

NAME: \_\_\_\_\_

# THE SCOTS COLLEGE



## YEAR 12 GENERAL MATHEMATICS AUGUST 2007

### TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

#### GENERAL INSTRUCTIONS

- Working time - 2½ hours
- Reading time - 5 minutes
- Write using blue or black pen
- Use Multiple Choice Answer Sheet provided for Questions 1 - 22
- Use a Separate Booklet for Questions 23 - 28.
- Use graph sheet provided for Question 25(a)
- Board-approved calculators may be used
- All necessary working should be shown for every question.
- A Formula Sheet is attached at the back of the exam

TOTAL MARKS (100)

#### SECTION I

22 MARKS

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

#### SECTION II

78 MARKS

- Attempt all of Questions 23 - 28
- Allow about 2 hours for this section

#### SECTION I

TOTAL MARKS - 22

- Attempt Questions 1-22
- Allow about 30 minutes for this Section
- Use the Multiple Choice Answer Sheet.
- Select the alternative A, B, C or D that best answers the question.

1. When fully simplified,  $4k(5z+2)-2k(4z-3)$  is the same as:

- A.  $12kz+14k$
- B.  $26k^2z$
- C.  $10k^2z$
- D.  $12kz-2k$

2. Make  $r$  the subject of  $s = \frac{a}{1-r}$

- A.  $r = a - s$
- B.  $r = s - a$
- C.  $r = 1 + \frac{a}{s}$
- D.  $r = 1 - \frac{a}{s}$

3. A photocopier purchased for \$9 400 is depreciated over 3 years at 16% per year using the declining-balance method. The salvage value of the photocopier is:

- A. \$14 672.42
- B. \$4 515
- C. \$38.50
- D. \$5 571.42

4. Calculate the present value of an annuity in which \$1 300 is invested at the end of every year for 12 years and interest is paid annually at a rate of 8%pa. (Answer to the nearest dollar).

- A. \$24 670
- B. \$9 797
- C. \$3 274
- D. \$9 796

STUDENTS ARE ADVISED THAT THIS IS A TRIAL EXAMINATION ONLY AND CANNOT IN ANY WAY GUARANTEE THE CONTENT OR THE FORMAT OF THE HIGHER SCHOOL CERTIFICATE EXAMINATION.

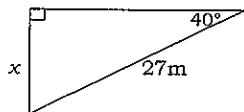
5. Alison invests \$5 000 at 8%p.a. for 3 years with interest compounding half-yearly. How much will her investment be worth in 3 year's time?

A. \$6 298.56  
 B. \$7 934.37  
 C. \$6 326.60  
 D. \$5 624.32

6. Tim purchases 1000 TSC shares at \$15.89 per share. His broker charges \$50 brokerage plus 1.5% of the first \$10 000 worth of shares and 1% thereafter. The total cost of shares plus broker's fees is:

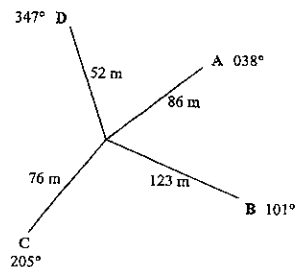
A. \$15 890  
 B. \$16 126.35  
 C. \$16 148.90  
 D. \$16 098.90

7. The value of  $x$  in this triangle would be:



A.  $27 \sin 40^\circ$   
 B.  $27 \cos 40^\circ$   
 C.  $\frac{27}{\sin 40^\circ}$   
 D.  $\frac{27}{\cos 40^\circ}$

8. The following notebook entry was made during a radial survey of a field.



NOT DRAWN  
TO SCALE

Find the length of AB correct to 2 decimal places.

A. 56.56 m  
 B. 113.67 m  
 C. 162.98 m  
 D. 12920.38 m

9. Students on a Duke of Edinburgh hike walk 15km due north and then 15km due west. Their true bearing from their starting point to their finishing point is:

A.  $045^\circ$   
 B.  $135^\circ$   
 C.  $225^\circ$   
 D.  $315^\circ$

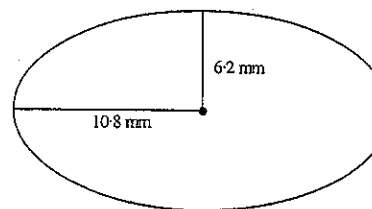
10.  $8.37 \times 10^5$  mg in tonnes is:

A.  $8.37 \times 10^{14}$   
 B.  $8.37 \times 10^2$   
 C.  $8.37 \times 10^{-1}$   
 D.  $8.37 \times 10^{-4}$

11. A sphere has a surface area of  $520 \text{ cm}^2$ . What is its radius (correct to the nearest millimetre)?

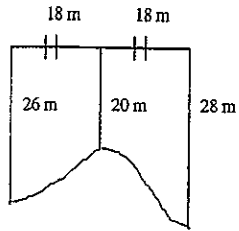
A. 6.4cm  
 B. 7.3cm  
 C. 17.1cm  
 D. 41.4cm

12. Which of the following calculations will correctly give the area of the ellipse drawn below?



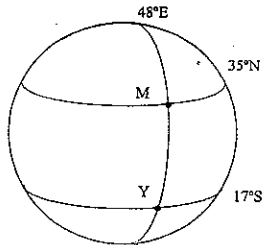
A.  $\pi \times 6.2^2$   
 B.  $\pi \times 12.4 \times 21.6$   
 C.  $\pi \times 10.8^2$   
 D.  $\pi \times 10.8 \times 6.2$

13. Using Simpson's rule, the area of the field below is closest to:



- A. 600 m<sup>2</sup>  
 B. 700 m<sup>2</sup>  
 C. 800 m<sup>2</sup>  
 D. 900 m<sup>2</sup>

14.



Murraba (M) is at (35°N, 48°E) and Yarrabin (Y) is at (17°S, 48°E) as shown in the diagram.

A plane flies from Murraba to Yarrabin at a speed of 640km/h. How long will the trip take? [Radius of earth = 6400km]

- A. 3.14 hours  
 B. 4.87 hours  
 C. 9.08 hours  
 D. 12.3 hours

15. Consider the stem and leaf plot below.

Stem	Leaf
1	2
2	1 3 5 5
3	1 3 4 5 6
4	6 6 6 6 7
5	5 8

The **median** and **mode** for this set of data is:

- A. 34 and 6  
 B. 35 and 6  
 C. 35 and 46  
 D. 36 and 46

16. Andrew wants to calculate his z- score for his French Exam. He scored 82% and the class mean was 68%. The standard deviation was 8.45%. Andrew's z-score is closest to:

- A. 7  
 B. 1.66  
 C. 14  
 D. 0.83

17. The number of minutes before 3:10pm that Year 12 students who are on Bus Duty begin to pack up was recorded over 4 weeks:

25	18	21	24	18	6	19	20	16	14
22	16	21	18	21	20	17	21	20	25

Which of the following measures are most effected by the outlier score of 6?

- A. Mean and range  
 B. Median and interquartile range  
 C. Median and mode  
 D. Median and mean

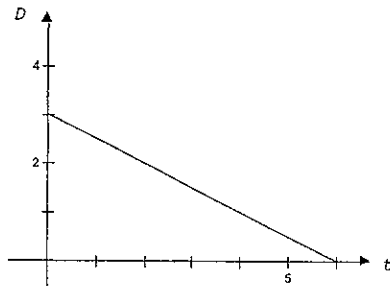
18. The eye colour of people on a bus trip to the city is noted and used as a sample for the population. The data formed by this survey would be an example of:

- A. categorical data  
 B. quantitative and discrete data  
 C. quantitative and continuous date  
 D. numerical data

19. Frank has a credit card with an interest rate of 0.045% per day and no interest-free period. Frank used the credit card to pay for car repairs costing \$575. He paid the credit card account 15 days later. What is the total amount (including interest) that he paid for the repairs?

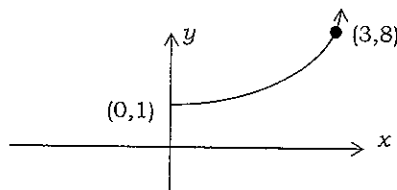
- A. \$578.88  
 B. \$388.13  
 C. \$963.13  
 D. \$575.26

20. After a flood, the depth of water was measured as it fell. The graph below show the changes in depth ( $D$ ) over time ( $t$ ).



What is the equation of the depth of water ( $D$ ) over time ( $t$ )?

- A.  $D = 3t - 6$   
 B.  $D = 3 + \frac{t}{2}$   
 C.  $D = 3 - \frac{t}{2}$   
 D.  $D = -3 - \frac{t}{2}$
21. To estimate the population of introduced carp in a NSW river, the National Parks and Wildlife Rangers netted 200 carp, tagged them and released them. Later, 300 carp were netted, of which 40 were found to be tagged. The approximate population of carp in the river is:
- A. 27  
 B. 280  
 C. 1500  
 D. 5000
22. State the equation of the curve below:



- A.  $y = x^2$   
 B.  $y = x^2 + 1$   
 C.  $y = x^3$   
 D.  $y = 2^x$

END OF MULTIPLE CHOICE SECTION

## SECTION II

TOTAL MARKS - 78

- Attempt Questions 23-28
- Allow about 2 hours for this Section
- Answer each question in a SEPARATE Writing Booklet.

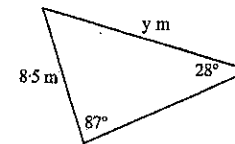
Question 23 [13 marks]

START A NEW BOOKLET

MARKS

- a. (i) Calculate the value of  $y$ , correct to 1 decimal place.

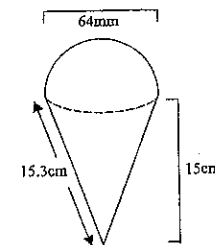
2



- (ii) Find the area of the triangle to 1 decimal place.

2

- b. A Cool Delight is made up of a cone filled with ice cream and a hemisphere of ice cream on top as shown in the diagram.



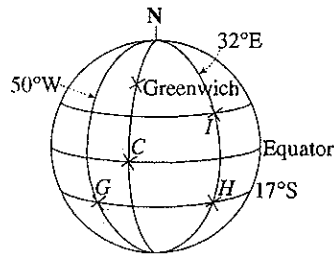
- (i) Calculate the volume of the ice cream correct to 1 decimal place.

3

- (ii) How many Cool Delights can be made from an 18L bucket of ice cream? (Answer to the nearest whole number. Assume  $1\text{cm}^3$  holds 1mL of ice cream)

1

- c. The diagram is not drawn to scale.



This diagram shows a number of longitude and latitude lines on the Earth. Goiania (G) is located at (17°S, 50°W), and Harare (H) at (17°S, 32°E)

- (i) What is the latitude and longitude of point C? 1
- (ii) Ignoring time zones, what time should it be in Harare (H) when it is 9:00am in Goiania? 2
- (iii) Harare (H) and Isparta (I) both lie on the 32°E longitude Line. The distance from Harare to Isparta is 3240 nautical miles.  
What are the position coordinates of Isparta? 2

END OF QUESTION 23

Question 24 [13 marks]

START A NEW BOOKLET

MARKS

- a. (i) Solve  $\frac{x^2}{5} - 4 = 16$  2
- (ii) Solve  $\sqrt{4x+9} = 7$  2
- b. Mary is completing her tax return for the 2006-2007 year.
- (i) She has a long term deposit, currently valued at \$10,012. It earns 5%p.a. interest, compounded monthly.  
Find the interest she would earn in 1 year, to the nearest dollar. 2
- (ii) Mary can claim depreciation on her computer as a tax deduction. Its present value is \$3,700 and the Australian Taxation Office has advised her that the depreciation rate is 40% p.a. How much can Mary claim for depreciation? 2
- (iii) As well as the interest on the long term deposit and depreciation, Mary also earned \$56,000 in income, \$70 dividend for her Telstra shares, and had other deductions of \$2,070. Calculate her taxable income, correct to the nearest dollar. 1
- (iv) She pays a Medicare levy of 1.5% of her taxable income. Calculate the Medicare levy she would have to pay. 2
- (v) Mary has paid \$14,000 in tax throughout the year. Use the following tax table to determine whether Mary has a tax debt or is owed a refund. Calculate the size of this debt or refund. 2

TAXABLE INCOME	TAX ON THIS INCOME
\$1 - \$6 000	Nil
\$6 001 - \$20 000	17 cents for each \$1 over \$6 000
\$20 001 - \$50 000	\$2 380 + 30 cents for each \$1 over \$20 000
\$50 001 - \$60 000	\$11 380 + 42 cents for each \$1 over \$50 000
\$60 001 and over	\$15 580 + 47 cents for each \$1 over \$60 000

END OF QUESTION 24

- a. After a dramatic rise in burglaries in the Strathfield area, police hypothesised that the approximate height of a thief could be gauged by the length of their footprint.

The following data was collected:

LENGTH OF FOOTPRINT (CM)	HEIGHT OF THIEF (CM)
33.6	200
29.4	174
27.2	160
25.2	148
28.0	167
31.1	186
28.6	167
25.8	153
25.5	150

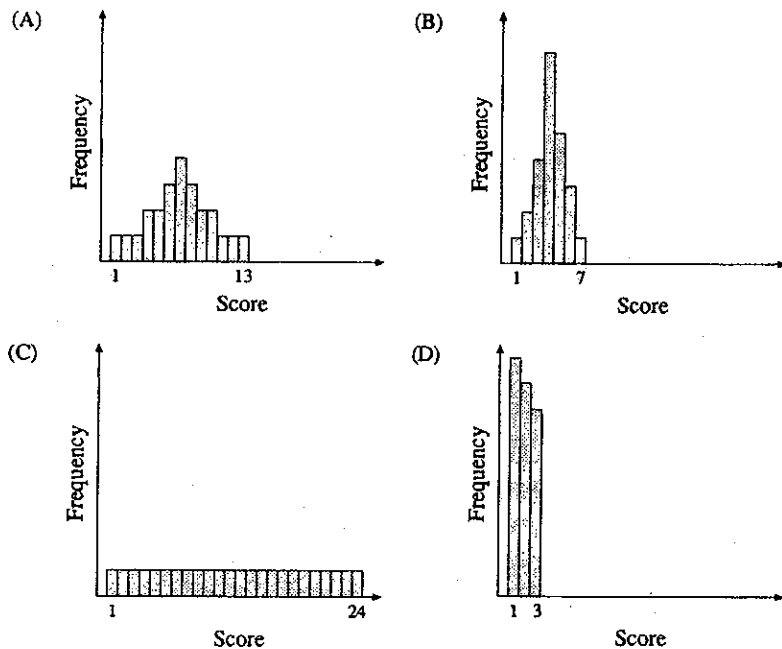
- (i) Draw a scatter plot showing this data. Show a clear scale on each axis. Graph paper is provided on the back of this booklet. Attach this page to the rest of Question 25. 2
- (ii) Describe the strength and type of the correlation between the length of a footprint and the height of the person. 2
- (iii) Construct a median regression line on your graph, show full working in answer booklet. 3
- (iv) Use your line to predict the length of the footprint of a person who is 172cm tall. 1

- b. The following Home Loan Table show how the repayments of a home loan progress. The loan of \$180 000 is to be repaid over 15 years in equal monthly repayments with interest fixed at 8.4% per annum calculated monthly. The monthly repayments are \$1762.

Amount of loan = \$180 000		Interest = rate / 12 × principal		
Annual interest rate = 8.4%				
Monthly repayment (R) = \$1762				
N	Principal (P)	Interest (I)	P + I	P + I - R
1	\$180 000.00	\$1 260.00	\$181 260.00	\$179 498.00
2	\$179 498.00	\$1 256.49	\$180 754.49	(i)
3	\$178 992.49	\$1 252.95	\$180 245.44	\$178 483.44
4	\$178 483.44	(iii)	\$179 732.82	\$177 970.82
5	\$177 970.82	\$1 245.80	\$179 216.62	\$177 454.62
6	\$177 454.62	\$1 242.18	\$178 696.80	\$176 934.80

- (i) Complete the missing amount marked (i) in row 2. 1
- (ii) How much has been paid off the loan at the end of six months? 1
- (iii) Complete the table by calculating the missing amount marked (iii). 1
- (iv) Calculate the total interest that will be paid during the 15 year life of the loan. 2

- a. The histograms represent the scores for a class of twenty-four students on four different tests.



Which set of scores (A, B, C or D) has the largest standard deviation? Explain your answer with reasoning. 2

- b. The results of two language tests are shown.

	Mean	Standard Deviation
Japanese	70	8
German	65	12

Alexander scored 82% in the Japanese test and 89% in the German test. In which test has Alexander performed better? Give reasons for your answer. 2

- c. Packets of noodles are labelled 'Net weight 250g'. The weights of packets were found to be normally distributed with a mean of 252g and a standard deviation of 2 g.

- (i) What percentage of packets weigh between 250g and 254g? 1
- (ii) What percentage of packets weigh more than the labelled weight? 2
- (iii) Is this brand of noodles labelled correctly? Justify your answer. 2

- d. Police data sheets from radar recordings are summarised below. They compare vehicle speeds in 60km/h zones in the country town of Tenterfield and the Sydney suburb of Maroubra.

	Tenterfield	Maroubra
Mean	72	53
Median	70	54
Standard deviation	8	5
Upper quartile	78	59
Lower quartile	57	49
Highest speed	95	73
Lowest speed	5	45

- (i) Draw a box and whisker plot for each of the data sets for Tenterfield and Maroubra. 2
- (ii) Compare and contrast the data for the two localities. 2

a. A restaurant offers these choices:

ENTRÉE	MAIN COURSE	DESSERT
Garlic prawns	Fillet steak	Strawberries
Soup of the day	Chicken	Apple pie and cream
Oysters	Fish	

How many different 3 course dinners can be chosen? 2

b. Seven boys are running in a race. In how many ways can the first 3 places be filled if there are no dead heats? 2

c. There are 7 routes from P to Q, and 5 routes from Q to R. How many routes are there from P to R through Q? 2

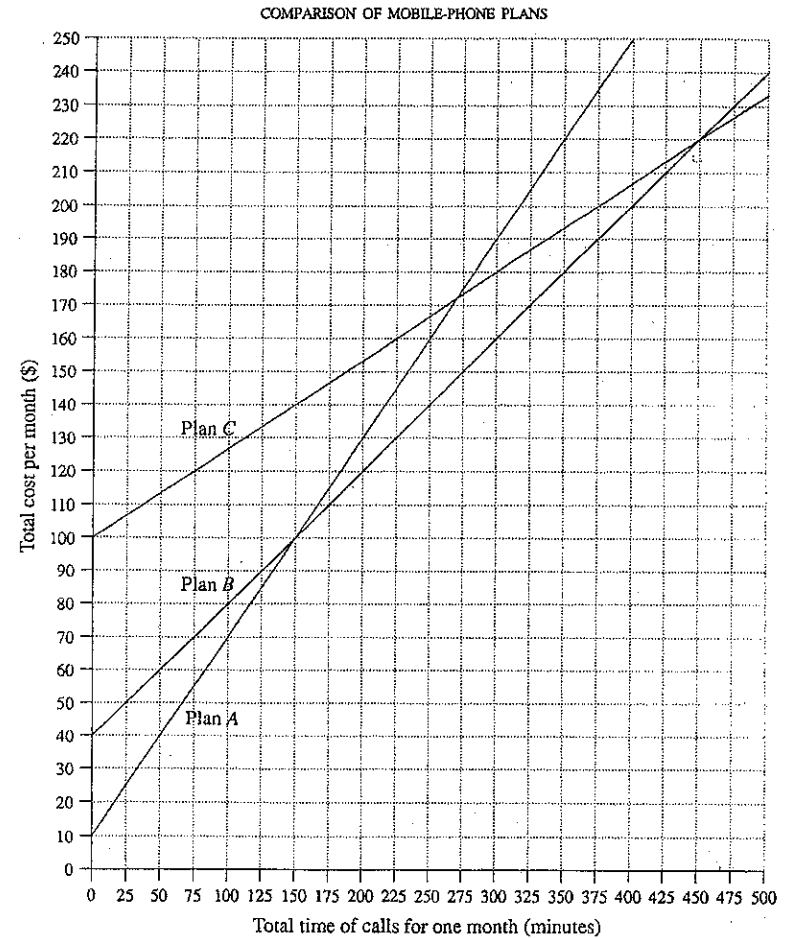
d. In how many ways can a basketball team of 5 players be chosen from 8 available players? 3

e. The graph over page compares the cost of 3 mobile phone plans.

(i) What is the total time of calls for Plan A and Plan B to have equal total costs for one month? 1

(ii) If the total time of calls from one month is 250 minutes, find the saving by using Plan B instead of Plan A. 1

(iii) By comparing all three plans, state between what length of calls Plan B is the cheapest. 2





**Question 28** [13 marks]

**START A NEW BOOKLET**

**MARKS**

Aaron is planning to invest his money to buy a car in 2 year's time. He has 3 alternatives for investing his money and one option of borrowing money to buy a car.

- OPTION A:** Invest \$24,000 for 2 years.
- OPTION B:** Invest \$1,000 each month for 2 years.
- OPTION C:** Invest \$2,000 each month for 1 year and then leave it invested for 1 year.
- OPTION D:** Borrow the full amount of a car worth \$28,000 and pay the car back with equal monthly repayments over 10 years.

The interest rate for all 4 options is 6.5% p.a., compounded monthly.

- (a) Find the value of Option A after 2 years. 2
- (b) Find the value of Option B after 2 years 2
- (c) Find the value of Option C after 2 years. 3
- (d) Find the monthly repayment for Option D. 2
- (e) Find the total amount paid for the car over 10 years using Option D. 1
- (f) Aaron realises he does not have \$24,000 and is deciding between Option B, C or D. 3
  - i) Which is the better option between Option B and Option C? Give reasons.
  - ii) State the advantages and disadvantages of Option D.

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2007

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

**END OF QUESTION 28**

**END OF EXAM**

Q23

a) i)  $\frac{y}{\sin 87^\circ} = \frac{8.5}{\sin 28^\circ}$  ✓  
 $y = 18.1 \text{ m (1dp)}$  ✓

b) i) Vol. hemi sphere  
 $= \frac{1}{2} \times \frac{4}{3} \times \pi \times (32)^3 \text{ cm}^3$   
 $= 68.6 \text{ cm}^3$  ✓

Vol. cone  
 $= \frac{1}{3} \times \pi \times (3.2 \text{ cm})^2 \times 15$   
 $= 160.8 \text{ cm}^3$  ✓

∴ total =  $229.4 \text{ cm}^3$  ✓

ii)  $180^\circ - 87^\circ - 28^\circ$   
 $= 65^\circ$  (included  $\angle$ )

Area =  $\frac{1}{2} \times 8.5 \times 18.1 \times \sin 65^\circ$  ✓  
 $= 69.7 \text{ m}^2$   
 (or  $69.6 \text{ m}^2$ ) ✓

ii)  $1 \text{ cm}^3 = 1 \text{ mL}$   
 $\therefore 1000 \text{ cm}^3 = 1 \text{ L}$   
 $\therefore 18 \text{ L} = 18000 \text{ cm}^3$   
 $= 229.4 \text{ cm}^3$

= 78 root delights can be made. ✓

c) i)  $0^\circ$  latitude + longitude ✓

ii)  $82^\circ$  apart  
 $1^\circ = 4 \text{ min}$   
~~12h~~  $328 \text{ min}$  apart  
 $= 5 \text{ hours } 28'$  ✓

∴ Time in Harare is 2:28pm ✓  
 when 9am in Goiania

iii)  $1^\circ = 60 \text{ M}$   
 $\therefore 3240 \text{ M} = 54^\circ$  apart ✓  
 $54 - 17 = 37^\circ$  north

∴ Isparta  $(37^\circ \text{ N } 326)$  ✓

Q24

a) i)  $\frac{x^2}{5} = 20$   
 $x^2 = 100$  ✓  
 $x = \pm 10$  ✓  
 $[-\frac{1}{2} \text{ no } \pm]$

ii)  $4x + 9 = 49$  ✓  
 $4x = 40$   
 $x = 10$  ✓

b) i)  $r = \frac{5}{100} \div 12$   
 $r = \frac{5}{1200}$   
 $n = 12 \text{ months}$

$A = \$10,012 \left(1 + \frac{5}{1200}\right)^{12}$  ✓

$A = 10,524.23$  (total amount)

∴ interest =  $\$512$  (nearest  $\$$ ) ✓

ii)  $\frac{40}{100} \times 3700$  ✓  
 $= \$1480$  ✓

∴ she can claim  $\$1480$  for depreciation

iii)

Income	Deductions
56,000	2,070
512	1,480
70	
<hr/>	<hr/>
+ 56,582	- 3550

∴ taxable income =  $\$53,032$

iv)  $\frac{1.5}{100} \times 53,032 = \$795.48$  pays in Medicare levy. ✓

v) tax on  $\$53,032$   
 $\$11380 + 0.42 \times 3,032$   
 $= \$12,653.44$  ✓  
 $\therefore 14000 - 12653.44$   
 $= \$1,346.56$  refund ✓

Student Number

Qv 25 a)

median regression line

$$M_L (150, 25.5)$$

$$M_M (28, 167)$$

$$M_R (31.1, 186)$$

- ii) strong positive correlation
- iii) 29cm

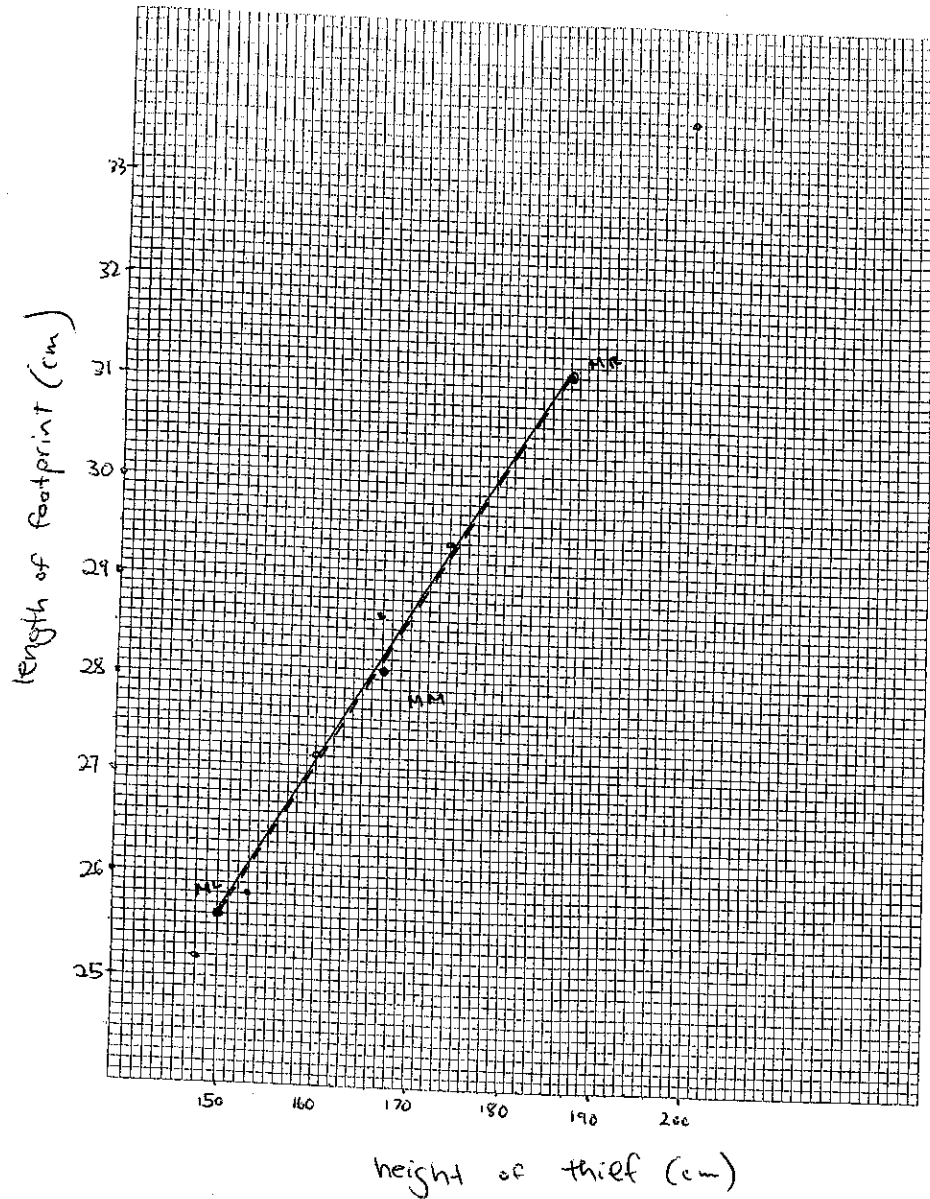
25b)

i) \$178 792.49

ii) \$3065.2

iii) \$1249.38

iv)  $\$1562 \times 15 \times 12$   
 $= \$281.166$   
 $\therefore 281160 - 180000$   
 $= \$101,160 \text{ interest}$



Qu26

a) C: greatest spread of scores ✓

b) Japanese =  $1\frac{1}{2}$  s.d. above ✓

German = 2 s.d. above ✓

∴ better in German; mark further from mean. ✓

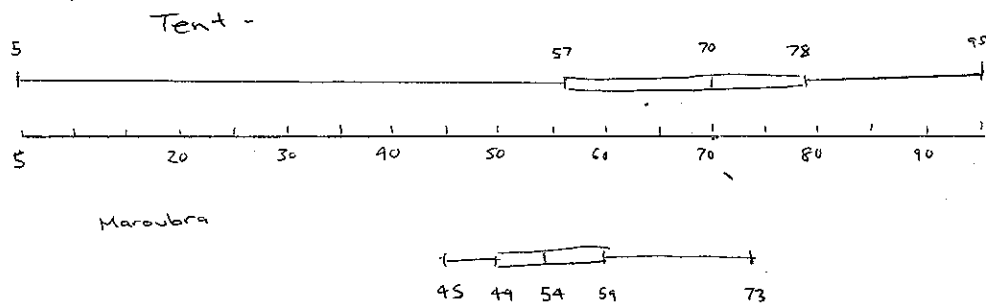
c) i) 68% ✓

ii) 50% + 34 ✓

= 84% of packets above 250g ✓

iii) Not labelled correctly. The weights of the packets are not normally distributed about 250g. ✓

d) i)



ii) Larger spread of scores in Tenterfield than Maroubra  
More spreads above mean in Tenterfield

(1 mark each for any 2 correct answers)

Qu27

a)  $3 \times 3 \times 2$  ✓  
 $= 18$  dinners ✓

b)  $7 \times 6 \times 5$  ✓  
 $= 210$  ways ✓

c)  $7 \times 5$  ✓  
 $= 35$  routes ✓

d)

d)  $\frac{8 \times 7 \times 6 \times 5 \times 4}{5 \times 4 \times 3 \times 2 \times 1}$  ✓ = 56 ✓

e) i) 150 min ✓

ii) \$20 ✓

iii) b/w 150 + 450 min. ✓✓

Q28

$$a) A = 24000 \left(1 + \frac{6.5}{1200}\right)^{24}$$
$$= 27,322.29$$

$$b) A = M \left\{ \frac{(1+r)^n - 1}{r} \right\}$$
$$= 29,556.11$$

$$c) 2000 \left\{ \frac{\left(1 + \frac{6.5}{1200}\right)^{12} - 1}{\frac{6.5}{1200}} \right\} = 24,728.07 \left(1 + \frac{6.5}{1200}\right)^{12}$$
$$= 26,384.15$$

$$d) A = M \left\{ \frac{(1+r)^n - 1}{r(1+r)^n} \right\}$$
$$28,000 = M \left\{ \frac{0.912}{r} \right\}$$

$$M = \$318.$$

$$e) 120 \times 318$$
$$= 38,159.80$$

- f) i) Option B & C he invests \$24,000  
option C generates the most money from the investment.
- ii) Option D is the easiest to finance & he will have a car immediately but ends up paying more than \$10,000 more for the car.  
Option C for value for money.