HURLSTONE AGRICULTURAL HIGH SCHOOL

GENERAL MATHEMATICS

2007

YEAR 12

HALF YEARLY EXAMINATION
(ASSESSMENT TASK 2)

Examiners ~ S Faulds, S Hackett, G Rawson

GENERAL INSTRUCTIONS

- Reading Time – 5 minutes.
- Working Time – 2 hours.
- Attempt **all** questions.
- Marks may not be awarded for careless or badly arranged work.
- Board approved calculators may be used.
- This examination paper must **NOT** be removed from the examination room.

- This paper contains two sections
  Section 1 – 15 multiple choice questions
  Use the answer sheet provided
  (15 marks)

  Section 2 – 5 questions worth 15 marks
  Show all necessary working
  Answer each question in a separate booklet
  (75 marks)

Note: You must hand in an answer booklet for each question, even if the question was not attempted.

STUDENT NAME: _____

TEACHER: _____

SECTION 1

15 questions: 1 mark each

Use the answer sheet provided.

(Total 15 marks)

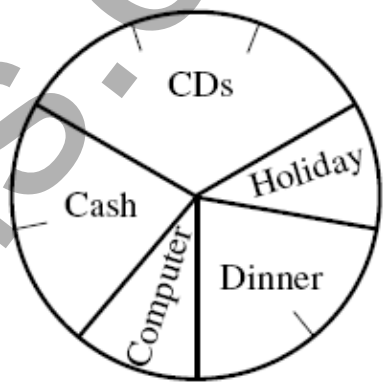
1. Expand and simplify $6(m+7)-(m-12)$

   A $5m + 1$ B. $5m + 25$ C. $5m + 30$ D. $5m + 54$

2. Calculate the time difference between Rome, Italy (42°N, 12°E) and Nairobi, Kenya (1°S, 37°E).

   A. 1 h 40 min B. 2 h 44 min C. 2 h 52 min D. 3 h 16 min

3. Kevin spins this wheel to determine his prize.
   What is the probability that he wins neither the holiday nor the computer?



   A. $\frac{2}{7}$ B. $\frac{7}{9}$

   C. $\frac{2}{9}$ D. $\frac{5}{7}$

4. Solve the equation $\frac{3d-5}{7} = d+1$

   A. $d = -2$ B. $d = -1\frac{1}{2}$ C. $d = 6\frac{1}{2}$ D. $d = -3$

5. Make x the subject of the formula $z = \frac{x-a}{s}$

   A. $x = \frac{z-s}{a}$ B. $x = sz + a$ C. $x = sz - a$ D. $x = \frac{sz}{a}$

6. Simplify $\frac{10kv}{4kv^2}$

   A. $6v$ B. $\frac{5}{2v}$ C. $\frac{6}{v}$ D. $\frac{5v}{2}$

7. A coin and a die are tossed together.
How many different possible outcomes are there in the sample space?

A. 8 B. 12 C. 36 D. 64

8. The probability of a 30-year-old woman dying this year is 0.04%.
What is the probability of a 30-year-old woman not dying?

A. 0.96% B. 96% C. 99·6% D. 99·96%

9. Vanessa has a credit card with a daily interest rate of 0.0438% and no interest-free period. She bought a mobile phone for $124 on 9 May using the credit card.
Calculate the interest due on 3 June.

A. $1·25 B. $1·30 C. $1·36 D. $1·41

10. Ulan Bator, Mongolia has coordinates (48°N, 107°E). If the radius of the Earth is 6400 km, find the great circle distance between Ulan Bator and the Equator.

A. 4691 km B. 5362 km C. 6590 km D. 11 952 km

11. A loan of $150 000 is repaid in monthly instalments of $1266 for 15 years.
Calculate the total interest paid.

A. $3 990 B. $77 880 C. $131 010 D. $227 880

12. Peter buys a car stereo system for $885 on interest-free terms over 48 weeks.
If he pays 20% deposit first, calculate the size of his weekly repayments.

A. $14·75 B. $18·44 C. $34·04 D. $36·88

13. Port Moresby, Papua New Guinea has latitude and longitude (9°S, 147°E). Nyngan, NSW is due south of Port Moresby. Which one of the following could be the location of Nyngan?

A. (4°S, 147°E) B. (9°S, 151°E) C. (9°S, 140°E) D. (31°S, 147°E)

14. Australian Eastern Standard Time (AEST) is 10 hours ahead of GMT. Calculate the local time in the United Kingdom when it is 6 pm in NSW and daylight saving is operating in the United Kingdom.

A. 3 am B. 5 am C. 7 am D. 9 am

15. A coloured die has 2 red faces, 3 blue faces and 1 green face. If the die is rolled 400 times, how many times can the green face be expected to turn up?

A. 15 B. 67 C. 80 D. 150

SECTION 2

5 questions: 15 marks each
(Total 75 marks)

Question 16 (15 marks) **(*start a new booklet*)**

(a) Medical research workers have developed a new test for performance enhancing drugs. They are trialling the drug on members of the general community.

The results of the trial are shown in the table.

	Test indicated drugs used	Test indicated drugs not used	Total
People who use drugs	48	7	55
People who don't use drugs	5		
Total	53		120

(i) Copy the table into your writing booklet and complete the three missing values. **2**

(ii) For what fraction of the people tested was the test result incorrect? **1**

(iii) For what percentage of the people who used the drugs did the test indicate that they didn't use drugs? **1**

(b) The chance of rain tomorrow is $\frac{1}{3}$.

The chance of Australia beating USA tomorrow in basketball is 0·4.

Billy places a $10 bet on Australia winning basketball tomorrow on a rainy day.
The bookmaker will pay $20 if it rains and Australia wins, and he will pay $12 if only one of these choices is correct
What is the Billy's financial expectation? **2**

(c) There is one seat at the back of the bus that is very popular among the students.

Before an excursion, a draw is conducted to determine who will sit in the popular seat.
The names of the 12 students are placed in a hat and 3 names are drawn without replacement.
The first name drawn determines who will sit in the seat on the first day.
The second name drawn determines who will sit in the seat on the second day.
The third name drawn determines who will sit in the seat on the third day.

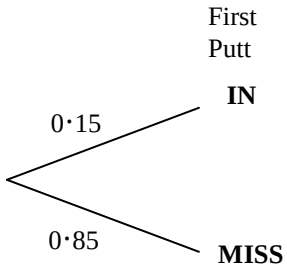
(i) What is the probability that Jane's name is the first drawn? **1**

(ii) What is the probability that Jane's name is the second drawn? **1**

(iii) What is the probability that Jane's name will NOT be one of the three names drawn? **2**

(d) When putting, the probability of a golfer taking only one shot to sink a 10m putt is 0·15.
If a second shot is required, it is taken from where the first shot finishes.
The probability that the same golfer will be successful with the second shot is 0·8.

(i) The probability tree below shows outcomes for the golfer's first shot at a 10m putt.
Copy the diagram into your answer booklet and complete it for outcomes of the second putt showing probability values on each branch. **2**



(ii) Find the probability that the golfer will take exactly two putts to get the ball into the hole. **1**

(iii) What is the probability that the golfer will take 3 or more shots to get the ball into the hole? **1**

(iv) Suggest a reason for the probability of a successful second shot being so much greater than the probability of success from the first putt. **1**

Question 17 (15 marks) **(*start a new booklet*)**

(a) When the local time in Sydney (34°S, 151°E) is 2 a.m. Monday
What will be the time and day at a point 100° to the west of Sydney? **2**

(b) Sonja and Barry have planned a holiday to the USA to visit friends.
Use the table of time differences below to answer the following questions:

Place	Hours from GMT
Samoa	–11
Alaska	–9
San Francisco	–8
Argentina	–3
Finland	+2
Pakistan	+5
Perth	+8
Sydney	+10
Norfolk Island	+11.5
Tonga	+13

(i) Sonja needs to call her friend in San Francisco to let her know their arrival time.
What time should she make the call from Sydney if her friend in San Francisco is to receive it at 7 pm?
You may disregard the day of the call. **2**

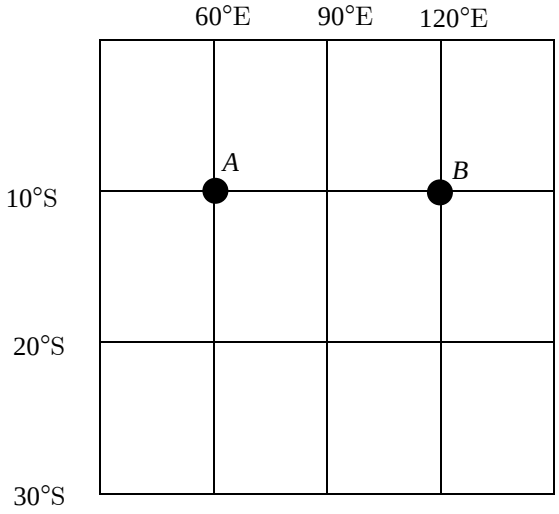
(ii) Sonja and Barry's flight is expected to leave at 9.20am Sydney time on a Friday, with a 36 hour stopover in Hawaii. If total flying time is expected to be 16 hours and 15 minutes, what will be their expected arrival time and day in San Francisco? **3**

(c) A team of Oceanographers researching ocean currents release a buoy, to be tracked by satellite, off the east coast of Australia at co-ordinates (25°S, 142°E).
Twenty four hours later, the tracking satellite gives the position of the buoy as (27·8°S, 142°E).

(i) How far did the buoy travel south in 24 hours?
Answer correct to the nearest nautical mile. **2**

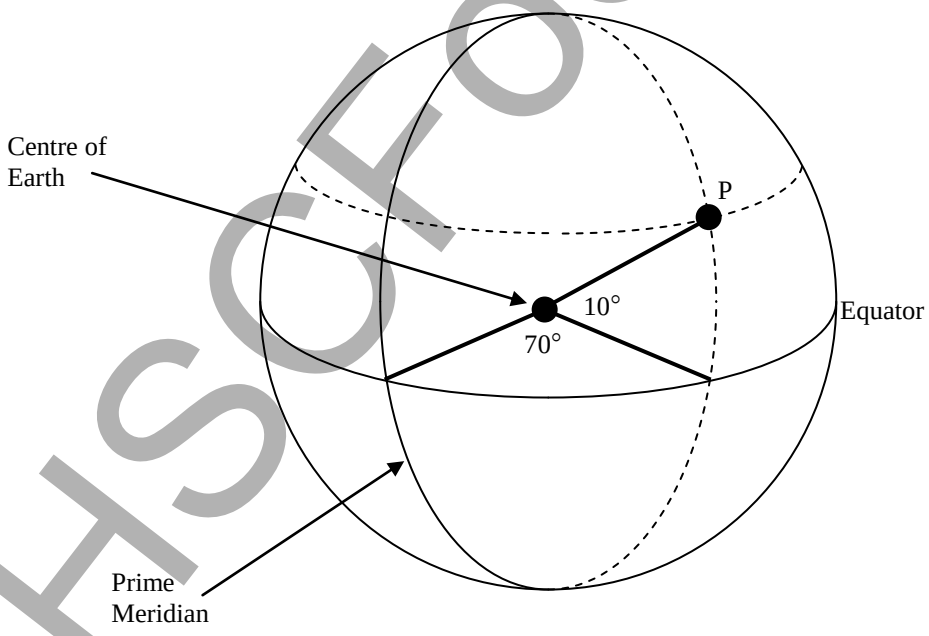
(ii) Convert the distance found in (i) to kilometres, and hence calculate the average speed of the ocean current to the nearest km/h. (Use 1 M = 1·852 km) **2**

(d) The diagram below shows two places on the Earth's surface.
A has position co-ordinates (10°S, 60°E) whilst *B* is located at (10°S, 120°E).



With reference to small circles and great circles, explain why the 10°S parallel of latitude joining *A* and *B* is not the shortest distance between these places on the Earth's surface. **2**

(e) Give latitude and longitude co-ordinates for the point *P* on the diagram below. **2**



Question 18 (15 marks) (*start a new booklet*)

(a) Miguel borrows \$50 000 to buy a new truck. The interest rate is 6% p.a. and the monthly repayment is \$650.

Amount borrowed	\$50 000
Interest rate p.a.	6%
Monthly repayment (*R*)	\$650

No. of months (*n*)	**Principal (*P*)**	**Interest (*I*)**	***P+I***	***P+I-R***
1	\$50 000	\$250	\$50 250	\$49600
2	\$49600	\$248	\$49848	\$49198
3	\$49198	A	B	C
4			\$49038	\$48388
5	\$48388	\$242		D

(i) Calculate the values that should go in the spaces marked A, B and C. **3**

(ii) How much of the loan has been paid off after 4 months? **2**

(iii) Miguel won some money in the 5th month so he made a bigger payment of \$5000 towards the loan that month. Find the value that should go in the space marked D. **1**

(b) The table below shows the monthly repayments for loans with a term of 20 years.

Amount borrowed	**5% p.a.**	**6% p.a.**	**7% p.a.**	**8% p.a.**
\$10 000	\$66.00	\$71.64	\$77.53	\$83.64
\$15 000	\$98.99	\$107.46	\$116.29	\$125.47
\$20 000	\$131.99	\$143.29	\$155.06	\$167.29
\$25 000	\$164.99	\$179.11	\$193.82	\$209.11

Pam borrowed \$25 000 at 7% p.a. over 20 years.

(i) Calculate how much she paid in total over the term of the loan. **2**

(ii) Hence calculate the interest she paid. **1**

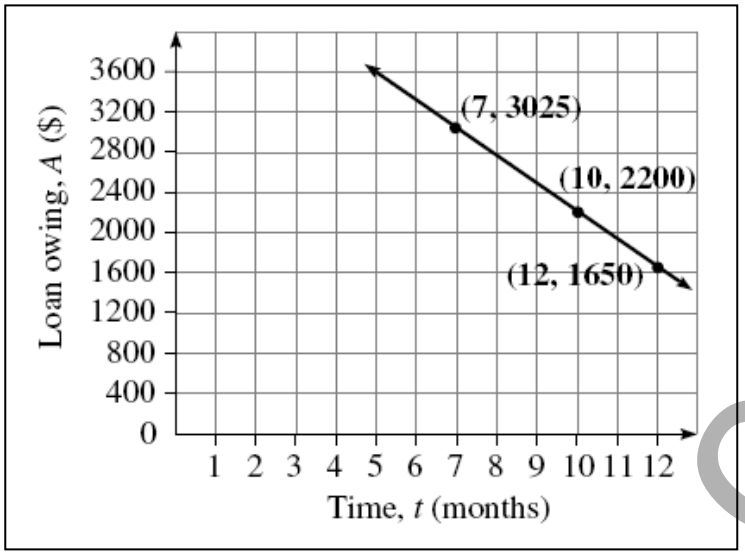
(c) Phillip bought a \$2495 computer using the deferred payment method.
There was no deposit, nothing to pay for 6 months, then 18 monthly payments of \$185. Calculate:

(i) the total cost of the computer **1**

(ii) the interest charged **1**

(iii) the equivalent flat rate interest rate p.a. **1**

(d) This graph shows the amount of a loan, A, decreasing over time as it is paid off monthly, where t represents the number of months.



(i) Find the equation of A as a function of t. **1**

(ii) What is the vertical intercept and what does it represent? **1**

(iii) What amount is still owing after 15 months? **1**

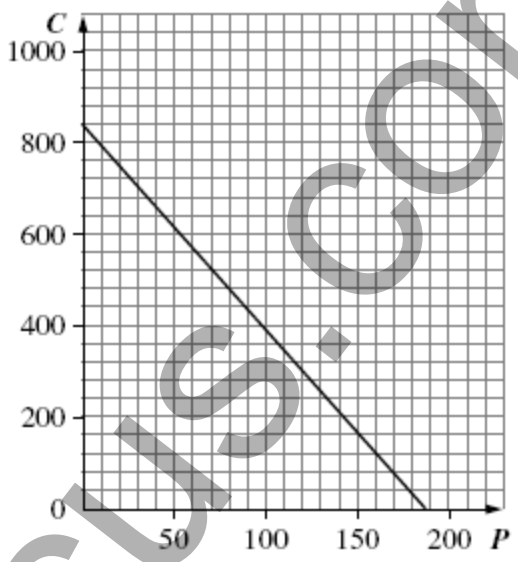
(iv) When will the loan be completely paid off? **1**

Question 19 (15 marks) (*start a new booklet*)

(a) (i) Solve $\frac{2t+1}{3}+\frac{t-4}{2}=5$ **2**

(ii) Find the value of x correct to 2 decimal places if $2^{x+1}=17$ **2**

(b) A criminologist studying crime in a suburban region found that the number of crimes, C, committed per week decreased as the number of police patrols, P, increased. She graphed her data and found a linear relationship between P and C. For example, with 80 police on patrol, the number of crimes was 480.



(i) What is the dependent variable? **1**

(ii) Find the linear function in the form $C = mP + b$. **2**

(iii) How many crimes were committed with 100 police on patrol? **1**

(iv) According to this model, how many police will need to be on patrol to have zero crimes? **1**

(c) Sara is investigating two mobile phone plans. Phonehome has a \$7.50 monthly access fee and a call charge of \$1.15 per minute. Talkfest has a \$30 monthly access fee and a call charge of \$0.25 per minute.

(i) If C represents the cost in dollars and t represents the total time spent in minutes, graph the following functions on the set of axes provided on the separate sheet. **2**

Phonehome: $C = 1{\cdot}15t + 7.5$

Talkfest: $C = 0{\cdot}25t + 30$

(ii) What is the point of intersection of the two lines? **2**

(iii) Explain in 1 or 2 sentences what the coordinates of the point of intersection represent. **2**

Question 20 (15 marks) (*start a new booklet*)

(a) The period T (in seconds), of a pendulum of length l metres is given by the formula:

$$T = 2\pi\sqrt{\frac{l}{9.8}}$$

(i) Calculate the period of a pendulum of length 30cm.
Give your answer correct to 2 significant figures. **1**

(ii) Do the variables T and l form a linear relationship?
Justify your answer. **2**

(iii) Change the subject of this formula to l. **2**

(b) The probability that a biased coin shows a 'head' is 0.8.

(i) What is the probability that the biased coin will show a 'tail'? **1**

(ii) David is going to toss the biased coin and a normal coin.
What is the probability that one or both of the coins will show 'heads'? **2**

There are 24 coins in a bag. Some of the coins are biased and the remainder are normal.
There are k biased coins in the bag.

(iii) Write an expression involving k for the number of normal coins in the bag. **1**

(iv) When I choose a coin from the bag at random, I am twice as likely to choose a biased coin as I am to choose a normal coin.
Write an equation, and solve it, to determine the number of biased coins in the bag. **2**

(c) Perth (32°S, 116 °E) lies to the west of Taree on the 32°S parallel of latitude.
The radius of the small circle on which they lie is 5428km, and the small circle distance between Perth and Taree along the parallel of latitude is 3411km.

(i) What is the angular distance between Perth and Taree on the small circle?
Answer to the nearest degree **2**

(ii) What are the position co-ordinates of Taree? (ie. Latitude and longitude.) **2**

Formulae Sheet

Area of an annulus

$A = \pi (R^2 - r^2)$

R = radius of outer circle
r = radius of inner circle

Area of an ellipse

$A = \pi ab$

a = length of semi-major axis
b = length of semi-minor axis

Area of a sector

$$A = \frac{\theta}{360} \pi r^2$$

θ = number of degrees in central angle

Arc length of a circle

$$l = \frac{\theta}{360} 2\pi r$$

θ = number of degrees in central angle

Surface area of a sphere

$A = 4\pi r^2$

Simpson's rule for area approximation

$$A \approx \frac{h}{3}(d_f + 4d_m + d_l)$$

h = distance between successive measurements
d_f = first measurement
d_m = middle measurement
d_l = last measurement

Volume

Cone $V = \frac{1}{3}\pi r^2 h$

Cylinder $V = \pi r^2 h$

Pyramid $V = \frac{1}{3} Ah$

Sphere $V = \frac{4}{3}\pi r^3$

A = area of base
h = perpendicular height

Mean of a distribution

$$\bar{x} = \frac{\sum x}{n}$$

$$\bar{x} = \frac{\sum fx}{\sum f}$$

x = individual score
$\bar{x}$ = mean

Formula for z-scores

$$z = \frac{x - \bar{x}}{s}$$

s = standard deviation

Probability of an event

The probability of an event where outcomes are equally likely is given by:

$$P(event) = \frac{number\ of\ favourable\ outcomes}{total\ number\ of\ outcomes}$$

Simple interest

$I = Prn$

P = initial quantity
r = percentage interest rate per period expressed as a decimal
n = number of periods

Compound interest

$A = P(1 + r)^n$

A = final balance
P = initial quantity
n = number of compounding periods
r = percentage interest rate per compounding period expressed as a decimal

Future value (A) of an annuity

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

M = contribution per period, paid at the end of the period

Present value (N) of an annuity

$$N = M\left\{\frac{(1+r)^n - 1}{r(1+r)^n}\right\}$$

or

$$N = \frac{A}{(1+r)^n}$$

Straight-line formula for depreciation

$S = V_o - Dn$

S = salvage value of asset after n periods
V_o = purchase price of the asset
D = amount of depreciation apportioned per period
n = number of periods

Declining balance formula for depreciation

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

S = salvage value of asset after n periods
r = percentage interest rate per period, expressed as a decimal

Sine rule

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Area of a triangle

$$A = \frac{1}{2}ab\sin C$$

Cosine rule

$c^2 = a^2 + b^2 - 2ab\cos C$

or

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

Gradient of a straight line

$$m = \frac{vertical\ \ change\ \ in\ \ position}{horizontal\ \ change\ \ in\ \ position}$$

Gradient–intercept form of straight line

$y = mx + b$

m = gradient
b = y-intercept

Answer Sheet

Name _____

Completely fill the response oval representing the most correct answer

1.	A ⬭	B ⬭	C ⬭	D ⬭
2.	A ⬭	B ⬭	C ⬭	D ⬭
3.	A ⬭	B ⬭	C ⬭	D ⬭
4.	A ⬭	B ⬭	C ⬭	D ⬭
5.	A ⬭	B ⬭	C ⬭	D ⬭
6.	A ⬭	B ⬭	C ⬭	D ⬭
7.	A ⬭	B ⬭	C ⬭	D ⬭
8.	A ⬭	B ⬭	C ⬭	D ⬭
9.	A ⬭	B ⬭	C ⬭	D ⬭
10.	A ⬭	B ⬭	C ⬭	D ⬭
11.	A ⬭	B ⬭	C ⬭	D ⬭
12.	A ⬭	B ⬭	C ⬭	D ⬭
13.	A ⬭	B ⬭	C ⬭	D ⬭
14.	A ⬭	B ⬭	C ⬭	D ⬭
15.	A ⬭	B ⬭	C ⬭	D ⬭

NAME:……..

ANSWER QUESTION 19 (c)(i) ON THIS PAPER
Hand this page in with your Question 19 booklet