

# GENERAL MATHEMATICS

## Half Yearly Examination 2006

**Time Allowed: 2 hours  
plus 5 minutes reading time**

Instructions to Students

*General Instructions*

- Write using black or blue pen
- Calculators may be used
- A formulae sheet is provided
- Write your **student number** and your teacher's name on each page

*Total Marks – 80*

*Section 1*

**15 marks**

- Attempt all questions
- Answer on the special Multiple Choice Answer Sheet

*Section 2*

**65 marks**

- Attempt all questions
- Answer each question on a new page

*Show all working*

Content

- All work from year 11
- From year 12
  - AM2, Modelling linear functions
  - AM3, Algebraic skills and techniques
  - PB3, Multistage events
  - DA5, Interpreting sets of data
  - FM4, Credit and borrowing
  - FM5, Annuities and loan repayments

## SECTION 1

Total marks (15, 1 mark each)

Attempt all questions.

Allow about 20 minutes for this section.

Use the multiple choice answer sheet provided

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1 The radius of a bacteria is 0.000 008 47mm. In scientific notation this is equal to:

- a)  $8.47 \times 10^5$     b)  $8.47 \times 10^6$     c)  $8.47 \times 10^{-5}$     d)  $8.47 \times 10^{-6}$
- 

2 Which of the following is an example of a stratified random sample?

- a) The first 50 students to arrive at school are surveyed  
b) 50 students names are drawn from a hat and those students are surveyed  
c) 10 students from each year are asked to complete the survey  
d) One class at the school is asked to complete the survey
- 

3 Sarah invests \$7 000 for 10 years at 6.3% p.a. with interest compounding every 6 months. How much money will Sarah end up with?

- a) \$7 221    b) \$9 545    c) \$12 895    d) \$13 016
- 

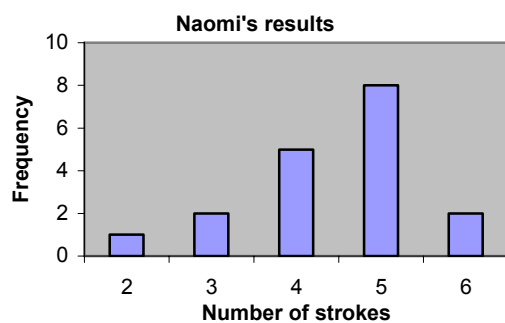
4 Jasmine is a telephone sales person, and is paid 20% commission on all sales up to and including \$4 000 and 25% on amounts over \$4 000. If Jasmine's total sales were \$7000, her commission was:

- a) \$1400    b) \$1550    c) \$1600    d) \$1750
- 

5 Naomi graphs the number of strokes per hole required for a round of golf.

The median number of strokes taken was:

- a) 4  
b) 5  
c) 6  
d) 8



6 Belinda was giving a series of lectures. The average number of people attending each of the last four lectures was 20. In order to raise the average attendance to 30, how many people must attend Belinda's next lecture?

- a) 25    b) 50    c) 70    d) 110
- 

7 If a topographical map has a scale of 1:10 000, then two places that are 200m apart, would on the map be:

- a) 0.2cm apart    b) 2cm apart    c) 20cm apart    d) 200cm apart
-

8 Which of the following points are on the line  $y = 2x + 3$

- a) (2, 3)      b) (1, 24)      c) (11, 4)      d) (5, 13)
- 

9 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
- 

10 Sam draws 4 cards from a standard deck of cards and has four aces. What is the probability the next card drawn is a king?

- a)  $\frac{1}{4}$       b)  $\frac{1}{12}$       c)  $\frac{1}{13}$       d)  $\frac{1}{52}$
- 

11 Jenny is a security officer and has 3 locks and 3 keys. If one key is placed alongside each lock, the probability that all the keys match the lock with which they have been placed is closest to:

- a) 33%      b) 30%      c) 17%      d) 4%
- 

12 Which of the following numbers could not be the answer to a probability calculation?

- a)  $\sqrt{2} - 1$       b)  $10^{-7}$       c)  $\sin 20^\circ$       d)  $3 - \pi$
- 

13 If  $5a = a + 120$ , then  $a =$

- a) 20      b) 24      c) 30      d) 125
- 

14 The answer to  $\frac{(38 \cdot 21)^2 - \sqrt[3]{9 \cdot 781}}{13 - 4 \times 2 \cdot 97}$  is closest to:

- a) 1 302      b) 478      c) 321      d) 100
- 

15 The cost in dollars of Belinda purchasing  $g$  galahs and  $c$  canaries and having them delivered is:

- a)  $23g + 35c + 20$       b)  $23g + 35c + 20g + c$   
c)  $23g + 35c + 20 \times 58$       d)  $23g + 35c + 20(g + c)$

Bird type	Cost per bird (\$)
Galah	23
Canary	35
* Cost of delivery is \$20	

## SECTION 2

Total marks (65)

Attempt all of questions 21 – 25

Answer each question on a separate page.

### Question 21

**Start this question on a new page**

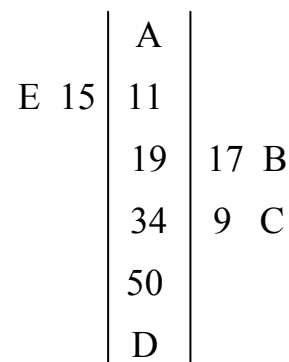
**Marks**

- a) What is the simple interest on a loan of \$12 000 for 6 years at  $7\frac{1}{2}\%$  p.a.? ①
- b) Expand and simplify  $2(p + q) - 3(p - q)$ . ②
- c) The Wilson family had a garage sale one weekend. Michelle recorded the age and sex of the people who attended. This stem-and-leaf plot shows the results.

**Garage sale age and gender survey**

Males	Stem	Females
2	0	4 5 5
8 6 4	1	2 5 5 7
8 7 4 2 2 1	2	1 2 2 4 6
8 6 4	3	2 4
	4	3 5 8

- i) How many people attended the garage sale? ①
- ii) What was the age of the youngest person? ①
- iii) What was the modal age of the group? ①
- iv) Indicate which group, males or females, has the greater spread. Justify your answer with appropriate calculations and/or reasoning. ①
- d) Julianne takes 15mL of cough medicine.
- i) What is the absolute error in this measurement? ①
- ii) what is the percentage error in this measurement? ①
- e) Alisha surveys the paddock ABCDE and makes the field diagram to the right. (All measurements are in metres)

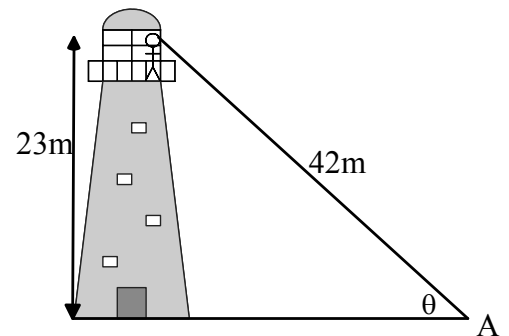


- i) Sketch the paddock. ②
- ii) Calculate the length of BC ②

**Question 22****Start this question on a new page****Marks**

a) Jessica paid instalments totalling \$3 400 to repay a \$2 800 loan. Interest was charged at a flat rate for three years. What was the annual interest rate to 2 decimal places? **2**

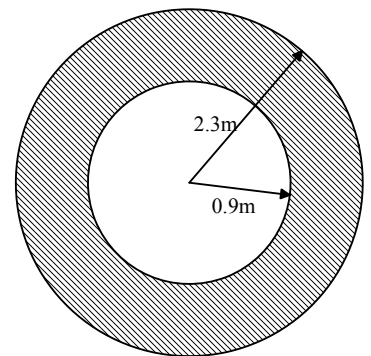
b) Eliza was at the top of the Chipping Norton Light House. Find the angle of elevation of Eliza from point A on the ground, to the nearest degree. **2**



c) Solve the equation  $\sqrt[3]{\frac{p+3}{7}} = 2$ . **3**

d) Sinead, an engineer, designed a tunnel to take storm water to an ocean outfall. A drawing of the tunnel is to the right.

- i) Calculate the cross sectional area of the pipe (1 dec pl). **2**
- ii) If water is travelling through the pipe at 7.2m/s, how much water goes through the pipe in 20s? **1**

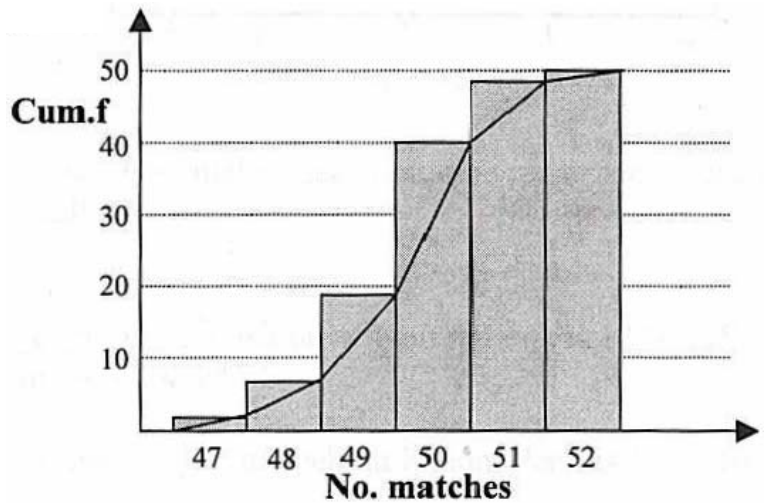


e) There are 12 boys and 14 girls in a class. In how many ways can the teacher choose:

- i) 2 girls to collect the lunches? **1**
- ii) 3 children to sort out the sporting equipment? **1**

f) In a class of 30 students, 20 do commerce, 15 do woodwork and 7 do neither. How many students do both commerce and woodwork? **1**

a) A random sample of matchboxes was taken and the number of matches in each box was recorded. The results are illustrated on the cumulative frequency histogram and polygon.



i) If the company making the matches claimed that at least 50% of boxes contained 50 matches or more, would this be a reasonable claim?

Give reasons for your answer.

1

ii) From the graph calculate the interquartile range.

2

iii) Calculate the median number of matches per sample.

1

iv) If a box were purchased from a similar batch of boxes, what is the probability that it contains exactly 50 matches?

1

b) Simplify the following.

i)  $4.76 \times 10^7 \times 7.3 \times 10^8$

1

ii)  $x^6 \times x^5$

1

c) Chantel invested \$7 000 at 6% p.a. compounding annually. She used the formula  $A = P(1+r)^n$ , to show that the amount ( $A$ ) of money she will have after  $n$  years.

Chantel plans to go overseas, using the money from this investment account and needs \$21 000. How many years will it take her investment to reach \$21 000.

3

d) Christine purchases the Darrell Lea starter pack. The pack contained 6 hard centred and 9 soft centred chocolates. Christine ate 1 chocolate.

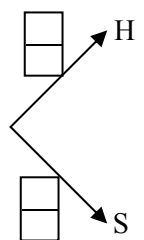
1<sup>st</sup>

i) Christine has correctly started the probability tree diagram. Copy the diagram onto your answer sheet and complete it.

1

ii) Christine then ate a second chocolate. Complete the probability tree diagram for the second chocolate.

1



iii) What is the probability that Christine ate a hard and a soft centre?

1

a) A teacher, Ms Grover, decides to set aside \$200 every fortnight to deposit into an investment fund. The fund pays 7.8% p.a. and this is compounded fortnightly.

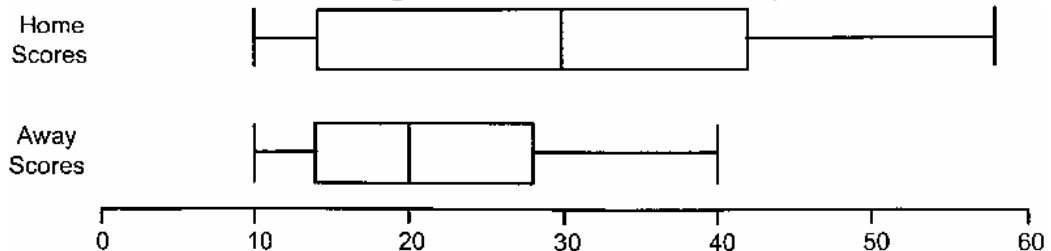
- i) Calculate the fortnightly interest rate. 1
- ii) How much will the annuity be worth after 3 years of deposits? 2
- iii) Ms Grover hoped to have \$200 000 as a retirement lump sum at the end of 7 years. How much would Ms Grover have to invest each fortnight to achieve this target? 2

b) 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 opponents 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 bow-and-whisker plot.



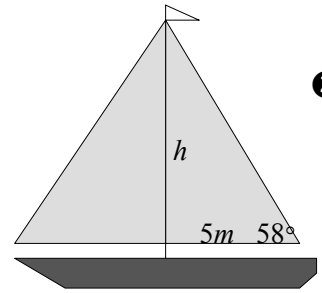
- ii) Write down the interquartile range for the Cheetahs home scores. 1
  - iii) Compare and contrast the Cheetahs home and away scores. In your answer, comment on the **shape and skewness** of the distributions, measures of **location** and measures of **spread**. 3
- c) Change the subject of the formula  $E = \frac{1}{2}mv^2$  to  $v$ . 2

**Question 25**

**Start this question on a new page**

**Marks**

a) Rachel's new sailing boat has a main sail that is 5m wide and an angle of  $58^\circ$  is made between the horizontal and sloping edge of the sail. How high is the sail?



2

b) Tania borrows \$350 000 from Eastpac to purchase a house. She takes the loan over 30 years at 6.48% pa.

i) Show that her monthly payment is \$2 207.64.

1

ii) How much does Tania repay over the 30 years to Eastpac?

1

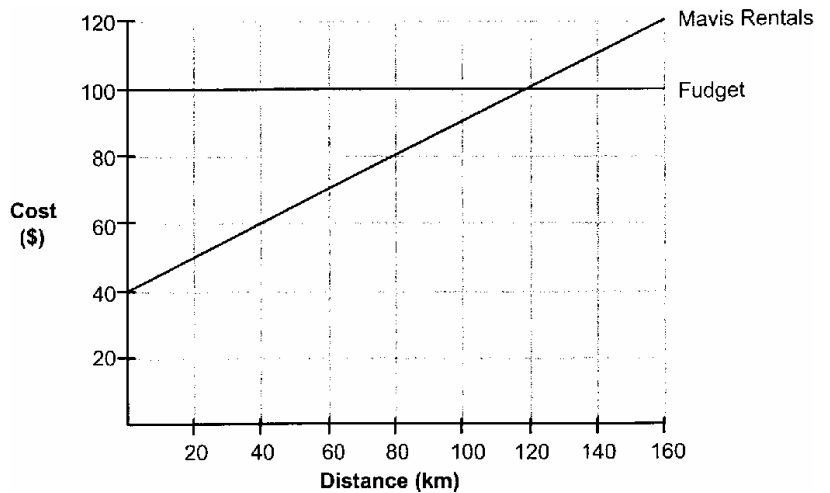
iii) How much interest does she pay over the 30 years?

1

iv) Tania gets a big promotion and decides to pay the loan off over 15 years. How much interest does she save by paying the loan off over 15 years?

3

c) The cost of hiring a car from two different rental companies, Mavis Rentals and Fudget Hire, are shown in the graph to the right.



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

2

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

1

d) Sarah is thinking about what to serve her guests when they come to lunch. She is deciding between soup or fruit or oysters followed by veal or chicken and finishing up with tiramisu or pastries.

i) How many different menus is Sarah considering?

1

ii) How many of the possible menus include veal?

1



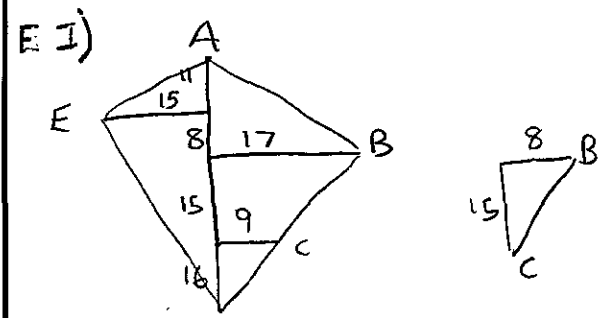
- i) D    2) C    3) D    4) B    5) B  
 6) C    7) B    8) D    9) A    10) B  
 11) C    12) D    13) C    14) A    15) A

Question 21

- A)  $I = PRN$   
 $= 12,000 \times 0.075 \times 6$   
 $= \$5400$
- B)  $2(p+q) - 3(p-q) = 2p+2q-3p+3q$   
 $= 5q-p$
- C I)  $13M + 17F = 30$  people  
 II) 2 (male)  
 III) 22  
 IV) Males  $38-2 = 36$  Females  $48-4 = 44$   
 $\therefore$  Females have largest range

D I) 0.5 mL

II)  $\frac{0.5}{15} \times 100 = 3\frac{1}{3}\%$



II)  $BC^2 = 8^2 + 15^2$   
 $= 64 + 225$   
 $= 289$   
 $BC = \sqrt{289}$   
 $= 17m$

Question 22

A) Int  $3400 - 2800 = 600$   
 $I = PRN$   
 $600 = 2800 \times R \times 3$   
 $600 = 8400 \times R$   
 $R = 0.0714$   
 $= 7.14\%$

B)  $\sin \theta = \frac{23}{42}$   
 $\theta = 33^\circ 12'$

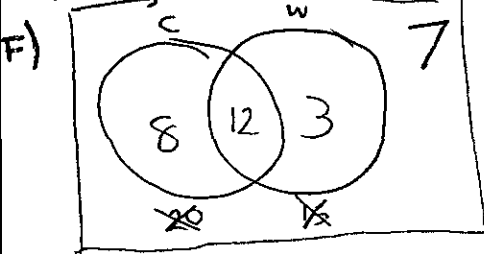
C)  $\sqrt[3]{p+3} = 2$   
 $\frac{p+3}{7} = 8$   
 $\frac{p+3}{7} = 56$   
 $p+3 = 56$   
 $p = 53$

D I)  $A = \pi(R^2 - r^2)$   
 $= \pi(2.3^2 - 0.9^2)$   
 $= 14.1 m^2$

II)  $V = 14.1 \times 7.2 \times 20$   
 $= 2,030.4 m^3$

E I)  ${}^{14}C_2 = 91$

II)  ${}^{26}C_3 = 2600$



$20 + 15 + 7 = 42$   
 $42 - 30 = 12$   
 Both = 12 students

Question 23

A I) 19 boxes contain less than 50 matches  
 $\therefore 62\%$  contain 50 or more  
 $\therefore$  the claim is reasonable ①

II) 50 scores  $\therefore Q_1 \leq 12\frac{1}{2}$ ,  $Q_3 \leq 37\frac{1}{2}$  ①  
 $IQR = 50 - 49$   
 $= 1$  ①

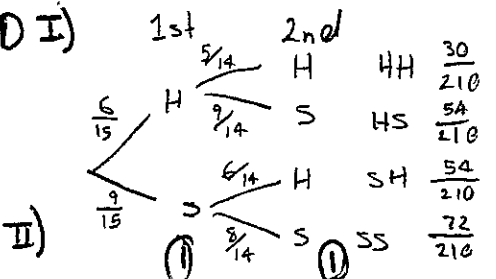
III) median av 25<sup>th</sup> and 26<sup>th</sup> scores  
 $\therefore$  median = 50 ①

IV) # with 50  $40 - 19 = 21$   
 $P(50) = \frac{21}{50}$  ①

B I)  $3.4748 \times 10^{16}$  ①

II)  $x^{11}$  ①

C)  $A = P(1+r)^n$   
 $21,000 = 7,000(1+0.06)^n$  ①  
 $1.06^n = 3$   
 let  $n=18$ ,  $1.06^{18} = 2.854$  ①  
 $n=19$ ,  $1.06^{19} = 3.026$   
 $\therefore$  after 19 year = ①



II) ① ①

III)  $P(H \text{ and } S) = \frac{54}{210} \times 2$   
 $= \frac{108}{210}$   
 $= \frac{18}{35}$  ①

Question 24

A I)  $r = 0.078 \div 26$  ~~INT~~  
 $= 0.003$

II)  $n = 26 \times 3 = 78$   $A = M \left[ \frac{(1+r)^n - 1}{r} \right]$

$A = 200 \left[ \frac{1.003^{78} - 1}{0.003} \right]$   
 $= \$17,546.79$

III)  $200,000 = M \left[ \frac{1.003^{152} - 1}{0.003} \right]$   $n = 26 \times 7$

$200,000 = M \times 241.6$   
 $M = \$827.67$

BI)  $\bar{x} = 22$   
 $\sigma_n = 9.56$

II)  $42 - 14 = 28$

III) Both sets of scores are skewed  
 The home scores have a higher median  
 The home scores have both a higher range and IQR

C)  $E = \frac{1}{2}mv^2$   
 $2E = mv^2$   
 $v^2 = \frac{2E}{m}$   
 $v = \sqrt{\frac{2E}{m}}$

Question 25

A)  $\tan 5\theta = \frac{h}{5}$   
 $h = 5 \tan 5\theta = 8.00m$

BI)  $N = M \left[ \frac{(1+r)^n - 1}{r(1+r)^n} \right]$   $r = 6.48 \div 12 = 0.54\%$   
 $350,000 = M \left[ \frac{1.0054^{360} - 1}{0.0054 \times 1.0054^{360}} \right]$   $n = 30 \times 12 = 360$   
 $350,000 = M \times 158.54$   
 $M = \$2,207.64$

II)  $\text{Repay} = 2,207.64 \times 12 \times 30 = \$794,750.40$

III)  $\text{Int} = 794,750.40 - 350,000 = \$444,750.40$

IV)  $350,000 = M \left[ \frac{1.0054^{180} - 1}{0.0054 \times 1.0054^{180}} \right]$   $n = 15 \times 12 = 180$   
 $350,000 = M \times 114.9$   
 $M = \$3045.03$

$\text{Repay} = 3045.03 \times 12 \times 15 = 548,105.40$

$\text{Save} = 794,750.40 - 548,105.40 = \$246,645$

CI)  $m = \frac{\text{rise}}{\text{run}} = \frac{20}{40} = \frac{1}{2}$   $y = mx + b$   
 $C = \frac{1}{2}d + 40$

II) You pay a flat rate, no matter how far you travel

DI)  $3 \times 2 \times 2 = 12$

II)  $3 \times 1 \times 2 = 6$

3)  $r = 6.3 \div 2 = 3.15\%$   $n = 10 \times 2 = 20$   $A = P(1+r)^n = 7000 \times 1.0315^{20} = \$13,016.15$

4)  $4000 \times 0.2 + 3000 \times 0.25 = \$1550$

5) 18 holes,  $\therefore$  av of 9<sup>th</sup> and 10<sup>th</sup> strokes  $\therefore (5+5) \div 2 = 5$

6)  $30 + 4 \times 10 = 70$

7) 1cm: 10,000cm  $200 \div 100 = 2cm$   
 1cm: 100m

8)  $y = 2 \times 5 + 3 = 13$   $\therefore (5, 13)$

10) 4 aces taken  $\therefore$  48 cards left  
 $P(K) = \frac{4}{48} = \frac{1}{12}$

11)  $\frac{1}{3} \times \frac{1}{2} \times 1 = \frac{1}{6} \approx 17\%$

12)  $\sqrt{2} - 1 = 0.4$   $10^{-7} = 0.0000007$   
 $\sin 2\theta = 0.34$   $3 - \pi = -0.14$   
 as  $P(E) > 0$ , only D

13)  $5a = a + 120$   
 $4a = 120$   
 $a = 30$

14)  $\frac{1457.87}{1.12} \approx 1301.6$

15)  $23 \times g + 35 \times c + 20 = 23g + 35c + 20$