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)

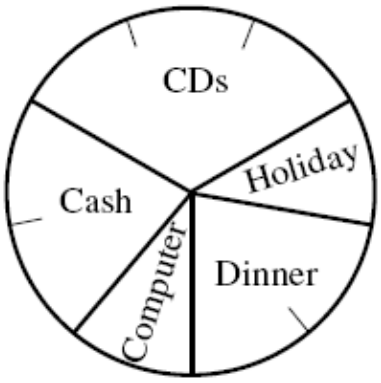
1. Expand and simplify $6(m+7)-(m-12)$

   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.

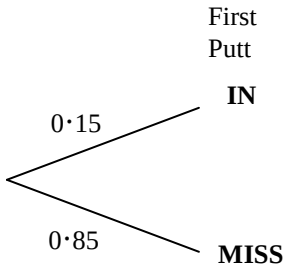
(i) What is the probability that Jane's name is the first drawn? **1**

(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**

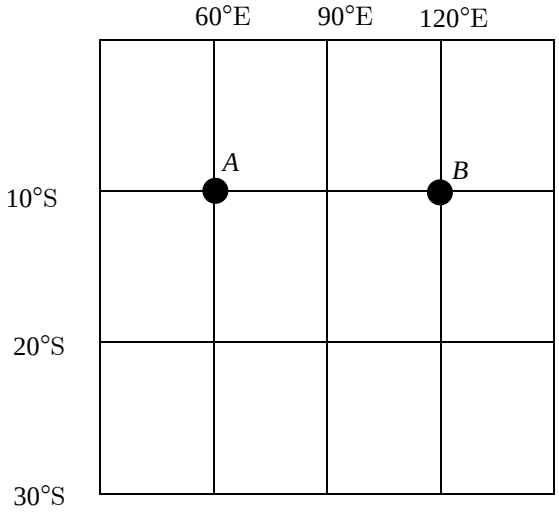
(ii) Sonja and Barry's flight is expected to leave at 9.20am Sydney time on a Friday, with a 36 hour stopover in Hawaii. If total flying time is expected to be 16 hours and 15 minutes, what will be their expected arrival time and day in San Francisco? **3**

(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**

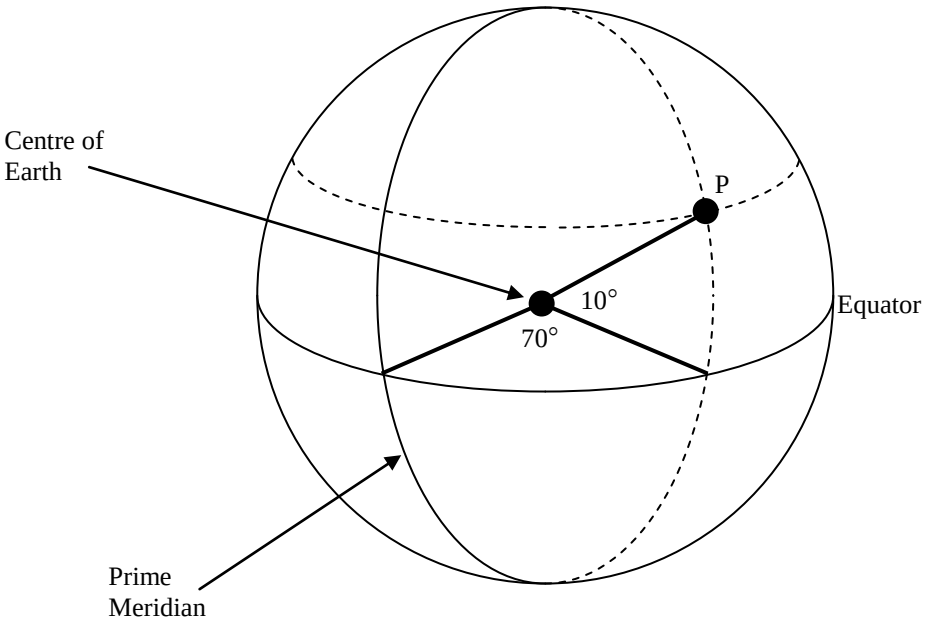
(ii) Convert the distance found in (i) to kilometres, and hence calculate the average speed of the ocean current to the nearest km/h. (Use 1 M = 1·852 km) **2**

(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**

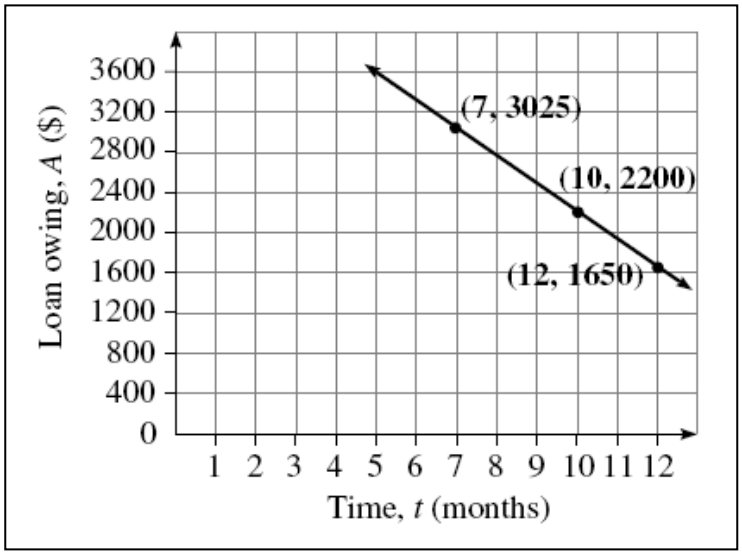
(c) Phillip bought a \$2495 computer using the deferred payment method.
There was no deposit, nothing to pay for 6 months, then 18 monthly payments of \$185. Calculate:

(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**

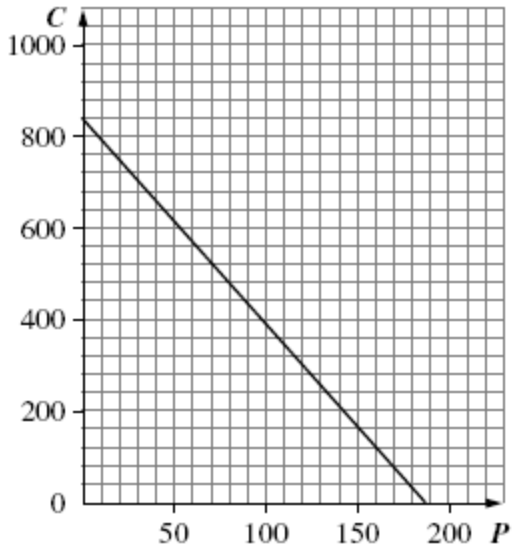
(iv) When will the loan be completely paid off? **1**

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

$S = V_0 - Dn$

S = salvage value of asset after n periods
V_0 = purchase price of the asset
D = amount of depreciation apportioned per period
n = number of periods

Declining balance formula for depreciation

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

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

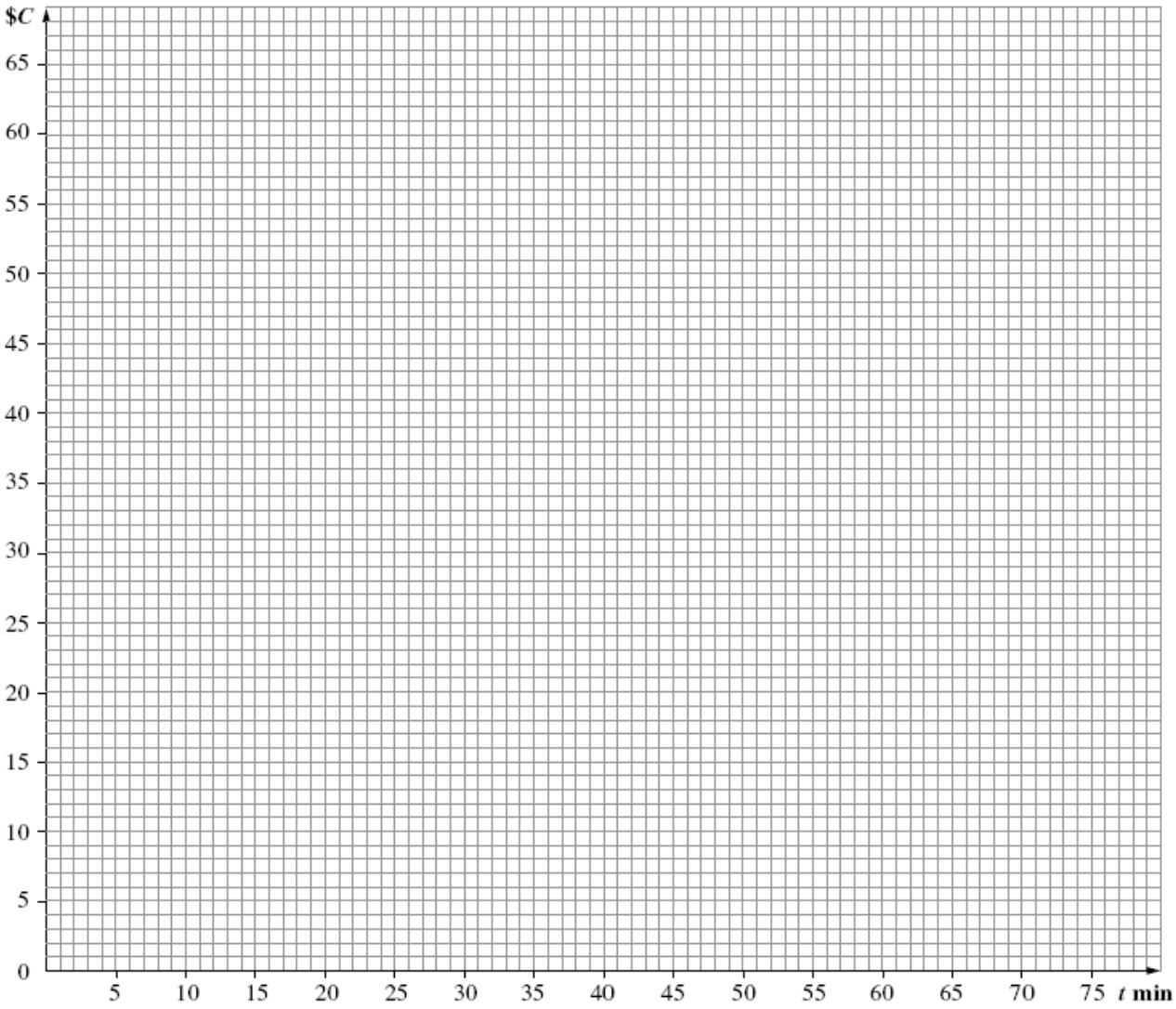
Name _____

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:……..

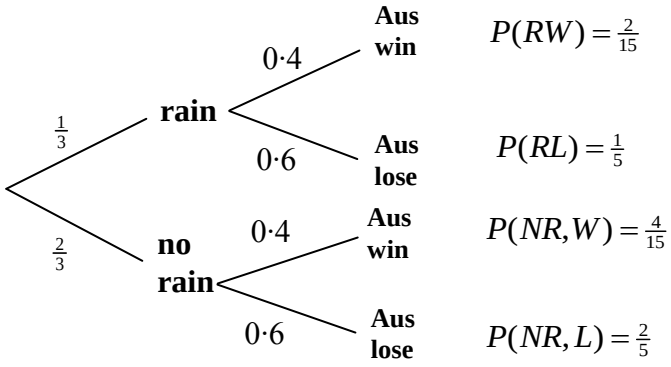
ANSWER QUESTION 19 (c)(i) ON THIS PAPER
Hand this page in with your Question 19 booklet



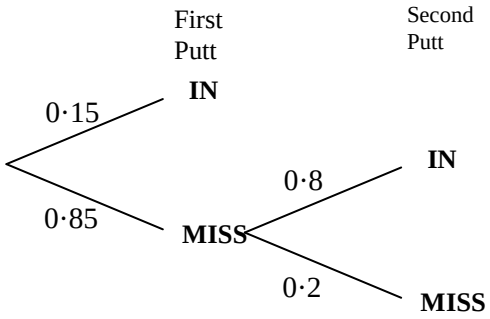
Year 12	General Mathematics	Half Yearly Exam 2007
Question No. 16	Solutions and Marking Guidelines	

Outcomes Addressed in this Question

H5 - makes predictions about the behaviour of situations based on simple models

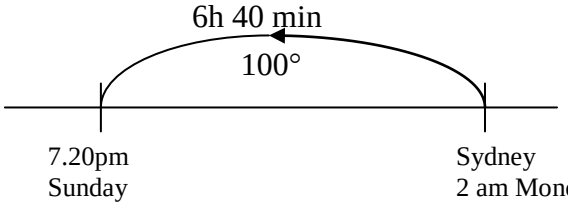
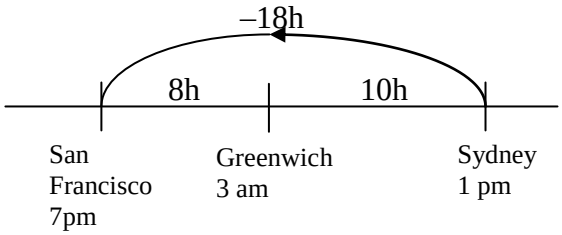
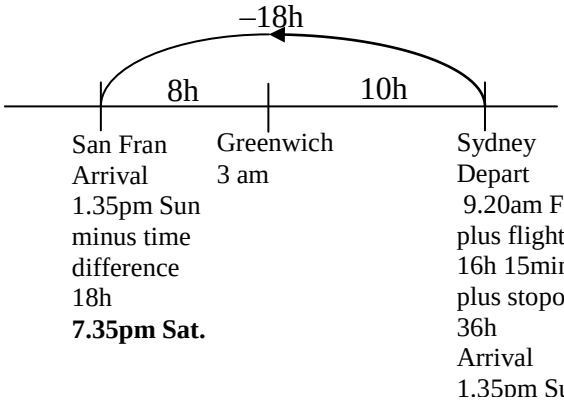
Outcome	Solutions	Marking Guidelines
(a)(i) **H5**		2 marks : all three values correct 1 mark : two values correct
(a)(ii) **H5**	$\frac{12}{120}$ OR $\frac{1}{10}$	1 mark : correct answer
(a)(iii) **H5**	$\frac{12}{120}\times 100 = 12\cdot 7\%$	1 mark : correct answer
(b) **H5**		2 marks : correct answer 1 mark : substantially correct (eg. Determining correct probabilities)
	Financial expectation $= \$20\times P(RW)+\$12\times P(RL)+\$12\times P(NR,W)$ $= \$20\times\frac{2}{15}+\$12\times\frac{1}{5}+\$12\times\frac{4}{15}$ $= \$8\cdot 27$	
(c)(i) **H5**	P(1^{st} draw) = $\frac{1}{12}$	1 mark : correct answer
(c)(ii) **H5**	P(2^{nd} draw) = P(not 1^{st}) x P(2^{nd}) $= \frac{11}{12}\times\frac{1}{11}=\frac{1}{12}$	1 mark : correct answer
(c)(iii) **H5**	P(not in first three) = P(not 1^{st}) x P(not 2^{nd}) x P(not 3^{rd}) $=\frac{11}{12}\times\frac{10}{11}\times\frac{9}{10}=\frac{3}{4}$	2 marks : correct answer 1 mark : partially correct

	Test indicated drugs used	Test indicated drugs not used	Total
People who use drugs	48	7	55
People who don't use drugs	5	**60**	**65**
Total	53	**67**	120

	Question 16 (cont)	
(d)(i) **H5**	 P(in) = 0·15 P(miss,in) = 0·68 P(miss,miss) = 0·17	<u>2 marks</u> : correct solution <u>1 mark</u> : substantially correct
(d)(ii) **H5**	P(2 putt) = P(miss, in) = 0·68	<u>1 mark</u> : correct answer
(d)(iii) **H5**	P(3 or more putt) = P(miss,miss) = 0·17	<u>1 mark</u> : correct answer
(d)(iv) **H5**	The ball should be closer to the hole after first putt, creating an easier second putt.	<u>1 mark</u> : legitimate reasoning

Multiple Choice (1 mark each)

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

Year 12 General Mathematics Half Yearly Examination 2007		
Question No. 17	Solutions and Marking Guidelines	
Outcomes Addressed in this Question		
H7 interprets the results of measurements and calculations and makes judgements about reasonableness		
Outcome	**Solutions**	**Marking Guidelines**
H7	(a) $1° = 4$ minutes $\therefore 100° = 400$ minutes $= 6h\ 40min$  **$\therefore$ Time will be 7.20pm Sunday.**	**2 marks** Correct answer **1 mark** States correct time difference
H7	(b) (i)  **$\therefore$ Sonja should make her phone call at 1pm**	**2 marks** Correct answer **1 mark** States correct time difference
H7	(ii)  **$\therefore$ Sonja and Barry expected arrival in San Francisco is 7.35pm Saturday.**	**3 marks** Correct solution **2 mark** Incorrect answer with a valid method of solution with minor errors in calculating time differences or flight/stopover times. **1 mark** Calculates total stopover/flight time or correct arrival time based upon other incorrect working
H7	(c) (i) Buoy travels along 142°E meridian (ie. A great circle) $\therefore 1° = 60M$, so $2.8° = 168M$ **Buoy has travelled 168 nautical miles.**	**2 marks** Correct answer **1 mark** States correct time equivalence between arc on great circle and distance.
	(ii) $168M = (168 \times 1.852)km$ $= 311.136km$ Av. speed of current $= (311.136 \div 24)km/h$ $= 13km/h$ (to nearest km/h)	**2 marks** Correct answer **1 mark** States correct time equivalence between arc on great circle and distance.
	Question 17 (cont)	

H7	(d) 10°S parallel of latitude is a small circle. The shortest distance between two points on the surface of a sphere is along a great circle. Therefore, the distance along the 10°S parallel would be further than along a great circle between these points.	**2 marks** Correct reasoning, making reference to both small circles and great circles. **1 mark** Some correct reasoning in solution but may only refer to one only of great circles and small circles.
H7	(e) 10°N 70°E	**2 marks** Latitude and longitude both stated correctly. **1 mark** One of latitude or longitude stated correctly.

Year 12 General Mathematics Half Yearly Examination 2007				
Question No. 18			Solutions and Marking Guidelines	
Outcomes Addressed in this Question				
H5 represents the relationships between changing quantities in algebraic and graphical form				
Outcome	**Solutions**			**Marking Guidelines**
H5	**(a)**	**(i)**	A = \$246 B = \$49 444 C = \$48 794	**1 mark** for each correct answer
		(ii)	\$50 000 – \$48 388 = \$1612	**1 mark** for identifying \$48 388 as amount owing after 4 months **2 marks** for correct answer
		(iii)	D = \$43 630	**1 mark** for correct answer
H5	**(b)**	**(i)**	\$193.82 x 20 x 12 = \$46 516.80	**1 mark** for identifying \$193.82 as repayment amount **2 marks** for correct answer
		(ii)	\$46 516.80 - \$25 000 = \$21 516.80	**1 mark** for correct answer
H5	**(c)**	**(i)**	18 x \$185 = \$3330	**1 mark** for correct answer
		(ii)	\$3330 - \$2495 = \$835	**1 mark** for correct answer
		(iii)	I = P *r* n 835 = 2495 x *r* x 2 $r = \frac{835}{2495 \times 2}$ *r* = 0.167 *r* = 16.7%	**1 mark** for correct answer
H5	**(d)**	**(i)**	A = -275 t + 4950	**1 mark** for correct answer
		(ii)	The vertical intercept is \$4950 This represents the original amount borrowed.	**1 mark** for correct answer
		(iii)	When t = 15 A = -275 x 15 + 4950 = \$825	**1 mark** for correct answer
		(iv)	When A =0 0 = -275 x t + 4950 t = 4950 / 275 t = 18 After 18 ***months***	**1 mark** for correct answer

Year 12	General Mathematics	Half Yearly Exam 2007
Question No. 19	Solutions and Marking Guidelines	

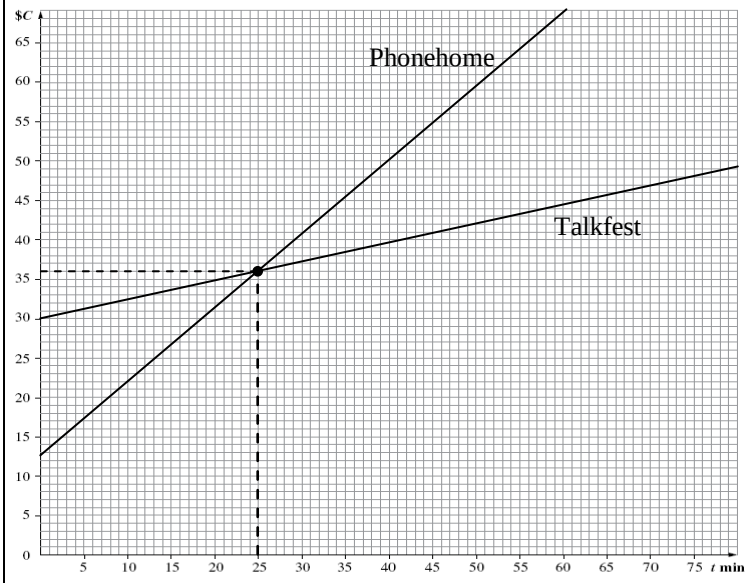
Outcomes Addressed in this Question

P5 - represents the relationships between changing quantities in algebraic and graphical form
H3 - develops and tests a general mathematical relationship from observed patterns

Outcome	Solutions	Marking Guidelines
(a)(i) **P5**	$\frac{2t+1}{3}+\frac{t-4}{2}=5$ $6\times\frac{2t+1}{3}+6\times\frac{t-4}{2}=5\times 6$ $2(2t+1)+3(t-4)=30$ $4t+2+3t-12=30$ $7t-10=30$ $7t=40$ $t=\frac{40}{7}=5\frac{5}{7}=5\cdot 71$	2 marks : correct solution 1 mark : partially correct working
(a)(ii) **P5**	$2^{x+1}=17$ $x+1=\frac{\log 17}{\log 2}$ $=4\cdot 087$ $x=3\cdot 087$ $=3\cdot 09$	2 marks : correct answer 1 mark : substantially correct
(b)(i) **P5**	independent variable is C	1 mark : correct answer
(b)(ii) **P5,H3**	b = 840 (from C intercept) graph passes through (0, 840) & (160, 120) so $m=\frac{\text{rise}}{\text{run}}=\frac{120-840}{160-0}$ $=-4.5$ (other similar answers are possible) $\therefore C=-4\cdot 5P+840$	2 marks : correct answer 1 mark : substantially correct (eg. m or b correctly)
(b)(iii) **P5,H3**	$C=-4\cdot 5P+840$ $=-4\cdot 5\times 100+840$ $=390$ (or read from graph)	1 mark : in the range 380-398 or correct substitution into function found in (ii) NB: graph is below 400 when P = 100
(b)(iv) **P5,H3**	$C=-4\cdot 5P+840$ $0=-4\cdot 5P+840$ $P=187$ (or read from graph)	1 mark : in the range 183-189 or correct substitution into function found in (ii)

Question 19 (cont)

(c)(i) **P5,H3**



2 marks : both graphs correct (and reasonably accurate)

1 mark : one graph correct or both graphs partially correct (eg correct intercept)

(c)(ii) **P5,H3**

Point of intersection is (25, 36)

2 marks : both values correct from graph obtained in (i)

1 mark : one value correct from graph obtained in (i)

(c)(iii) **P5,H3**

The **coordinates** of the point of intersection represent both companies having the same charge ($*C*) for that particular total amount of time (*t* min).

2 marks : legitimate explanation (must make mention of what each variable/coordinate represents)

1 mark : legitimate explanation (but only referring to what one variable/coordinate represents)

Year 12 General Mathematics Half Yearly Examination 2007

Question No. 20 Solutions and Marking Guidelines

Outcomes Addressed in this Question

P5 represents the relationships between changing quantities in algebraic and graphical form
H3 develops and tests a general mathematical relationship from observed patterns
H5 makes predictions about the behaviour of situations based on simple models
H7 interprets the results of measurements and calculations and makes judgements about reasonableness

Outcome	Solutions	Marking Guidelines
P5, H3	(a) (i) $T = 2\pi\sqrt{\frac{l}{9.8}}$ if l = 30cm = 0.3 cm $T = 2\pi\sqrt{\frac{0.3}{9.8}}$ $= 1.1s \quad (2\,sig.\,figs)$	**1 mark** Correct answer (no need for correct rounding in this instance)
P5, H5	(ii) No. The square root function is involved in the relationship so it cannot be linear.	**2 marks** Correct answer and reasoning **1 mark** Correct answer. Reasoning absent or incorrect
P5	(iii) $T = 2\pi\sqrt{\frac{l}{9,8}}$ $\frac{T}{2\pi} = \sqrt{\frac{l}{9.8}}$ $\frac{T^2}{4\pi^2} = \frac{l}{9.8}$ $\therefore l = \frac{9.8 \times T^2}{4\pi^2}$	**2 marks** Correct solution **1 mark** Substantial progress towards correct solution.
H7	(b) (i) P(T) = 0.2	**1 mark** Correct answer
	(ii) P(at least 1H) = 1 – P(TT) = 1 – 0.2 × 0.5 = 0.9	**2 marks** Correct answer **1 mark** Substantial progress towards correct solution showing correct combination of probabilities.
H7	(iii) No. of normal coins = 24 – k	**1 mark** Correct answer
H3, H7	(iv) There must be twice as many biased coins as there are normal coins. ie. 2 × no. of normal coins = no. of biased coins 2(24 – k) = k 48 – 2k = k 3k = 48 k = 16 ∴ There are 16 biased coins in the bag.	**2 marks** Correct answer obtained by solving an equation involving k. **1 mark** Correct answer obtained without an equation **OR** substantial progress towards solution.
H7	(c) $l = \frac{\theta}{360} \times 2\pi r$ $3411 = \frac{\theta}{360} \times 2\pi \times 5428$ $\theta = \frac{3411 \times 360}{2\pi \times 5428}$ $= 36°$	**2 marks** Correct solution **1 mark** Shows correct relationship between radius of small circle and arc length, including substitution.
H7	(d) Co-odinates of Taree: 32°S, 152°E	**2 marks** Correct answer. **1 mark** Either latitude or longitude shown correctly.