 = 64 \text{ kg.}$$

Difference in weights = $72 - 64 = 8$ kg.

ie. Fred needs to lose 8 kg.

(b) (i) Relationship is of the form $C = kb^3$, where k is a constant.

(ii) Substitute $C = 50$, $b = 10$.

$$50 = k \times 10^3$$

$$50 = 1000k$$

$$k = \frac{50}{1000}$$

$$\therefore k = 0.05.$$

(iii) **METHOD 1**

$$C = 0.05b^3$$

Replace b with $2b$ in equation from (b)(i).

$$C = k(2b)^3$$

$$= k \times 8b^3$$

$$= 8kb^3.$$

∴ The cost is 8 times bigger, so Felicity is incorrect.

METHOD 2

$C = 0.05b^3$

Substitute $b = 10$: $C = 0.05 \times 10^3$
 $= 50.$

Substitute $b = 20$ (since the base is doubled):
 $C = 0.05 \times (20)^3$
 $= 400.$

When the base is doubled the cost is 8 times more, so Felicity is incorrect.

- (c) (i) Median height of middle section = 170.
 Median weight of middle section = 55.
 \therefore Coordinates of C are (170, 55).

- (ii) Jill needs to draw a line parallel to AB which is a third of the distance towards C .

(iii) (I) Weight in kg = $\frac{2}{3}$ (height in cm) - 50.
 Substitute weight = 75.

$75 = \frac{2}{3}$ (height in cm) - 50

$125 = \frac{2}{3}$ height in cm

height in cm = $\frac{125}{2} \times 3$
 $= 187.5.$

\therefore The height is predicted to be 187.5 cm.

- (2) Suggested possible answers are:

- the sample used is small (only 9 people)

OR

- tall people are not necessarily heavier

OR

- the model cannot be used outside the range of the sample

OR

- the accuracy with which the graph is drawn.

END OF GENERAL MATHEMATICS SOLUTIONS

2003 HIGHER SCHOOL CERTIFICATE
 EXAMINATION PAPER
 GENERAL MATHEMATICS

Section I

22 marks

Attempt Questions 1 - 22

Allow about 30 minutes for this section

- 1 A number of men and women were surveyed at a railway station. They were asked whether or not they were travelling to work. The table shows the results.

	Going to work	Not going to work
Men	64	24
Women	60	42

How many men were surveyed?

- (A) 64 (B) 88 (C) 124 (D) 190

- 2 Simplify $3y^3 + 12y^2$.

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

- 3 Dora works for \$9.60 per hour for eight hours each day on Thursday and Friday. On Saturday she works for six hours at time-and-a-half.

How much does Dora earn in total for Thursday, Friday and Saturday?

- (A) \$192.00 (B) \$211.20 (C) \$240.00 (D) \$316.80

- 4 If $d = \sqrt{\frac{h}{5}}$, what is the value of d , correct to one decimal place, when $h = 28$?

- (A) 1.1 (B) 2.4 (C) 2.8 (D) 5.6

- 5 Jim bought a new car at the beginning of 2001 for \$40 000. At the end of 2001 the value of the car had depreciated by 30%. In 2002 the value of the car depreciated by 25% of the value it had at the end of 2001.

What was the value of the car at the end of 2002?

- (A) \$18 000 (B) \$19 600 (C) \$21 000 (D) \$22 000

- 6 From 5 boys and 7 girls, two children will be chosen at random to work together on a project. Which of the following probability trees could be used to determine the probability of choosing a boy and a girl?

