Student's name

Student's number

Teacher's name

PLC PRESBYTERIAN LADIES' COLLEGE **SYDNEY**

—————— 1888

2012

TRIAL
HIGHER SCHOOL CERTIFICATE
EXAMINATION

General Mathematics

General Instructions
- Reading time: 5 minutes
- Working time: $2\frac{1}{2}$ hours
- Write using blue or black pen
- Calculators may be used
- A formula sheet is provided at the back of this paper

Total Marks – 100

Section I: Pages 2-8
25 marks
- Attempt questions 1-25, using the answer sheet on page 19.
- Allow about 30 minutes for this section

Section II: Pages 9-16
75 marks
- Attempt questions 26-30, using all 5 writing booklets provided.
- Allow about 2 hours for this section

Multiple Choice	26	27	28	29	30	Total
						%

## Section I

25 marks

Attempt Questions 1-25

Allow about 30 minutes for this section

1.   Mrs Barnett decides to survey the Year 12 girls about the method used for selecting prefects. She used an alphabetical list to choose every 5th girl on the list. This is an example of:
   - (A) Census
   - (B) Representative sampling
   - (C) Systematic sampling
   - (D) Stratified random sampling

2.   Simplify $(2x-3y)-(3x-5y)$
   - (A) $x-5y$
   - (B) $2y-x$
   - (C) $-x-2y$
   - (D) $-x-8y$

3.   What is the median of this set of scores?

Score	Frequency
1	8
2	5
3	5
4	3
5	3
	$\sum f = 24$

   - (A) 1
   - (B) 2
   - (C) 2.5
   - (D) 3

4.   It takes 20 seconds to fill a 10 litre bucket with water. What is the rate of flow of the water in litres/hour?
   - (A) 30
   - (B) 180
   - (C) 200
   - (D) 1800

5. Three towns, *Wilkie*, *Harper* and *Kinross* are situated as shown in the diagram. *Wilkie* is due east of *Harper*.
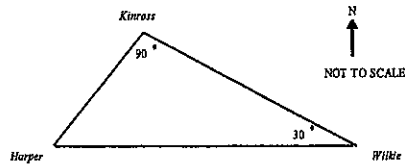
What is the bearing of *Wilkie* from *Kinross*?

(A) 030°
(B) 120°
(C) 150°
(D) 300°

6. Amy has a packet which contains 50 gummi bears: 25 orange, 20 yellow and 5 green. She eats all the green gummi bears and offers the packet to Grant to choose a gummi bear at random.
What is the probability that Grant chooses an orange gummi bear?

(A) $\dfrac{2}{5}$

(B) $\dfrac{1}{2}$

(C) $\dfrac{4}{9}$

(D) $\dfrac{5}{9}$

7. What is the interquartile range?
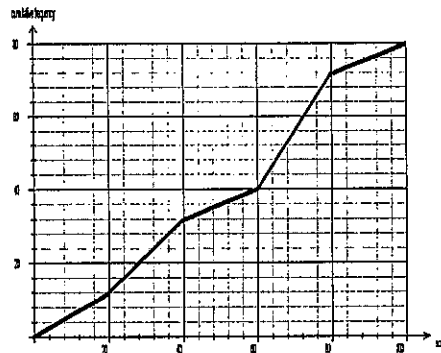
(A) 40
(B) 41
(C) 44
(D) 50

8. Mary has sat for ten tests this term and has an average score of 68. What mark must she gain in the next test to raise her average to 70?
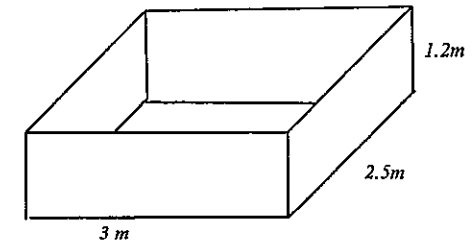
(A) 72
(B) 78
(C) 88
(D) 90

9. A survey was conducted at PLC of girls in Year 12. Each girl was asked to indicate how many children in their family.
What is the total number of children in the families of the Year 12 girls?

Number of Children	Frequency
1	23
2	39
3	43
4	19
5	6

(A) 5
(B) 15
(C) 130
(D) 336

10. The diagram shows a tank.

There is water in the tank to a depth of 8 *cm*. The amount of water in the tank is

(A) 9 L
(B) 600 L
(C) 6000 L
(D) 9000 L

11. Georgie sold her graphics calculator for $180 which was $60 less than she originally paid. What was her loss as a percentage of the cost price?

(A) 25%

(B) $33\dfrac{1}{3}\%$

(C) 50%

(D) 60%

12. A Service is to be held at Gallipoli on Anzac Day at 11am on Thursday April 25 2013. Gallipoli is located at $(40°N, 27°E)$. If Sydney is located at $(34°S, 151°E)$, what is the local time in Sydney at that time?

(A) 2:44 am on Thursday
(B) 5:56 am on Thursday
(C) 3:56 am on Thursday
(D) 7:16 pm on Thursday

13. A sum of $10 000 is invested at 4.4% per annum, compounded quarterly. How much is the investment worth at the end of 5 years (to the nearest dollar)?

(A) $12 402
(B) $12 446
(C) $12 456
(D) $16 851

14. In 10 years time I wish to have $50 000 to pay for Chris's university course. If the interest rate is 6% per annum, compounded monthly, what is the present value of this annuity to the nearest dollar?

(A) $46
(B) $27 482
(C) $27 920
(D) $47 567

15. The number of chairs on a stage varies inversely with the distance between them. When they are $15\,m$ apart the stage can accomodate 48 chairs. How many chairs can be placed on the stage if the distance between the chairs is $16\,m$?

(A) 3
(B) 45
(C) 49
(D) 51

**16.** Use Simpson's Rule to calculate the area of the figure below
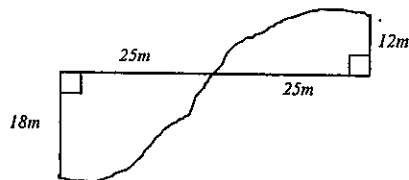
(A) $50m^2$
(B) $125m^2$
(C) $250m^2$
(D) $1083.33m^2$

17. If $R = 2 + \sqrt{\dfrac{T}{g}}$, what would T equal?

(A) $T = g(R^2 - 4)$
(B) $T = g(R - 2)^2$
(C) $T = gR^2 - 4$
(D) $T = 4(R^2 - g)$

18. Suppose the ant population of the world is 2.5×10^{10} and that these ants can be packed into a cubic box with no space wasted. If the average volume of an ant is $5mm^3$, how long would the edge of the box have to be?

(A) $5cm$
(B) $25cm$
(C) $5m$
(D) $36m$

19. The angle of elevation of the top of a tree from a point P on the ground is $30°$. The point P is $28\,m$ from the base of the tree.
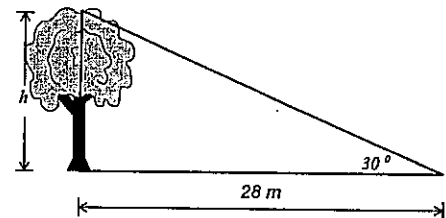
The correct expression for h, the height of the tree is

(A) $h = 28 \tan 30°$
(B) $h = \dfrac{\tan 30°}{28}$
(C) $h = \dfrac{\tan 28}{30°}$
(D) $h = 30° \tan 28$

20. There are 5 cards labelled 1,2,3,4,5. One card is selected at random from the deck and the result is recorded as odd or even. This experiment is repeated 200 times. Which of the following is the *most likely* final outcome of the experiment?

(A) 115 odd and 85 even
(B) 105 odd and 75 even
(C) 100 odd and 100 even
(D) 75 odd and 105 even

21. At what interest rate does an annuity of $500 per month for 4 months need to be invested to have a future value of $2 220? Use the table of *Future Values of $1* below.

Future Value of $1					
Interest Rates					
Period	4%	5%	6%	7%	8%
1	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0400	2.0500	2.0600	2.0700	2.0800
3	3.1216	3.1525	3.1836	3.2149	3.2464
4	4.2465	4.3101	4.3746	4.4400	4.5061
5	5.4163	5.5256	5.6371	5.7507	5.8666

(A) 5%
(B) 6%
(C) 7%
(D) 8%

22. 100 tickets are sold in a guessing competition in which there are 3 prizes to be drawn by selecting 3 different tickets. Maria buys 3 tickets and wins exactly one of the first two prizes.
What is the probability of Maria now winning the third prize?

(A) $\dfrac{1}{99}$

(B) $\dfrac{1}{98}$

(C) $\dfrac{2}{98}$

(D) $\dfrac{3}{100}$

23. Myles has a loan of $400 000. If the interest rate on the loan is reduced from 8%p.a. to 7%p.a. how much interest does Myles save over the next 5 years?

Amount repaid for a loan of $1				
Interest rate per period				
Period	6%	7%	8%	9%
1	1.0600	1.0700	1.0800	1.0900
2	1.1236	1.1449	1.1664	1.1881
3	1.1910	1.2250	1.2597	1.2950
4	1.2625	1.3108	1.3605	1.4116
5	1.3382	1.4026	1.4693	1.5386

(A) $1
(B) $4 000
(C) $20 000
(D) $26 680

24. A set of test marks has a:
   mean of 21
   standard deviation of 3.5

An extra mark of 28 is added to the set. Consider the following:
I   the mean will increase.
II   the standard deviation will decrease.

Which is true?
(A) I only
(B) II only
(C) I and II
(D) Neither I nor II

25. A special die has 6 square faces and 8 triangular faces. When rolled, the die is twice as likely to land on a square face as a triangular face. What is the probability that the face it lands on is triangular?

(A) $\dfrac{3}{11}$

(B) $\dfrac{2}{5}$

(C) $\dfrac{4}{7}$

(D) $\dfrac{7}{10}$

End of Section I

Section II

75 marks

Attempt Questions 26-30

Allow about 2 hours for this section

**Question 26**   15 Marks

a)   Lauren earns $1500 per week.

  i.   What is her taxable income for the year if she has allowable   **1**
          deductions of $2650?

  ii.   Use the tax table below to calculate the tax on this income.   **2**

Taxable Income	Tax on this income
0 - $18,200	Nil
$18,201 - $37,000	19c for each $1 over $18,200
$37,001 - $80,000	$3,572 plus 32.5c for each $1 over $37,000
$80,001 - $180,000	$17,547 plus 37c for each $1 over $80,000
$180,001 and over	$54,547 plus 45c for each $1 over $180,000

b)   At peak times, The Cheesecake Factory on Waikiki Beach has a
          queue to get a table. The time customers waited was recorded over
          a two week period and the results recorded in the box and whisker
   plot below.
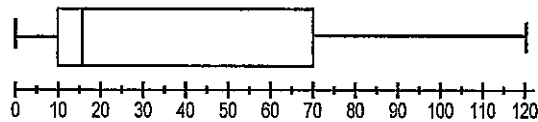
Waiting Time in Minutes

  i.   What is the maximum time spent waiting for a table?   **1**
  ii.   There were 2400 waiting times recorded in this survey. How many   **1**
          people waited more than 70 minutes for a table?
  iii.   The waiting time, W, for a table varies directly with the square **2**
          root of the number of minutes after 6pm. It is known that people
          that arrive at 6:15pm wait 30 minutes for a table. How long would
          you expect to wait if you arrive at the restaurant at 7pm?
  iv.   The Cheesecake Factory claim that "*most people/groups have a*   **2**
          waiting time of less than 20 minutes." Is this statement true? Use
          statistics to support your answer.

Question 26 continued over page

c)   Grace takes out a $7000 personal loan over 4 years. She makes
          monthly repayments of $192.75 each month.

  i.   How much will Grace pay back altogether?   **1**

  ii.   What is the annual interest rate for the loan?   **2**

d)   The quality controller for a toothpaste manufacturer inspected a
          sample of 400 tubes of toothpaste. The number of faults of different
          types is recorded in the graph below.
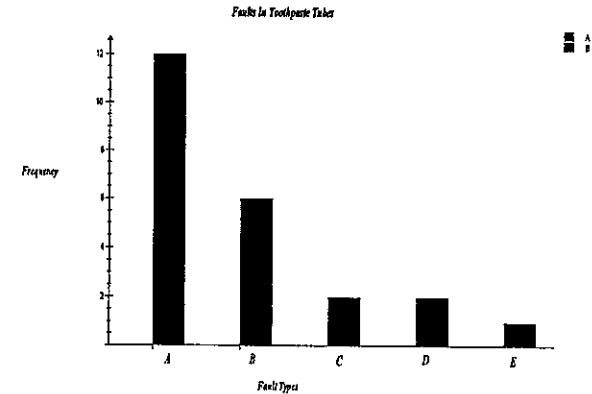
  i.   What was the total number of faults in the toothpaste tubes?   **1**

  ii.   What is the probability that if a tube is selected at random that it will   **1**
          not be faulty?

  iii.   The company wants to improve its product by reducing the number   **1**
          of faulty tubes. Which one of the fault types should be fixed to give
          the greatest improvement?

End of Question 26

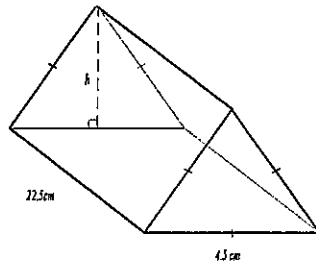**Question 27**   **15 Marks**

a)   Beijing is located at $(40^\circ N, 116^\circ E)$ and Perth is located at   **2**

          $(32^\circ S, 116^\circ E)$.

          Find the distance, in kilometres between these two cities.
Earth's radius is 6400*km*.

b)   A popular chocolate is packaged in the shape of a triangular prism
as shown below.

      i.   The length of the packet measures 22.5 *cm*, measured correct to the   **2**
nearest 0.1 *cm*. What is the percentage error in this measurement?

     ii.   Sketch the net of the packaging, clearly marking sides that are   **2**
equal. It is not necessary to draw this to scale.

    iii.   Show that the height of the packaging, *h* is 3.9*cm*, correct to 1   **1**
decimal place.

     iv.   Find the volume of the packet, correct to the nearest cm^3.   **2**

      v.   The company is marketing a new size chocolate in the same shape.   **1**
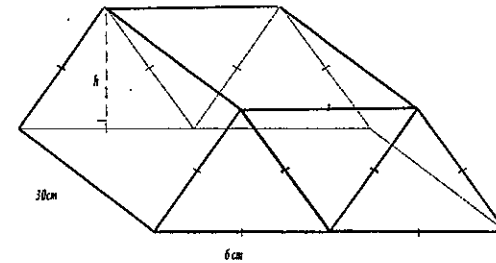The new packaging is shown below.
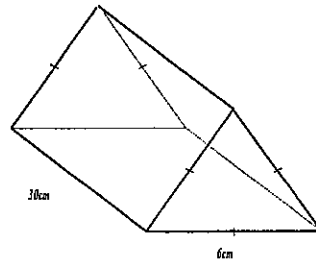
         What scale factor was used?

     vi.   Three of the new-sized packets are packed together to form a   **3**
trapezoidal prism, as shown. Calculate the surface area of this
trapezoidal prism.

    vii.   The list of contents on this chocolate states that there is 1.4g of   **2**
protein per 25g. Ben and Claire share one 400g block in the ratio
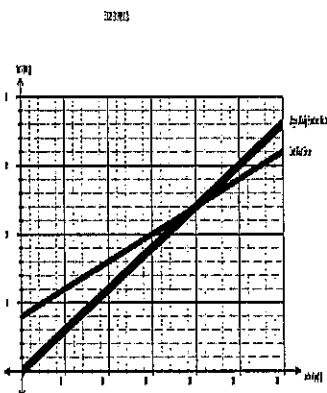2:3. How much protein will Claire consume when eating her share
of chocolate?

End of Question 27

a) PLC Sydney Year 12 2012 are planning their Formal. They get 2
    quotes from 2 different venues, the *Super Shady Function Centre*
    and *Last Blast House*. The cost in $1000, C, for the number of
   people, n, of each venue is represented on the graph below.

i.   What is the quoted cost for the *Super Shady Function Centre* if   1
     250 are to attend the formal?

ii. How many people would be attending the formal at *Last Blast*   1
     House if the quote was for $20000?

     The equation for the cost of a function at *Last Blast House* is of the
     form $C = a + bn$ where a and b are constants.

iii. Write down the value of a and give an explanation of its meaning.   2

iv. Calculate the value of b. What does b represent in this situation? 2

v.   Rearrange the formula $C = a + bn$ to make n the subject.   1

vi. How much would be quoted by *Last Blast House* for 400 people?   1

vii. If the cost for both places was exactly the same how many people   2
     would be attending and how much would the cost be?

viii. A total of 376 people will be attending the formal. Which venue   1
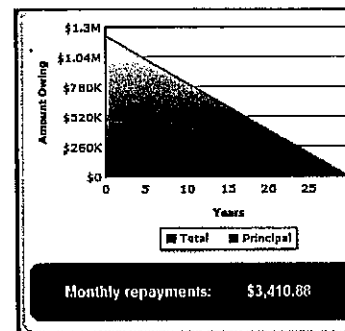   will the Year 12 girls choose? Explain your answer.

b) A home loan is to be taken out for $500 000 at 7.5% per annum.
    The graphs below are the outcome of using the Home Loan
    Repayment Calculator, comparing different time periods for the
    length of the loan.

*Loan 1*
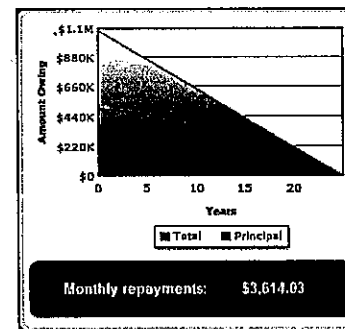
Loan 2

i. How much are the monthly repayments if the loan is taken out   1
    over 30 years?

ii. Calculate how much interest is saved if the loan is taken out for 25 3
    years rather than 30 years?

End of Question 28

Question 29

a) On a Gold Duke of Edinburgh expedition, the girls leave Camp *A* and walk for *6km* on a bearing of 120° to site *B*. From *B*, they canoe for 12 *km* on a bearing of 235° to Camp *C*.

    i.   Draw a diagram showing all the given information.

    ii.   Find the distance from Camp *C* directly to Camp *A*.   **2**

    iii.   What is the bearing of Camp *A* from Camp *C*, correct to the nearest degree.   **2**

b) Noah is to receive a regular payment of $6000 at the end of each year for 3 years. He invests each payment immediately at 7.5% p.a. compounded annually. Find the total amount of the investment at the end of 3 years.   **3**

c) A game is played where the spinner below is spun twice and the number recorded after each spin. The two numbers are then multiplied together to give a final score.
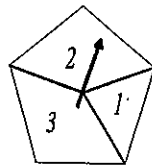
    i.   Write the sample space for this game.   **2**

    ii.   What is the probability of getting a final score of 6?   **1**

    iii.   In the game, the following rules apply:

Final Score	Payout
1	Win $5
Perfect square, not including 1	Win $2
Not perfect square	Lose $0.50

    What is the financial expectation of the game?   **3**

    iv.   If it costs $1 to play this game would you expect a gain or a loss and by how much will it be?   **1**

    v.   If the rules were simplified to: **1**

Final Score	Payout
Even number	Win $4.50
Odd number	A

    Calculate the payout, A, if the game is to have a financial expectation of zero. There is no cost to play.

End of Question 29

Question 30   15 Marks

Henrietta has a free-range chicken farm.

a) Henrietta uses the 'capture-recapture' technique to estimate the number of chickens on her farm. She caught, tagged and released 50 chickens. Later she caught 160 chickens at random. Henrietta found 8 of these 160 chickens were tagged. Calculate the estimate of the number of chickens on the farm.   **2**

b) Henrietta has a hatchery on her chicken farm. She finds that 90% of the chicken eggs at the hatchery are fertile and that 85% of fertile eggs hatch into chicks.

    i.   If she chooses a newly laid egg at random, what is the probability that the egg will hatch a chick?   **1**

    ii.   If on a particular day 600 eggs are laid, how many chicks are expected to hatch?   **1**

c) For a particular group of hens, Henrietta counts and records the number of total eggs laid in a one month period. The results are recorded below:

11	12	13	19	20	22	22	22	24	25
30	30	31	31	37	46	47	52	64	64

    i.   What is the mode of the set of scores?   **1**

    ii.   Draw a stem-and-leaf plot to represent the data.   **2**

    iii.   Calculate the mean and standard deviation for this set of scores.   **2**

    iv.   Discuss whether the hens are consistent in the number of eggs they lay each day. Use statistics to support your answer.   **1**

d) Henrietta purchased farm machinery for $7000. After 3 years it has depreciated to $5089 using the declining balance formula for depreciation. Calculate the rate of depreciation per year as a percentage.   **2**

e) Henrietta starts saving for a deposit to buy an adjoining farm. She decides to invest $1250, at the end of each month, investing it at 9% per annum compounded monthly. Henrietta does this for a 3 year period. She needs $50000 in 3 years time. Will she have enough money accumulated?   **3**

End of Examination

General Mathematics: Multiple Choice Answer Sheet

Student Number __ANSWERS.__

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 ○
16. A ○   B ○   C ●   D ○
17. A ○   B ●   C ○   D ○
18. A ○   B ○   C ●   D ○
19. A ●   B ○   C ○   D ○
20. A ●   B ○   C ○   D ○
21. A ○   B ○   C ●   D ○
22. A ○   B ○   C ●   D ○
23. A ○   B ○   C ○   D ●
24. A ●   B ○   C ○   D ○
25. A ○   B ●   C ○   D ○

Academic Year	Yr 12	Calendar Year	2012
Course	General maths	Name of task/exam	Trial Exam

Section 2

Q26 a i 1500×52

$= 78\,000$ per year

Taxable income $= 78\,000 - 2650$

$= 75\,350$

ii Tax $= 3572 + 0.325(75\,350 - 37\,000)$

$= 3572 + 12463.75$

$\$16\,035.75$

b i 120 mins or 2 hours

ii $25\% \times 2400 = 600$ people

iii $W \propto \sqrt{m}$

$W = k\sqrt{m}$

$30 = k\sqrt{15}$

$k = \dfrac{30}{\sqrt{15}}$

$W = \dfrac{30}{\sqrt{15}} \times \sqrt{60}$

$= 30 \times 2$

$= 60$

wait 60 min (1 hr).

iv Yes, the statement is true based on these results. This is because median was 15 mins so 50% of people wait 15 mins or less so most people will wait less than 20 mins.

c i 192.75 per month for $4 \times 12 = 48$ months.

∴ pays back 48×192.75

$= 9252.$

ii Since loan $= 7000$ must pay 2252 as interest

∴ simple interest $=$ principal $\times$ rate $\times$ time

$2252 = 7000 \times r \times 4$

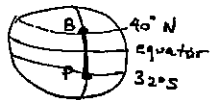$r = 0.08042....$

∴ interest rate $= 8\%$ p.a.

d i 23

ii if 23 faulty then 377 not faulty

$P(\text{not faulty}) = \dfrac{377}{400}$

iii Type A because it has the most faults.

Q 27

a) Beijing $(40°N, 116°E)$

Perth $(32°S, 116°E)$

∴ great circle.   **OR:**

angle $= 72°$ angle $= 72°$

∴ $\frac{72}{360} \times 2\pi r$ Dist $= 72 \times 60 M$

$= \frac{72}{360} \times 2\pi \times 6400$ $= 72 \times 60 \times 1.852$ km

$= 8042.48$ km $= 8000.64$ km

b) i) $\frac{0.05}{22.5} \times 100\% = 0.2\%$ error

ii)

iii)

$c^2 = a^2 + b^2$

$4.5^2 = 2.25^2 + h^2$

$h = \sqrt{15.1875}$
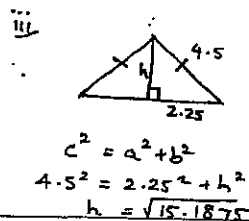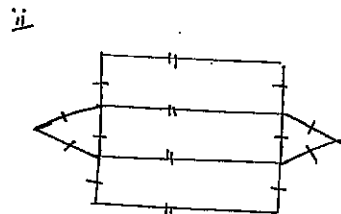
$= 3.9$ cm (1dp)

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iv) $V = A \times h$

$= \left(\frac{1}{2} \times 4.5 \times 3.897...\right) \times 22.5$

$= 197.29...$

$= 197$ cm^3

v) scale factor $= \frac{\text{new side}}{\text{old side}}$

$= \frac{6}{4.5}$

$= \frac{4}{3}$

vi) S.A $= 2 \times$ front $+$ top $+$ bottom $+2(\text{sides})$

$= 2 \times \left[\frac{1}{2} \times \sqrt{27} \times (12+6)\right] + (30 \times 6)$

$+ (30 \times 12) + 2(30 \times 6)$

S.A $= (\sqrt{27} \times 18) + 180 + 360 + 360$

S.A $= 993.5$ cm^2 (1 d.p).

vii) 400g

Ben : Claire
2 : 3

Ben $= 160$g   Claire $= 240$g

1.4 g protein per 25g

? g protein for 240g

∴ $\frac{x}{1.4} = \frac{240}{25}$

$x = 13.44$

∴13.44 grams of protein.

Q 28 a) i) $30\,000

ii) 150 people

iii) $C = a + bn$

∴ $a = 8000$

This is the costs of running the function regardless of the number of people attending.

iv) $b = \frac{20-8}{150} = \frac{12}{150}$

$= 0.08$

∴ $b = 80$/person

"b" is the cost per person of attending the formal.

v) $C = a + bn$

$C - a = bn$

$n = \frac{C-a}{b}$

vi) $C = 8000 + 80 \times 400$

$= 40\,000$

vii) 200 people attending
$24\,000 is the cost

viii) Last blast house because for that number of people, this is the cheaper price as it is after the break even point.

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b) i) $3410.88 /month

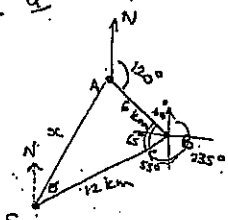**ii)** $(30 \times 12) \times 3410.88$

$(25 \times 12) \times 3614.03$

$= 1227916.8 - 1084209$

$= 143,707.80$

save $143,707.80

Q 29

a)

i)

ii) $x^2 = a^2 + b^2 - 2ab\cos C$

$x^2 = 6^2 + 12^2 - 2 \times 6 \times 12 \cos 65°$

$x = 10.915\ldots$ km

iii) $\dfrac{\sin \theta}{6} = \dfrac{\sin 65}{x}$

$\sin \theta = \dfrac{6 \times \sin 65}{10.915\ldots}$

$\theta = 29°53'$

$\therefore$ bearing $= 55 - 29°53'$

$= 25°7'$

$\doteqdot 25°$

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

$= 6000 \left\{ \dfrac{(1 + 0.075)^3 - 1}{0.075} \right\}$

$A = \$19383.75$

---

c)

	2	2	1	3	3
2	4	4	2	6	6
2	4	4	2	6	6
1	2	2	1	3	3
3	6	6	3	9	9
3	6	6	3	9	9

i) Sample space

1, 2, 3, 4, 6, 9

OR 1, 2, 2, 2, 2, 3, 3, 3, 3, 4, 4, 4,

6, 6, 6, 6, 6, 6, 6, 9, 9, 9, 9

ii) $\dfrac{8}{25}$

iii) financial expectation

$\dfrac{1}{25} \times 5 + \dfrac{8}{25} \times 2 - \dfrac{16}{25} \times 0.5$

$= 0.52$ gain

iv) loss of 48 c

v) financial expectation

$\dfrac{16}{25} \times 4.50 - \dfrac{9}{25} \times A = 0$

$\dfrac{16}{25} \times 4.50 = \dfrac{9}{25} A$
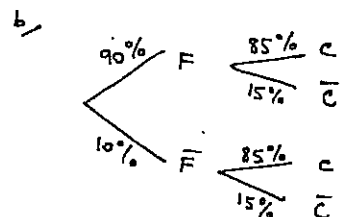
$A = 8$

Loss of $8.

Q 30

a) $\dfrac{50}{total} = \dfrac{8}{160}$

$\dfrac{50 \times 160}{8} = $ estimate of total

$1000 = $ estimate of total

b)

i) $P(F \, C) = \dfrac{9}{10} \times \dfrac{85}{100}$

$= \dfrac{153}{200} \quad (\text{or } 76\tfrac{1}{2}\%)$

ii) $\dfrac{153}{200} \times 600 = 459$ chicks

c) i) 22

ii)

Stem	leaf
1	1 2 3 9
2	0 2 2 2 4 5
3	0 0 1 1 7
4	6 7
5	2
6	4 +

iii) $\bar{x} = 31.1$

$\sigma_n = 15.5$

iv) Since the spread (standard deviation) is large, 15.5, the hens are **not** consistent. To be consistent the spread needs to be small.

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

$5089 = 7000 (1-r)^3$

$\dfrac{5089}{7000} = (1-r)^3$

$\sqrt[3]{0.727} = 1 - r$

$0.8991762 = 1 - r$

$r = 1 - 0.899\ldots$

$r = 0.1008\ldots$

%rate $= 10.08\%$ pa

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

$= 1250 \left\{ \dfrac{(1 + \tfrac{9}{12}\%)^{36} - 1}{\tfrac{9}{12}\%} \right\}$

$= 51\,440.895\ldots$

She will have $51\,440.895\ldots so will have enough to buy the farm.