STUDENT NUMBER: _____

TEACHER: _____

Founded 1982

THE HILLS GRAMMAR SCHOOL

TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

2010

GENERAL MATHEMATICS

Teacher Responsible: Mr C O'Neill

General Instructions:

- Reading time – 5 minutes
- Working time – 2½ hours
- Students are to attempt ALL questions.
- Approved silent calculators may be used.
- Hand up your multiple choice answer sheet with the question paper in one bundle.
- A Formula sheet is provided.
- Marks may be deducted for careless, untidy or badly arranged work.

Total marks – 100

Section I 22 marks

- Indicate all answers on the multiple choice answer sheet provided.
- Allow 30 minutes for this section.

Section II 78 marks

- All necessary working must be shown.
- **Answer each question in a separate writing booklet.**
- Write your student number on each booklet.
- Allow 2 hours for this section.

Multiple Choice	Question 23	Question 24	Question 25	Question 26	Question 27	Question 28	TOTAL
/22	/13	/13	/13	/13	/13	/13	/100

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.

Trial Higher School Certificate Examination
Mathematics General

Section I
Answer on Multiple Choice Answer sheet provided.

1. What is 0.000 158 kg when expressed in scientific notation?

A) $0.158 \times 10^{3}\ kg$
B) $0.158 \times 10^{-3}\ kg$
C) $1.58 \times 10^{4}\ kg$
D) $1.58 \times 10^{-4}\ kg$

2.

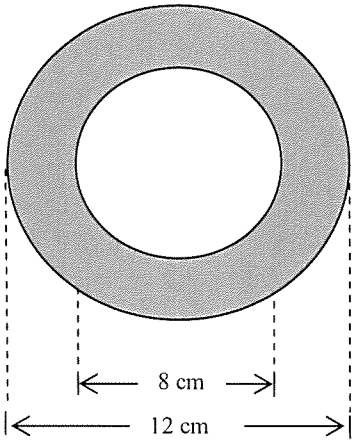


Diagram not to scale

Which of the following expressions will give the area, in square centimetres, of the cross-section (shaded area) of the pipe?

A) $\pi(12-8)^2$ **B)** $\pi(12^2-8^2)$ **C)** $\pi(6-4)^2$ **D)** $\pi(6^2-4^2)$

3. The solution to the equation $7-2(x-4)=25$ is

A) $x=-7$ **B)** $x=-5$ **C)** $x=5\frac{4}{5}$ **D)** $x=9$

4. Simplify the algebraic fraction $\frac{15a^3b^8}{25a^6b^2}$

A) $\frac{3b^6}{5a^3}$ **B)** $\frac{b^6}{10a^3}$ **C)** $\frac{3b^4}{5a^2}$ **D)** $\frac{b^4}{10a^2}$

5. Sascha measured a piece of material for her HSC major work as 200 mm correct to the nearest millimetre. What is the percentage error in her measurement?

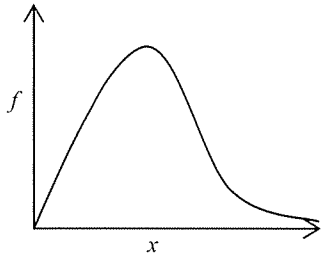
A) $\pm 0.0025\%$ **B)** $\pm 0.005\%$ **C)** $\pm 0.25\%$ **D)** $\pm 0.5\%$

6. A coin is tossed 50 times and lands on tails 23 times. The relative frequency of getting tails is:

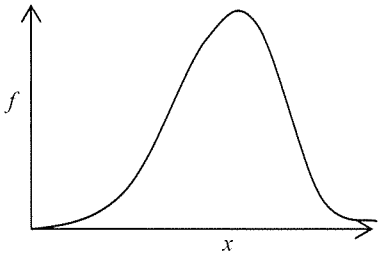
A) 0.23 **B)** 0.27 **C)** 0.46 **D)** 0.50

7. Which of the following graphs best represents negatively skewed data?

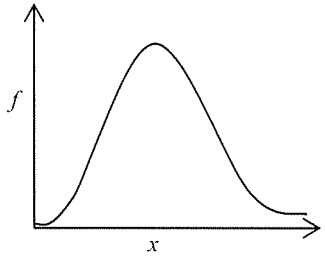
A)



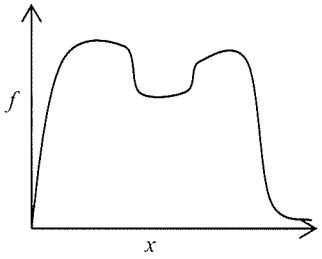
B)



C)



D)



8. In a One Day Cricket game Brett Lee bowled a ball at a speed of 141.6 km/hr. This speed in m/s is closest to:

A) 3.9 m/s **B)** 39.3 m/s **C)** 509.8 m/s **D)** 2360 m/s

9. Which of the following is equivalent to $12x(x-3)-5(2x+1)$?

A) $12x^2-26x+5$ **B)** $12x^2-26x-5$

C) $12x^2-46x+5$ **D)** $12x^2-46x-5$

10. The area of an ellipse with a major axis of 16 cm and a minor axis of 8 cm, is given by the formula:

A) $\pi \times 8 \times 4\ cm^2$ **B)** $\pi \times 16 \times 4\ cm^2$

C) $\pi \times 16 \times 8\ cm^2$ **D)** $\pi \times 32 \times 16\ cm^2$

11. The value of $\sqrt[3]{\frac{3v}{4\pi}}$ when $v = 463$ is closest to:

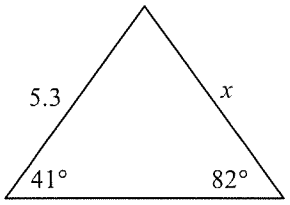
A) 4.8 **B)** 10.2 **C)** 36.8 **D)** 363.6

12. The following equation was used correctly to find the value of x.

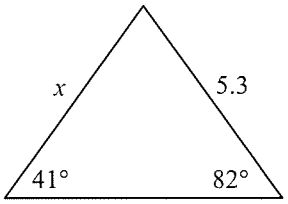
$$\frac{x}{\sin 82°} = \frac{5 \cdot 3}{\sin 41°}$$

This equation represents the information from which diagram?

A)

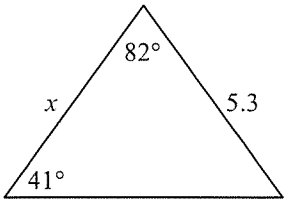


B)

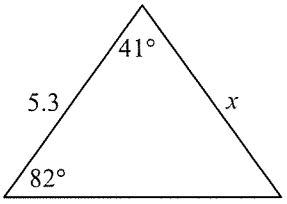


Diagrams not to scale

C)



D)



13. A magazine wants to survey the different types of cars people drive.

What type of data is this?

A) discrete

B) continuous

C) systematic

D) categorical

14. During the last month in the town of Billabong, houses were sold for the following prices:

$160 000	$145 000	$175 000	$200 000
$180 000	$1 250 000	$145 000	$210 000

Which measure gives the best idea of house prices in the area?

A) Mean

B) Median

C) Mode

D) Range

15. A Visa card has an annual interest rate of 16%. What would be the equivalent DAILY interest rate to 3 significant figures (1 year = 365 days) ?

A) 0.000438%

B) 0.0438%

C) 0.044%

D) 0.160%

16. The Darlinghurst Daredevil Pest Control company used the 'capture – recapture' technique to estimate the number of cockroaches in the Year 7 locker area. They initially caught, marked and released 50 cockroaches. When they caught 200 cockroaches later on, 5 were marked. The best estimate for the cockroach population would be:

A) 245

B) 250

C) 2000

D) 10 000

17. Maria receives a z-score of 1.6 in an Assessment Task. If the mean of the task was 60 with a standard deviation of 15, what was her raw score?

A) 36

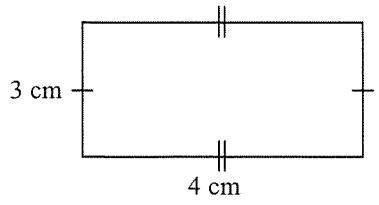
B) 64

C) 84

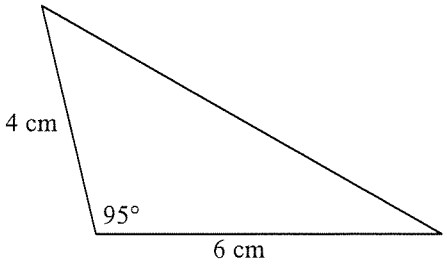
D) 96

18. Which of the following shapes has the greatest area?

A)

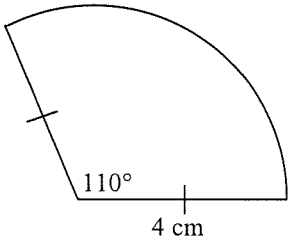


B)

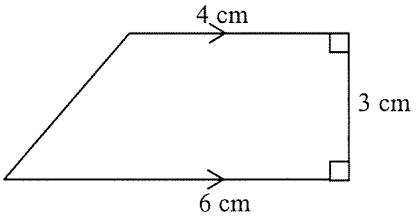


Diagrams not to scale

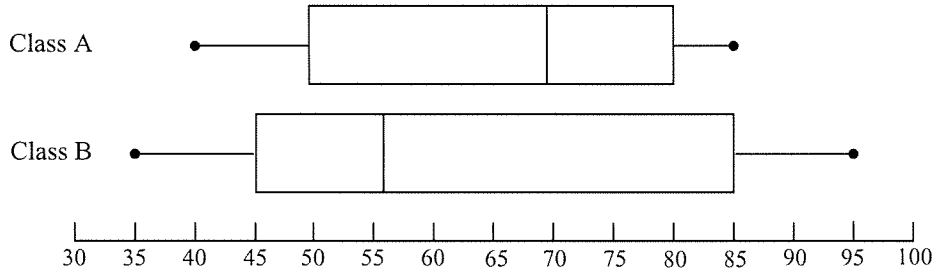
C)



D)



19. The box and whisker plots shown below compare the marks of students in two classes. Which of the following statements is correct?



A) The median of Class B is greater.

B) Class A is positively skewed.

C) The range of Class B is smaller.

D) Class A is negatively skewed.

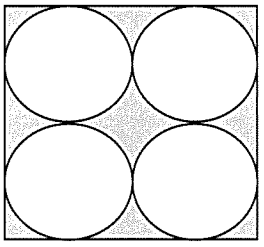
20. From the diagram, find the area of the region between the circles and the square, to the nearest square centimetre, if each of the circles has a diameter of 6 cm.

A) 31 cm^2

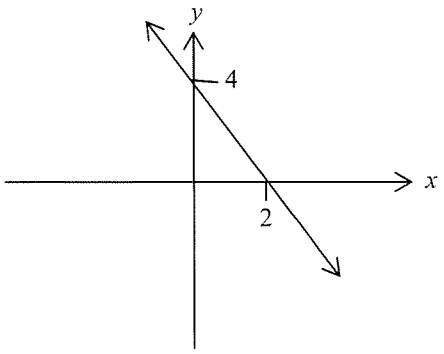
B) 69 cm^2

C) 77 cm^2

D) 89 cm^2



21. Which equation represents the straight line in the diagram.



A) $y = 4 + 2x$

B) $y = 2x - 4$

C) $y = 4 - 2x$

D) $y = 4 + \frac{1}{2}x$

22. The location of Town A is 25°N 45°E. The location of Town B is 10°N 105°E. What of the following is true? (Ignore Time Zones)

A) Town A is four hours behind Town B
B) Town A is four hours ahead of Town B
C) Town A is one hour behind Town B
D) Town A is one hour ahead of Town B

Section II

Total Marks (78)
Attempt Questions 23 – 28
Allow about 2 hours for this section.

Answer all questions, starting each question on a new sheet of paper with your name and question number at the top of the page. Do not write on the back of sheets.

Question 23 (13 marks) Start a new sheet of paper. **Marks**

a) Coral obtains a loan of $480 000 over a period of 30 years at a rate of 8% p.a. reducible interest.

Monthly Repayment Table				
Principal and interest per $1 000 borrowed				
Interest Rate	**Term of Loan (years)**			
	15	**20**	**25**	**30**
7%	8.99	7.75	7.07	6.65
8%	9.56	8.36	7.72	7.34
9%	10.14	9.00	8.39	8.05
10%	10.75	9.65	9.09	8.78

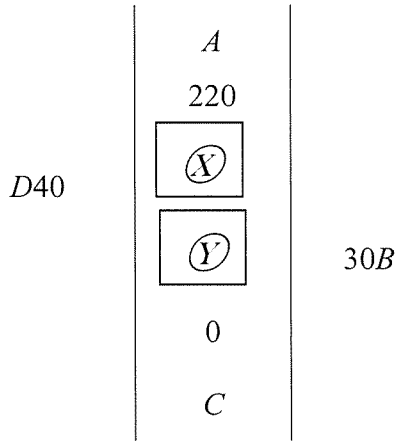
i) Using the monthly repayment table, calculate Coral's monthly repayment. **2**

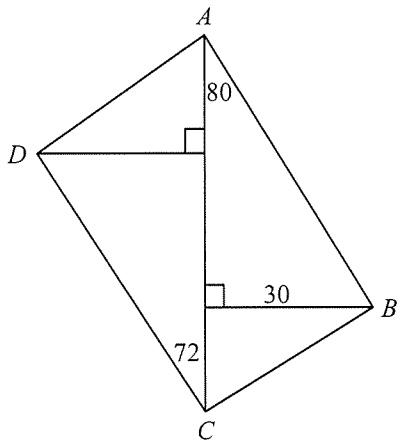
ii) How much interest does she pay over the 30 years? **2**

iii) If Coral reduces the term of the loan whilst the interest rate remains constant, what effect will this have on the monthly repayment? **1**

iv) What effect will an increase of 1% on the interest rate have on the amount of interest that needs to be paid on the loan? **2**

b) A survey of a park was conducted. The notebook entry and a sketch are drawn below. Both are incomplete (measurements are in metres).





i) Write down the measurements that should replace (X) and (Y) in the notebook entry. **2**

ii) Copy the sketch of the field into your answer booklet and fill in the missing measurements. **2**

iii) Calculate the area of the sketch to the nearest metre. **2**

End of Question 23

Question 24 (13 marks) Use a separate writing booklet. **Marks**

a) Lui plays a game involving tossing 2 coins. The possible outcomes for the game are:

2 heads	win \$6
1 head, 1 tail	win \$2
2 tails	lose \$8

The game costs 80 cents to play:

i) What is Lui's expected financial return? **2**

ii) Is the game fair? Why or Why not? **1**

b) The number of text messages sent each day by Year 10 students was recorded on Monday 11 August. The data was analysed and the following five number summary resulted:

4 10 12 16 18

i) Draw a box-and-whisker plot to illustrate this data. **2**

ii) What percentage of Year 10 students sent between 12 and 16 text messages on that day? **1**

c) Mimi wants to purchase a new motor scooter. The price of the scooter is \$7 499. She decides on the following finance option?

- Deposit of \$1 499.
- Simple Interest is charged on the balance at 11% p.a. over 3 years.

She will repay the loan with equal monthly instalments over the 3 years.

i) Calculate the amount of interest charged on the loan. **1**

ii) Calculate the total amount paid for the motor scooter. **1**

iii) Calculate the monthly repayment. **2**

d) The result of the 2008 General Mathematics Trial Examination were found to be normally distributed with a mean of 72% and a standard deviation of 8%.

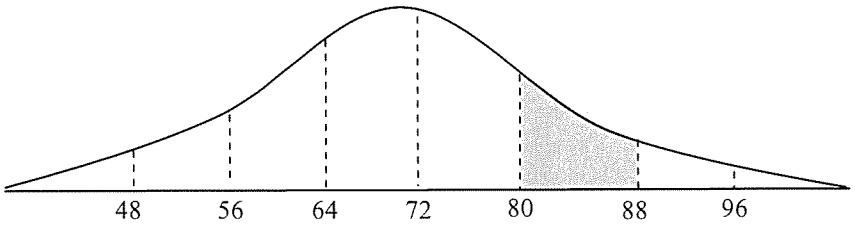


Diagram not to scale

i) Jenny has a raw score in the shaded region.
What could her z-score have been? **1**

ii) How many of the thirty thousand students who sat for this exam would be expected to have a raw score in the shaded region? **2**

End of Question 24

Question 25 (13 marks) Use a separate writing booklet. **Marks**

a) Border Security are testing out a new device to detect the presence of food items stored in overseas passengers' luggage as they pass through customs. The results are presented in this two way table.

	Test Results		
	Positive	**Negative**	**Total**
Passengers with food	192	8	200
Passengers without food	A	186	200
	206	194	400

i) What is the value of A? **1**

ii) How many passengers had an accurate reading? **1**

iii) What is the probability that, of the passengers tested, a person chosen at random will have food but test negatively? **2**

b) The maximum daily temperature in Broken Hill and Sydney was recorded in the first two weeks of August.
The results were:

BROKEN HILL										SYDNEY									
					9	8	7	6	0	9	9								
					3	3	1	0	1	0	2	3	4	4	6	6	6	7	8
8	8	6	5	3				2	2	0	2								
									3										

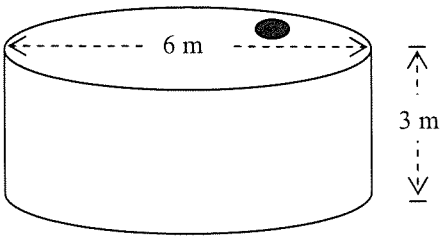
i) Find the median temperature of Broken Hill. **1**

ii) Calculate the range of the temperature in Sydney. **1**

iii) Compare and contrast the two data sets. Justify your answers with reference to measures of location and measures of spread. **2**

Question 25 continued **Marks**

c) The diagram of a closed metal water tank is shown below. The tank has a hole in the top to allow rainfall in. The area of this hole is 0.6 square metres.



i) Find the volume of the tank in cubic metres, to 1 decimal place. **1**

ii) If the average household uses 1 500 litres per week, how many weeks of water does the tank hold, assuming that there is no rain? (to 1 decimal place) **2**

iii) Find the area of metal used to construct the tank, to 1 decimal place. **2**

Question 26 (13 marks) Use a separate writing booklet. **Marks**

a) The students studying Swahili for Beginners through the Open High School had a vocabulary test.

The results are shown:

Score	Frequency
3	2
4	1
5	3
6	4
7	5
8	4
9	8
10	3

i) Calculate the mean and the sample standard deviation. Answers correct to 1 decimal place. **2**

ii) The following week the students had a second test and the sample standard deviation was 1.5. In which test did the students perform more consistently? Explain your answer. **2**

b) From a starting point A Roy rows 1500 m on a bearing of 068° to point B. He then turns and continues on a bearing of 145° for 2km to a point C. He then returns to his starting point A.

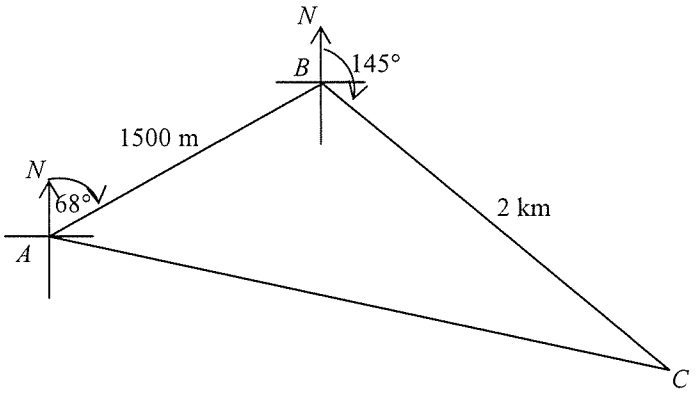


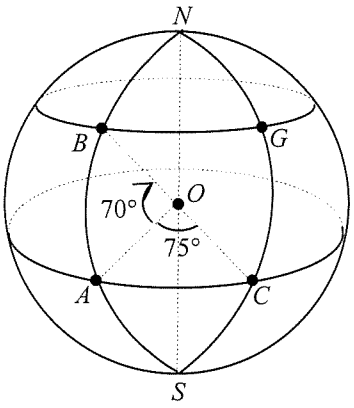
Diagram not to scale

i) Calculate the size of $\angle ABC$. **1**

ii) Calculate AC, the distance Roy rows back to his starting point. Answer to the nearest metre. **2**

Question 26 continued **Marks**

c) In the diagram of the Earth, O represents the centre and G represents Greenwich. The point A lies on the equator.



i) What are the coordinates of point B? **2**

ii) What is the time difference between Greenwich and Point B? (in hours) **1**

d) Solve: $\frac{x+1}{3} - \frac{2x-8}{5} = 1$ **3**

End of Question 26

Question 27 (13 marks) Use a separate writing booklet. **Marks**

a) Solve: $\frac{3x^2}{2} = 294$ **3**

b) A breakfast cereal company decides to make a 525g pack of their cereal. The factory produces packets with a mean weight of 527.5g and a standard deviation of 2.5g.

i) For quality control purposes they reject any box containing less than 525g. Under these conditions what percentage of packets produced will be rejected? **1**

ii) The company also decides to reject packets greater than 3 standard deviations above 525g. What is the maximum weight that will be accepted? **1**

iii) A packet is selected at random, what is the probability that it weighs greater than 535g? **2**

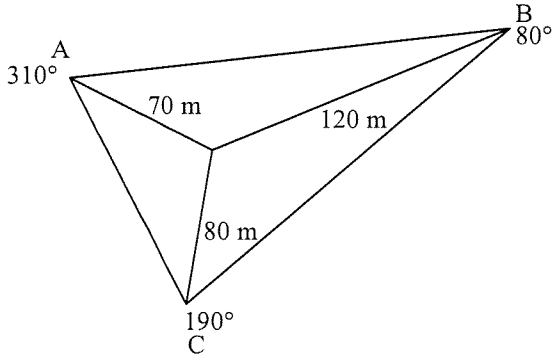
c) For their retirement Penny and John decide to go on a trip around the world. They leave Perth, Australia (32°S, 116°E) and travel to Beijing, China (40°N, 116°E).

i) Find the distance in nautical miles, between Beijing and Perth. **1**

ii) The flight takes 12 hours. What is the average speed in knots of the plane? **1**

iii) Philippa, Penny and John's daughter, is in Madrid, Spain (40°N, 4°W). Penny and John want to call Philippa for her birthday when it is 1pm local time in Madrid. What is the time in Beijing when they make the call? **2**

d) The figure below shows a radial compass survey of a field.



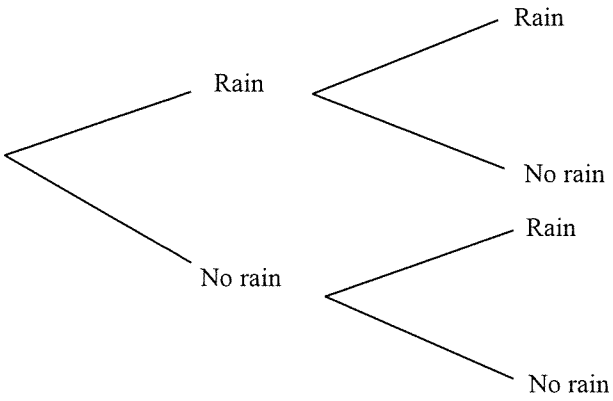
Find the length of AB correct to the nearest metre. **2**

End of Question 27

Question 28 (13 marks) Use a separate writing booklet. **Marks**

a) Dorothea is going away for the weekend and wanted to know if it was likely to rain. She checked the weather channel and it reported that there was a 30% chance of rain on Saturday and a 20% chance of rain on Sunday.

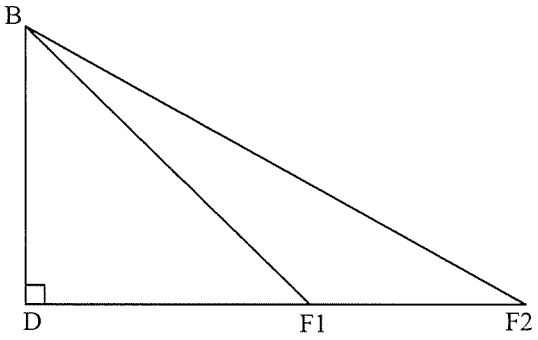
i) Copy the probability tree below into your answer booklet and complete. **1**



ii) Calculate the probability that Dorothea will have a rain free weekend. **1**

iii) Calculate the probability that Dorothea will have at least one day with rain. **2**

b) Bob the Builder is climbing the Sydney Harbour Bridge. When he is 72 metres above water level he notices two ferries **F1** and **F2** in line. From his position the angle of depression of **F1** is 23° while the angle of depression to **F2** is 12°.

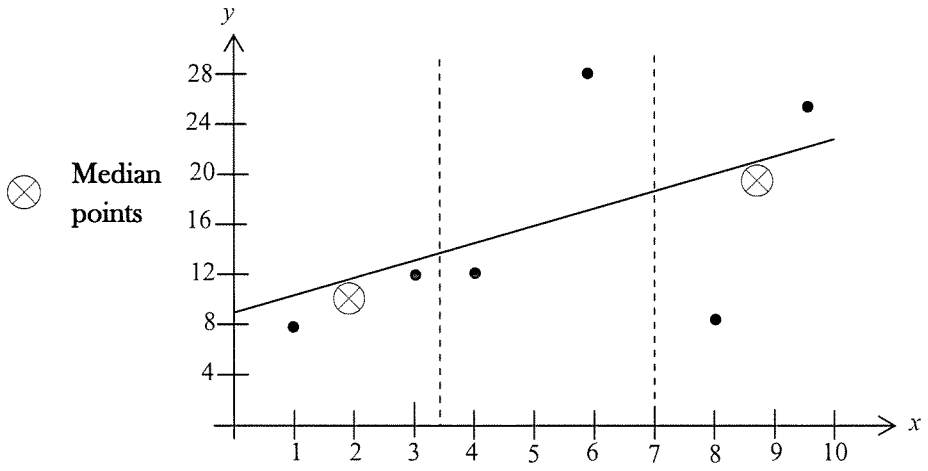


i) Copy the diagram into your booklet clearly showing all given information. **2**

ii) Find the distance between the ferries **F1** and **F2**, to the nearest metre. **3**

Question 28 continued **Marks**

c) Ethel was asked to plot a series of points and then draw a median regression line. Her correct solution is shown below?



i) Find the coordinate of the median point for the middle section. **2**

ii) An additional point is added to this graph at (5, 26). Describe the effect this point would have on the gradient and the y-intercept of the median regression line. **1**

d) There are eight girls in a basketball team. In how many ways can five players be chosen for the starting line-up? **1**

END OF EXAMINATION

General Mathematics 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

Simpson's rule for area approximation

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

h = distance between successive measurements

d_f = first measurement

d_m = middle measurement

d_l = last measurement

Surface area

Sphere $A = 4\pi r^2$
Closed cylinder $A = 2\pi rh + 2\pi r^2$

r = radius
h = perpendicular height

Volume

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

Cylinder $V = \pi r^2 h$

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

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

r = radius
h = perpendicular height
A = area of base

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

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

General Mathematics Formulae Sheet (continued)

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 assets 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

Mean of a sample

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

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

$\bar{x}$ = mean
x = individual score
n = number of scores
f = frequency

Formula for a *z*-score

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

s = standard deviation

Gradient of a straight line

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

Gradient-intercept form of a straight line

$y = mx + b$

m = gradient
b = y-intercept

Probability of an event

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

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

STUDENT NAME_____

THE HILLS GRAMMAR SCHOOL

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Section I - Multiple Choice Answer Sheet

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
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17				
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19				
20				
21				
22				

Yr 12 Trial 2010 General Maths
SOLUTIONS

1. D 2. D 3. B 4. A 5. C 6 C

7 B 8 B 9 D 10 A 11 A 12 B
13 D 14 B 15 B 16 C 17 C
18 C 19 D 20 A 21 C 22 A

Question 23

(a)(i) $\$7.34 \times 480 = \$3523.20$

(ii) $\$3523.20 \times 12 \times 30 - \$450000$
$= \$788\,352$

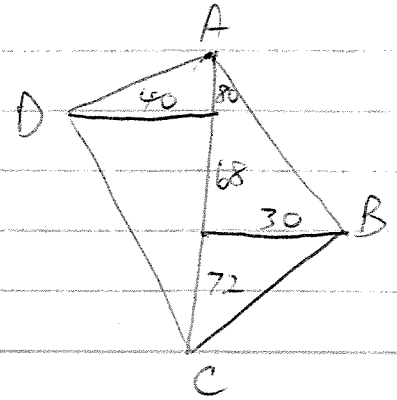
(iii) Increase

(iv) $\$8.05 \times 480 = \$3864$
$\$3864 \times 12 \times 30 = \$1391040$
Interest $= \$1391040 - \$450000$
$= \$911,040$

$\$911,040 - 788352 = \$122688$
∴ She will pay an extra $\$122688$ in interest ✓

(b) (i) $X = 220 - 80 = 140$
$Y = 72$

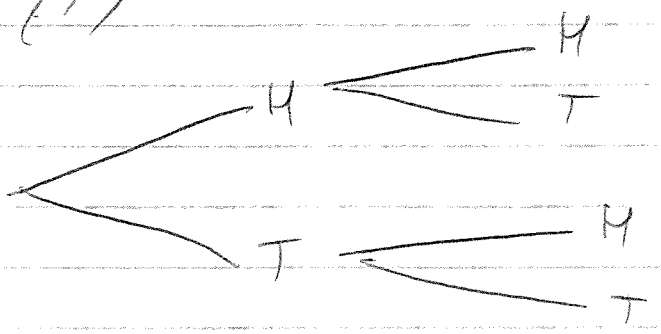
(ii)



(iii) $A = \frac{220 \times 40}{2} + \frac{220 \times 3}{2}$
$= 7700 m^2$

Question 24

(a) (i)



$\therefore P(2H) = \frac{1}{4} \quad P(H \& T) = \frac{1}{2}$

$P(2T) = \frac{1}{4}$

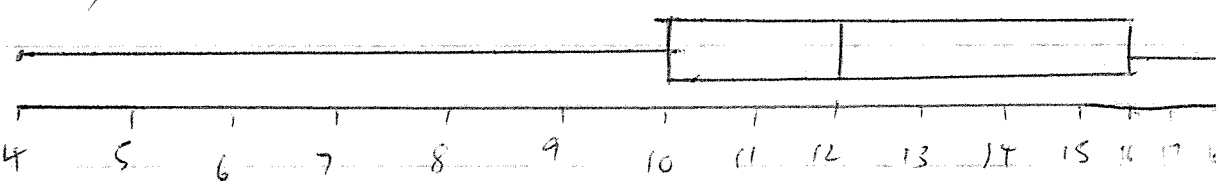
F_{IN} return $= \$6 \times \frac{1}{4} + \$2 \times \frac{1}{2} - \$8 \times \frac{1}{4}$.

$= \$1.50 + \$1 - \$2$

$= 0.50$ ¢

(ii) The game is not fair as on average she expects to lose 50¢!

(b) (i)



(ii) 25%.

(c) (i.) $P = 7499 - 1499 = \$6000$

$I = 6000 \times 0.11 \times 3$

$I = \$1980$

(ii) $\$7499 + \$1980 = \$9479.$

(iii) $6000 + $1980 = $7980 ÷ 36

= $221.67

(e) (i) Between 1 and 2

(ii) 13.5% × 30000

= 4050 people.

Question 25

(a) (i) A = 200 − 186 = 14

(ii) 192 + 186 = 378

(iii) $\frac{8}{400}$ or $\frac{1}{50}$

(b) (i) 23

(ii) 22 − 9 = 13

(iii) Median temp in B Hills is higher than Syd. Range of temp in Syd is higher than in BH.

(c) (i) $V = \pi r^2 h$

$= \pi \times 3^2 \times 3$

$= 84.8\ m^3$

(ii) $1m^3 = 1000L$

$84.82m^3 = 84.82 \times 1000 = 84820L$

No. of weeks = 84820 ÷ 1500

= 56.6 weeks.

(iii) $SA = 2\pi r^2 + 2\pi rh - 0.6$

$= 2 \times \pi \times 3^2 + 2 \times \pi \times 3 \times 5 - 0.6$

$= 112.5 m^2$

Question 26

(a) (i) $\bar{x} = 7.3$

$\sigma_x = 2$

(ii) Second test since a smaller s.d indicates less spread

(b) (i) $68° + 35° = 103°$

(ii) $c^2 = 1500^2 + 2000^2 - 2 \times 1500 \times 2000 \times \cos 103$

$c = 2757 m$

(c) (i) $(70°N, 75°W)$

(ii) $4 \times 75 = 300 min$

$= 5 hr.$

(d) $\frac{x+1}{3}^{\times 15} - \frac{2x-8}{5}^{\times 15} = 1^{\times 15}$

$5(x+1) - 3(2x-8) = 15$

$5x + 5 - 6x + 24 = 15$

$-x + 29 = 15$

$-x = -14$

$x = 14.$

Question 27

(a) $\frac{3x^2}{2} = 294$

$3x^2 = 588$

$x^2 = 196$

$x = \sqrt{196}$

$x = \pm 14$

(b) (i) % reject = 16%

(ii) 532.5g

(iii) $\frac{7.5g}{2.5} = 3$

$\therefore$ Prob = 0.15%

(c) (i) Angular distance = 72°

Distance = $72 \times 60 = 4320M$

(ii) $S = \frac{4320}{12} = 360$ knots

(iii) Time diff = $120 \times 4 = 480$ min = 8hr.

1pm Madrid = 1 + 8h

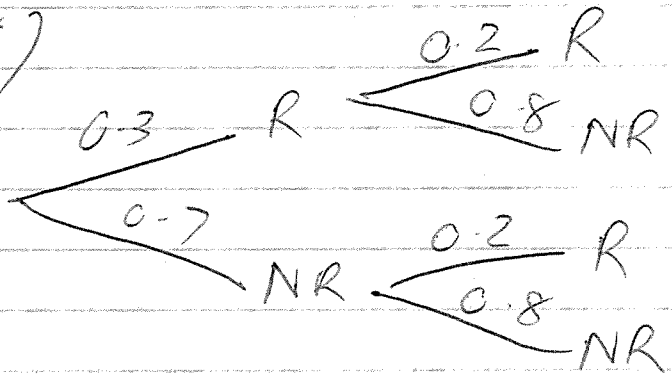
= 9pm Beijing.

(d) $AB^2 = 70^2 + 120^2 - 2 \times 70 \times 120 \cos 130$

$AB = 173m$

Question 28

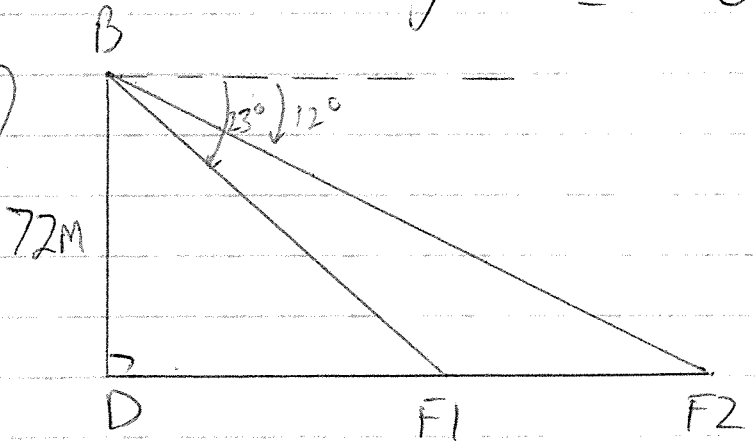
(a) (i)



(ii) $P(nR) = 0.7 \times 0.8 = 0.56$

(iii) $P(\text{at least 1 day rain}) = 1 - 0.56$
$= 0.44$

(b). (i)



(ii) $\tan\theta = \frac{o}{a}$ $\quad \tan 78 = \frac{y}{72}$

$\tan 67 = \frac{x}{72}$ $\quad y = 338.73m$

$x = 169.62m$

Distance $= 338.73 - 169.62 = 169m$

(c) (i) (4, 12) (6, 28)

Median point = $\left(\frac{4+6}{2}, \frac{12+28}{2}\right)$

$= (5, 20)$

(ii) gradient is the same but y-intercept increased

(d) ${}^{8}C_{5} = 56$.