

Student number:



Ascham School

General Mathematics Trial HSC Examination July 2010

General Instructions

- Reading time – 5 minutes.
- Working time – 2 ½ hours.
- Write using blue or black pen.
- Calculators may be used.
- A Formulae sheet is provided with this paper.

Total marks - 100

Section I

22 Marks

- Attempt Questions 1-22
- Allow about 30 minutes for this section.
- Give your answers on the multiple choice answer sheet.

Section II

78 Marks

- Attempt Questions 23 - 28
- Allow about 2 hours for this section.
- Use a separate writing booklet for each question.

SECTION I**22 Marks****Attempt Question 1 – 22****Allow about 30 minutes for this section.**

Use the multiple-choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

 A ☐ B ☒ C ☐ D ☐

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

 A ☒ B ☒ C ☐ D ☐

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:

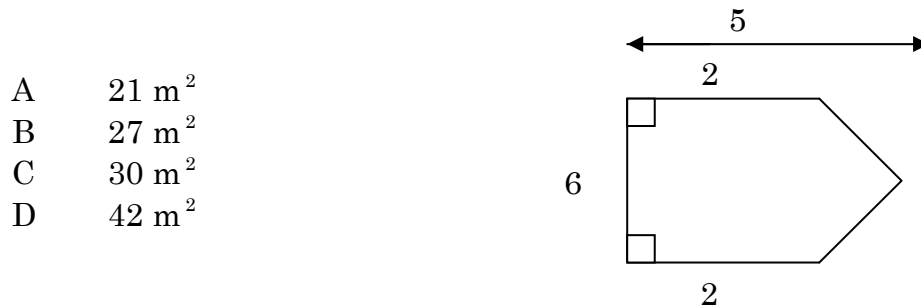
 A ☒ B ☒ C ☐ D ☐

Section 1: Multiple Choice (22 Marks)

- 1 Simplify: $3(x + 3) - (x - 1)$
- A $2x + 8$
- B $4x + 10$
- C $2x + 10$
- D $4x + 10$
- 2 How many ways can a captain and vice captain be chosen if there are 6 candidates:
- A 36
- B 30
- C 15
- D 11
- 3 A bank charges 21.26% p.a. interest on outstanding amounts on credit cards. Alex has an outstanding amount of \$127.50 on her credit card for 22 days. How much interest is she charged?
- A \$1.23
- B \$1.63
- C \$7.43
- D \$27.11

- 4 Use the formula $A = \sqrt{\frac{s^2(s-a)}{bc}}$ to find the value of A, correct to 2 decimal places, when $s = 7$, $a = 4$, $b = 5$ and $c = 6$.
- A 13.28
B 15
C 4.88
D 2.21

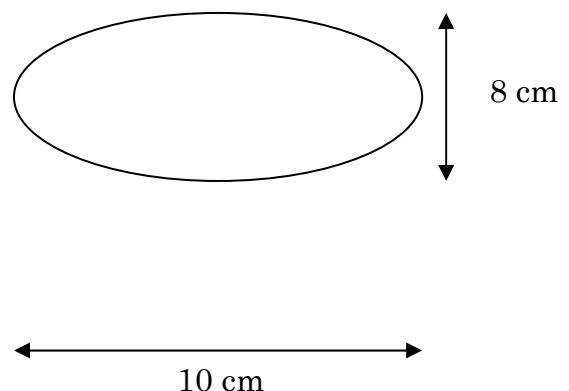
- 5 The dimensions of this figure are in metres. What is its area?



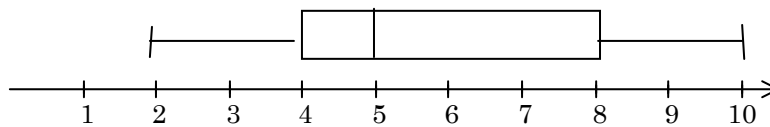
- 6 Two points on the surface of the Earth are M(45° N, 45° W) and N(30° S, 60° E). Which of the following statements about the time difference between M and N is true?
- A M is 5 hours behind N
B M is 5 hours ahead of N
C M is 7 hours behind N
D M is 7 hours ahead N
- 7 A biased die is tossed 70 times and gives 10 sixes. Based on this result, approximately how many sixes would you expect if the same die was tossed 200 times?
- A 70
B 29
C 60
D 140

- 8 The area of the ellipse drawn below is given by

- A $10 \times 8 \times \pi \text{ cm}^2$
B $5 \times 4^2 \times \pi \text{ cm}^2$
C $10 \times 4^2 \times \pi \text{ cm}^2$
D $5 \times 4 \times \pi \text{ cm}^2$



- 9 You are given the following box plot.



Which of the following statements is incorrect?

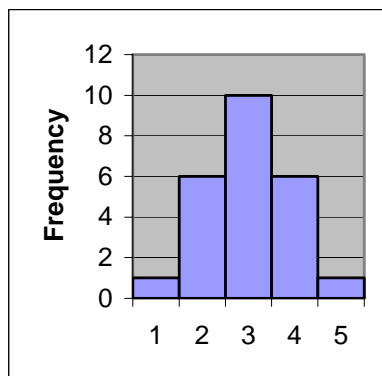
- A The median is 5
 B the IQR is 8
 C About 50 % of the data is less than 5.
 D the data set is positively skewed.
- 10 The two way table below shows the results of a trial on new metal detectors at the airport. The metal detector scans a piece of luggage and lights up if metal is found.

	Test Results		Total
	Accurate	Not Accurate	
With metal	9	1	10
Without metal	87	3	90
Total	96	4	

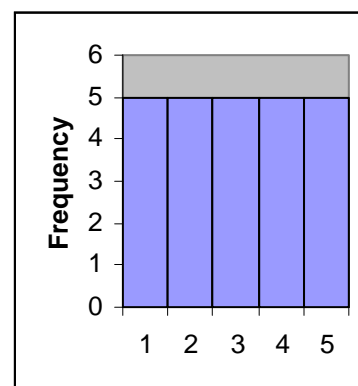
Based on the above results, the probability of metal going undetected in a piece of hand luggage is:

- A 10%
 B 25%
 C 75%
 D 90%
- 11 Which of the distributions below has the largest standard deviation?

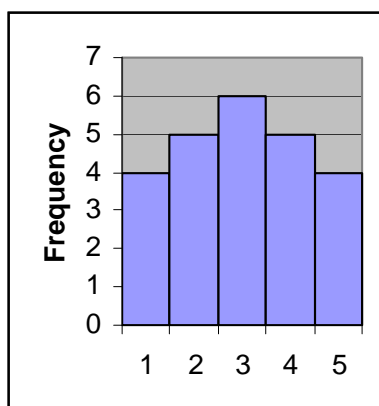
A



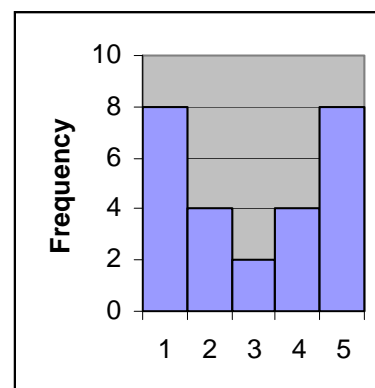
B



C



D

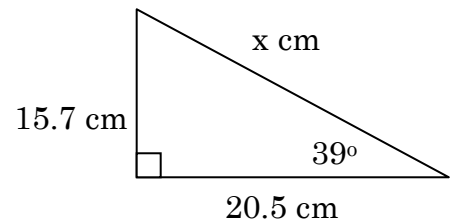


- 12 The circumference of children's heads are measured and recorded. Which of the following best describes this data?

A Discrete
B Stratified
C Categorical
D Continuous

- 13 Find the value of x correct to 2 significant figures

A 10
B 26
C 20
D 12



- 14 Make h the subject of the formula $S = 2x^2 + 4xh$.

A $h = \frac{S + 2x^2}{4x}$
B $h = \frac{S - x}{2}$
C $h = \frac{S + x}{2}$
D $h = \frac{S - 2x^2}{4x}$

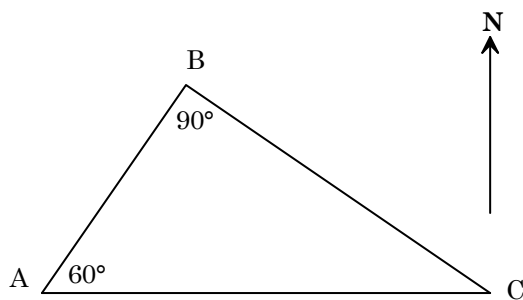
- 15 Perth is approximately (31° S, 115° E) while Hong Kong is approximately (22° N, 115° E). The distance between Perth and Hong Kong is approximately

A 9 M
B 53 M
C 540 M
D 3180 M

- 16 John buys 3 tickets in a raffle which has 200 tickets. There are two prizes to be won. The probability of him winning both prizes is

A $\frac{3}{200} \times \frac{1}{199}$
B $\frac{2}{200} + \frac{1}{199}$
C $\frac{3}{200} \times \frac{2}{199}$
D $\frac{3}{100} + \frac{3}{199}$

- 17 A school buys a colour printer for \$7600 plus \$400 for delivery and installation. Depreciation on the printer is claimed using the straight line method. If the useful life of the printer is 5 years with salvage value of \$1000 what is the yearly tax deduction claimed for the printer?
- A \$1500
B \$1400
C \$1580
D \$7500
- 18 The lift at Centerpoint Tower travels 298 metres in 42 seconds. Its average speed to the nearest kilometre per hour is
- A 2 km/h
B 7 km/h
C 26 km/h
D 118 km/h
- 19 Three towns, A, B and C are situated as shown in the diagram. C is due east of A.



- The bearing of C from B is
- A 030°
B 120°
C 150°
D 300°
- 20 In triangle ABC, if $a = 8$, $\angle A = 70^\circ$ and $b = 6$, then $\angle B$ is
- A 11°
B 20°
C 23°
D 45°
- 21 A speed of 70 knots is closest to a speed of
- A 37.8 km/h
B 4200 km/h
C 129.6 km/h
D 70 km/h

- 22 Sarah borrows \$9300 at 6.45% p.a. compounded monthly. The loan is repaid in 36 equal monthly payments. The amount of the monthly payment is closest to
- A \$284.82
 - B \$313.32
 - C \$499.88
 - D \$599.85

Section II Questions 23 – 28 : 6 questions: 13 Marks each (Total 78 Marks)**Question 23 (13 Marks)**

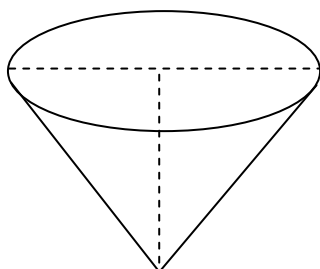
- a) Solve the equation

$$x - 3 = \frac{3x}{2} + 5$$

2

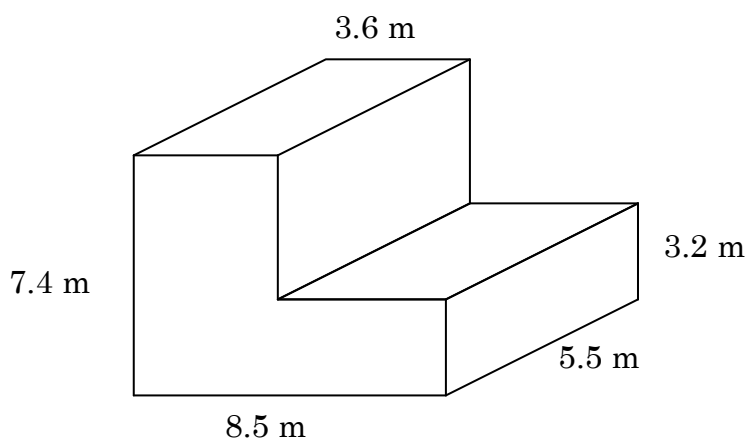
- b) Calculate to 3 significant figures the slant height,
- s
- , of a cone with diameter 1.3m and a perpendicular height of 250 cm.

2



- c) Find the volume of this solid, to 1 decimal places.

2



- d) A box contains 5 cards numbered 1 to 5. Harold draws two cards in succession without replacement. This is shown in the table below.

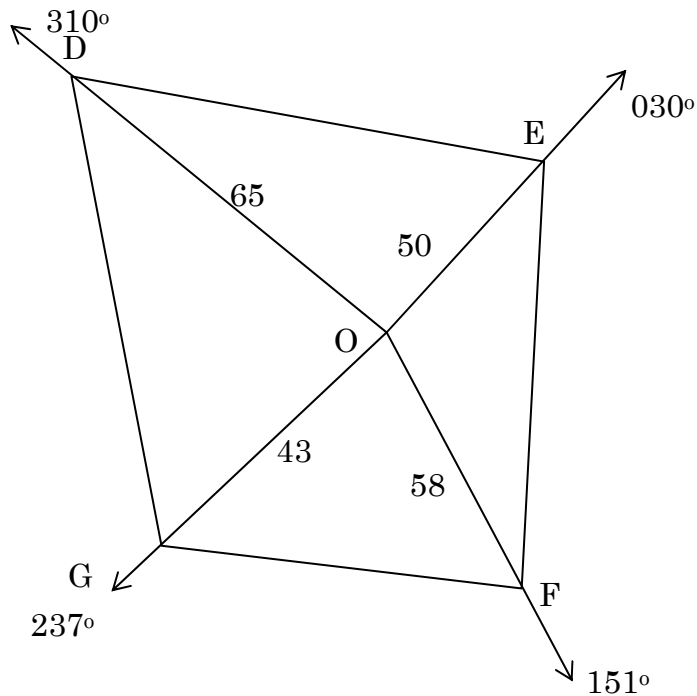
Cards	1	2	3	4	5
1		♦	♦	♦	♦
2	♦		♦	♦	♦
3	♦	♦		♦	♦
4	♦	♦	♦		♦
5	♦	♦	♦	♦	

- i) How many selections are possible ? **1**
- ii) What is the probability that Harold will draw two even cards? **1**
- iii) If the box contained 10 cards numbered from 1 to 10, how many selections would be possible? **1**
- iv) if there were n cards in the box, how many selections would be possible? **2**
- e) i) An teacher buys a computer for \$2440 and depreciates it using the declining balance method at a rate of 30% per annum. How much is the depreciation in the first year? **1**
- ii) What is the tax deduction the teacher can claim in the second year? **1**

Question 24 (13 Marks)

- a) The price of a dress after it was discounted by 10% was \$198. What was the original price, before the discount? 2

- b) The radial survey of a farm is drawn below (all distances are in metres)

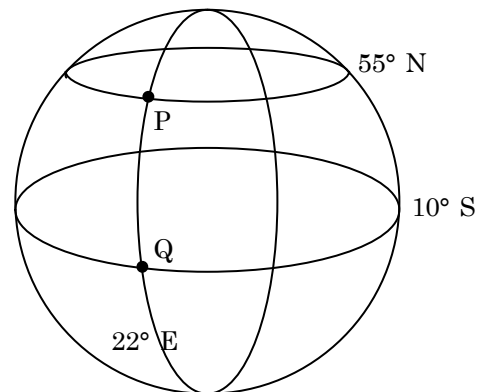


- i) What is the size of angle EOF? 1
- ii) Calculate the area of the section of the farm labelled EOF correct to one decimal place. 2
- iii) Calculate the length of EF correct to one decimal place. 2
- c) In a horse race there are 12 runners. A trifecta is defined as picking the first 3 horses in the correct order.
- i) How many different trifectas are possible? 2
- ii) If you picked three horses in order to finish 1st, 2nd and 3rd what is the probability that you are correct? 2
- d) How many different 7 digit phone numbers are possible if they must start with the digit 9 and cannot end with a 0? 2

Question 25 (13 Marks)

- a) The diagram represents the Earth with two Points, P and Q on the surface of the Earth.

- i) What great circle runs through the points P and Q? **1**
- ii) Calculate the angular distance between P and Q, and hence find the shortest distance between P and Q in nautical miles, given that 1 degree of latitude equals 60 M. **2**
- iii) Now calculate the shortest distance between P and Q to the nearest kilometre using $r = 6400$ km. **2**



- b) A ball is projected from the ground vertically into the air. Its path is given by the equation $h = 2t - t^2$ where h is the height and t is the time. Find the maximum height reached by the ball. **2**
- c) Mary has 500 BHP shares, each with a current market value of \$40.80. In June BHP pays Mary a share dividend of \$2.80. Find:
 - i) How much she receives in total dividends **1**
 - ii) The dividend yield correct to 4 significant figures **2**
- d) If a square block of land is measured as being 86m in length to the nearest metre, find:
 - i) The percentage error in the length correct to 2 decimal places **1**
 - ii) The smallest possible area of the block **2**

Question 26 (13 Marks)

- a) Given that $K = \frac{x+y}{2}$, find K if $x = 3.1 \times 10^{-12}$ and $y = 4.5 \times 10^{18}$.

Give your answer in scientific notation correct to 2 significant figures.

1

- b) Katherine selected 30 students at random from Year 12 and asked each of them how many sibling they had. The results are shown in the table below.

Number of siblings	Frequency
0	6
1	11
2	7
3	3
4	3

- i) Calculate the mean number of siblings **1**
 ii) Calculate the sample standard deviation **1**
 iii) Calculate the median number of siblings **1**
 iv) Describe the skewness of the data **1**
 v) If there are 120 students in Katherine's Year 12, using the data from the table estimate how many students would have three siblings or more. **1**

- c) Ashley deposits \$100 into an account each year. Her investment is compounded at 8% p.a. The spreadsheet below represents her annuity for the first 5 years.

	A	B	C	D	E	
1	Annuity Table					
2	Annual Payment		\$100			
3	Interest rate		8%			
4						
5	Year	Payment (\$)	Amount at start of year (\$)	Interest (\$)	Amount at end of Year (\$)	
6	1	\$ 100.00	\$ 100.00	\$ 8.00	\$ 108.00	
7	2	\$ 100.00	\$ 208.00	\$ 16.64	\$ 224.64	
8	3	\$ 100.00	\$ 324.64		\$ 350.61	
9	4	\$ 100.00			\$ 486.66	
10	5	\$ 100.00	\$ 586.66	\$ 46.93	\$ 633.59	
11						

- i) Find the missing values for D8, C9 and D9 **3**
 ii) What would be the amount at the end of 5 years if Ashley's annual payment had been \$250? **2**
 iii) Charly wishes to have the same amount of money as Ashley after 5 years, but she wants to invest a single lump sum. What single lump sum does Charly need to invest for 5 years at 8% p.a. if she wishes to have it grow to \$633.59? **2**

Question 27 (13 Marks)

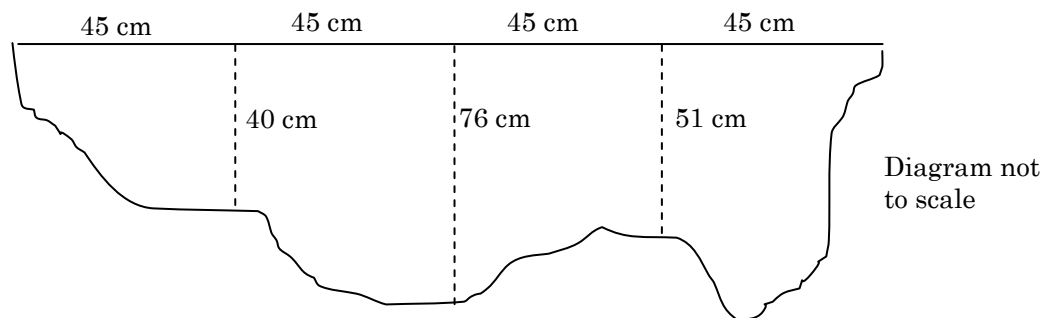
- a) A test has been developed to detect whether an individual carries the swine flu virus. Four hundred people were tested and the results were recorded in a two-way table.

	Positive	Negative
Carrier	148	24
Non Carrier	32	A

- i) What is the value of A ? 1
- ii) A person selected from the group is a carrier of the virus. What is the probability that the test results show this? 2
- iii) For how many of the people tested were the results inaccurate? 1
- b) Georgie has an 60% chance of winning each game of tennis that she plays in a particular competition. She is to play 3 matches.
- i) Draw a tree diagram indicating relevant probabilities and the sample space. 2
- ii) What is the probability that she wins at least one match? 2
- c) India and Bob want to take out a home loan to buy a unit. They have saved \$45000 as a deposit and they can only afford to pay back \$3600 per month. If the bank interest rate is 6.8% per annum over 25 years what is the most expensive unit that India and Bob can afford to buy? 3
- d) It is known that the density D of a certain material varies inversely as the square root of its mass M . If a mass of 7 kg of this material has a density of 1.8, find the material's density (correct to 1 decimal place) when its mass is 14kg. 2

Question 28 (13 Marks)

- a) The diagram shows a vertical cross-section of a garden bed.



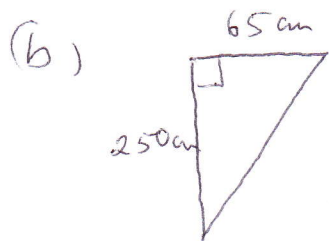
- i) By using Simpson's rule twice, find an approximation for the area of the cross-section of the garden bed. 2
- ii) The garden bed is to be 6.5 metres long. If the garden bed has approximately the same cross-section throughout estimate the volume of soil needed to fill the garden bed to the nearest cubic metre. 2
- b) Kristina who lives in Los Angeles (GMT -8) wanted to watch the football world cup final in South Africa which was being played in Johannesburg (GMT + 2). The final started at 2 pm Sunday Johannesburg local time. When would Kristina need to be watching so that she would not miss the start of the world cup final. 2
- c)
- i) The population of Australia is 22 million in 2010 and the growth rate of Australia's population is predicted to be 1.9% per annum. If P represents the predicted number of people in Australia at time t years after 2010, write a formula relating t and P in the form $P = b(a^t)$ 2
- ii) Using the formula or otherwise estimate the population of Australia in 2040. 2
- d) The state government builds a new tunnel. During the first three months no toll is charged and on average 10400 vehicles use the tunnel each day. Every month the government increased the toll by one dollar. It found that for each dollar increase on average 800 fewer cars used the tunnel.
- i) Find the lowest toll for which no vehicles will use the tunnel 1
- ii) If d (dollars) represents the value of the toll, find an equation for the number of vehicles V using the tunnel each day in terms of d . 2

END OF EXAM

- ① ~~A~~ C
 ② B
 ③ B
 ④ D
 ⑤ A
 ⑥ C
 ⑦ B
 ⑧ D
 ⑨ B
 ⑩ A
 ⑪ D
- ⑫ D
 ⑬ B
 ⑭ D
 ⑮ D
 ⑯ C
 ⑰ B
 ⑱ C
 ⑲ B
 ⑳ D
 ㉑ C
 ㉒ ~~B~~ A

Q 23 :

a) $x - 3 = \frac{3x}{2} + 5$
 $2x - 6 = 3x + 10$
 $x = -16$



$$s^2 = 250^2 + 65^2$$

$$s^2 = 66725$$

$$s = 258.311 \dots$$

$$s \approx 258 \text{ (3 s.f.)}$$

(c) $A = (8.5 \times 7.4) - (4.9 \times 4.2)$
 $= 42.32$

$$V = A \times h$$

$$= 42.32 \times 5.5$$

$$V = 232.76 \text{ m}^3$$

8 (1 dec. pl.)

(d) (i) 20
 (ii) $P(24, 42) = \frac{2}{20}$
 $= \frac{1}{10}$

(iii) $10 \times 90 = 90$

(iv) $n(n-1) = n^2 - n$

Q1 (i) Depreciation = $2440 \times 30\%$
 $= \$732$

(ii) Tax Deduction
 $= 30\% \times (2440 - 732)$
 $= \$512.40$

QUESTION 24

a) Original Price = $\frac{198 \times 10}{9}$
 $= 220$

(b) i) $\angle EOF = 151 - 30$
 $= 121^\circ$

ii) Area = $\frac{1}{2} \times 50 \times 50 \times \sin(121)$
 $= 1242.892 \dots$
 $= 1242.9 \text{ m}^2$

(iii) $EF^2 = 50^2 + 50^2 - 2 \times 50 \times 50 \cos(121)$
 $EF^2 = 8851.22 \dots$
 $EF = 94.0809 \dots$
 $EF = \underline{94.1 \text{ m}}$

(c) i) Possible triangles
 $= 12 \times 11 \times 10$
 $= 1320$

(ii) $P(\text{correct}) = \frac{1}{1320}$

(c) $\frac{1 \times 10 \times 10 \times 10 \times 10 \times 10 \times 9}{1}$
 $= 9 \times 10^5$

QUESTION 25

a) i) ~~22~~ 22° E longitude

ii) Ang. Dist = $55 + 10$
 $= 65^\circ$

Dist = 65×60
 $= 3900 \text{ M}$

(iii) Distance = $\frac{65}{360} \times 2 \times \pi \times 6400$
 $= 7260.56$
 $= 7261 \text{ km}$

b) $h = 2t - t^2$
 ~~$h = 2t - t^2$~~
 $axis = \frac{-2}{-2}$
 $= 1$

$\therefore h = 2 \times 1 - 1^2$
 $= 1$

\therefore max height is 1 m.

c) (i) total div = 2.80×500
 $= \$1400$

(ii) Div Yield = $\frac{2.80}{40.80} \times 100\%$
 $= 6.8627\%$
 $= 6.8\%$
 6.863% (4 sig figs)

d) (i) Abs. error = 0.5 m
 $\% \text{ error} = \frac{0.5}{86} \times 100\%$
 $= 0.581395\%$
 $\approx 0.5814\% (4 \text{ s.f.})$
 0.58% 2 decpl.

(ii) Smallest = 85.5×85.5
 $= 7310.25 \text{ m}^2$

Q 26:

a) $K = \frac{3.1 \times 10^{-12} + 4.5 \times 10^{-18}}{2}$

$K = 13950$

$K = 1.4 \times 10^4$

(b) i) $\bar{x} = 1.53$

ii) $\sigma_{n-1} = 1.22$

iii) median = 1

(iv) skewness = +ve

(v) $\frac{3+3}{30} \times 120 = 24$

c) i) $118 = 25.97$ $89 = \$450.61$ $D9 = \$36.05$

ii) $2.5 \times 633.59 = \$1583.98$

(iii) $633.59 = P(1+0.04)^5$

$$P = \frac{633.59}{(1.04)^5}$$

$P = \$431.21$

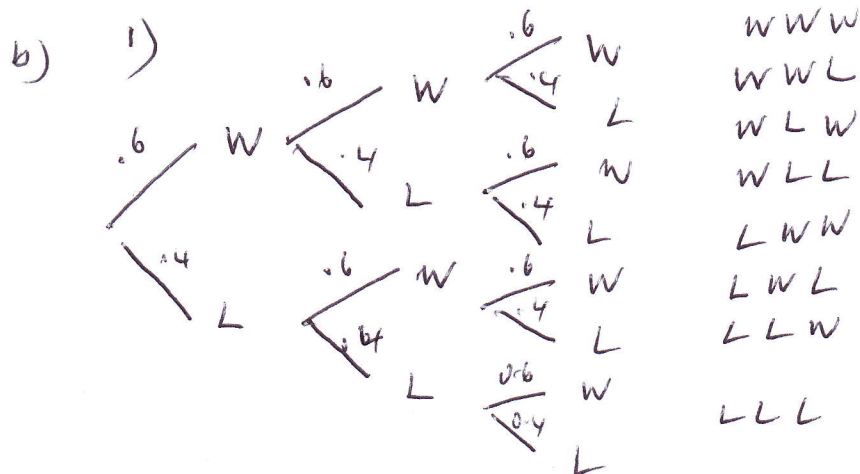
\therefore needs to invest
\$431.21

QUESTION 27:

a) i) $A = 400 - (148 + 32 + 24)$
 $= 196$

ii) $P(\text{show carrier}) = \frac{148}{172}$

(iii) Inaccurate $= 32 + 24$
 $= 56$



(ii) $P(\text{at least one})$
 $= 1 - P(\text{none})$
 $= 1 - P(LL L)$
 $= 1 - (0.4)^3$
 $= 0.936 \text{ or } 93.6\%$

c) $N = 3600 \left\{ \frac{(1.005666)^{300} - 1}{0.005666 (1.056666)^{300}} \right\}$

$= 518678.10$

they can afford

d) $D = \frac{k}{\sqrt{m}}$
 $1.8 = \frac{k}{\sqrt{7}}$
 $\therefore k = 1.8\sqrt{7}$
 $D = \frac{1.8\sqrt{7}}{\sqrt{m}}$
 $= 518678.10 + 45000$
 $= \$563678.10$
 $D = \frac{1.8\sqrt{7}}{\sqrt{14}} = 1.2727$
 $= 1.3(1dp)$

QUESTION 2P

$$a) i) \text{Area} = \frac{45}{3} [0 + 4 \times 40 + 76] + \frac{45}{3} [76 + 4 \times 51 + 0] \\ = 7740 \text{ cm}^2$$

$$ii) V_0/V_{\text{max}} = A \times h$$

$$= 7740 \text{ cm}^2 \times 650 \text{ cm}$$

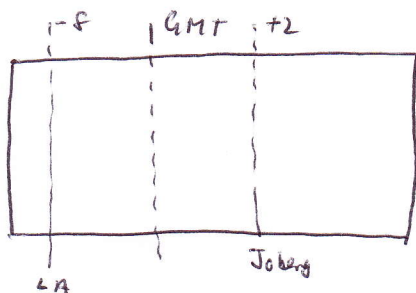
$$= 5031000 \text{ cm}^3$$

$$= 5.31 \text{ m}^3$$

$$\approx 5 \text{ m}^3$$

$$\dots 1 \text{ m}^3 = 100 \times 100 \times 100$$

(b)



\therefore Joburg is 10 hours ahead

$$\therefore 2 \text{ pm in Joburg} = 2 \text{ pm} - 10 \text{ h} \\ = 4 \text{ a.m.}$$

\therefore 4 am in LA

$$(c) i) P = b(a^t) \\ P = 22000000(1.019)^t$$

$$(ii) P = 22000000(1.019)^{30} \\ \approx 38694408 \text{ (nearest whole)}$$

$$(d) i) \frac{10400}{800} = \$13$$

$$ii) V = 10400 - \$000$$

\therefore \$13 toll