STUDENT NUMBER:_____

THE SCOTS COLLEGE
Sydney

2011
TRIAL H.S.C.
EXAMINATION

General Mathematics

General Instructions
- Reading time – 5 minutes
- Working time – 2½ hours
- Write using black or blue pen
- Board-approved calculators may be used
- Use the Multiple Choice Answer Sheet provided
- Use graph paper provided for Question 27 (a) and Question 28(d)
- A separate formula sheet is provided
- All necessary working should be shown in every question

Total marks – 100

Section I
- Total marks 22
- Attempt Questions 1-22
- Allow about 30 minutes for this section

Section II
- Total marks 78
- Attempt Questions 23-28
- Allow about 2 hours for this section

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.

Section 1

Total Marks – 22

- Attempt Questions 1-22
- Allow approximately 30 minutes for this section
- Use the Multiple Choice Answer Sheet provided
- Select the alternative A, B, C or D that best answers the question.
- Fill in the response oval completely.

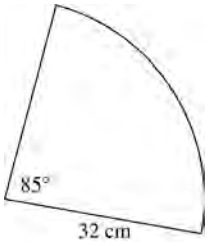
1. 0.012093 written correct to 3 significant figures is:

A. 0.0120
B. 0.012
C. 0.0121
D. 0.013

2. Simplify fully $\frac{3a^2 \times 12a^4}{6a^3}$

A. $6a^3$
B. $6a^2$
C. $\frac{a^3}{3}$
D. $\frac{a^2}{3}$

3. The area of the sector drawn below is given by:

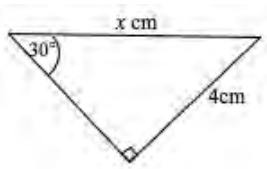


A. $A = \frac{275}{360} \times \pi \times 32^2$
B. $A = \frac{85}{360} \times \pi \times 32^2$
C. $A = \frac{85}{360} \times \pi \times 32$
D. $A = \frac{85}{360} \times 2\pi \times 32$

4. The average resting heart rate of a champion swimmer is 42 beats per minute. How many beats is this per day? Answer correct to three significant figures.

A. 6.048×10^4
B. 6.05×10^{-4}
C. 6.04×10^3
D. 6.05×10^4

5. Which one of the following expressions, when evaluated, gives the value of x?



A. $\dfrac{4}{\tan 30^\circ}$

B. $\dfrac{4}{\sin 30^\circ}$

C. $4\tan 30^\circ$

D. $4\sin 30^\circ$

6. Wei Chung bought a new DVD player for \$540 on his credit card on 4th July. He was charged 0.062% per day in interest from the purchase date as he made no repayments by the due date of 1st August. He repaid the full amount on 18th August.
Which formula represents the amount of interest charged?

A. $540 \times \dfrac{.062}{100} \times 46$

B. $540 \times \dfrac{62}{100} \times 46$

C. $540 \times .062 \times 18$

D. $540 \times \dfrac{.062}{100} \times 18$

7. Simplify fully $-3x(x+2) - (x^2 + 2x)$

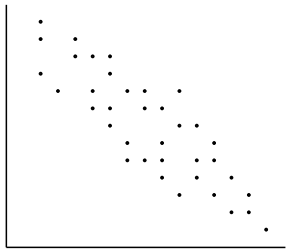
-3

A. $-4x^2 - 4x$
B. $-4 - 4x$
C. $-4x^2 - 8x$
D. $-2x^2 - 4x$

8. The point A on the Earth's surface has coordinates $(65^0\text{S}, 22^0\text{E})$, while the point B is at $(4^0\text{S}, 22^0\text{E})$. What is the distance between A and B?

A. 61 M
B. 77 M
C. 3660 M
D. 4620 M

9. What type of correlation is shown by the graph?



A. Strong positive correlation
B. Moderate positive correlation
C. Strong negative correlation
D. Moderate negative correlation

10. A data set is normally distributed with a mean of 27 and a standard deviation of $2 \cdot 5$. What is the percentage of scores that will lie within the range 24.5 to 32?

A. 34%
B. 47.5%
C. 81.5%
D. 95%

11. The solution to the equation $9^x = 342$ is closest to?

A. 2.6
B. 2.8
C. 3.0
D. 3.8

12. How many square millimetres in $0 \cdot 375 cm^2$?

A. 3.75
B. 37.5
C. 375
D. 3750

13. The length of a table was measured with a tape marked in centimetres. It was found to be 216cm. The actual length of the table is:

A. 216 ± 10mm
B. 216 ± 10cm
C. 216 ± 5mm
D. 216 ± 5cm

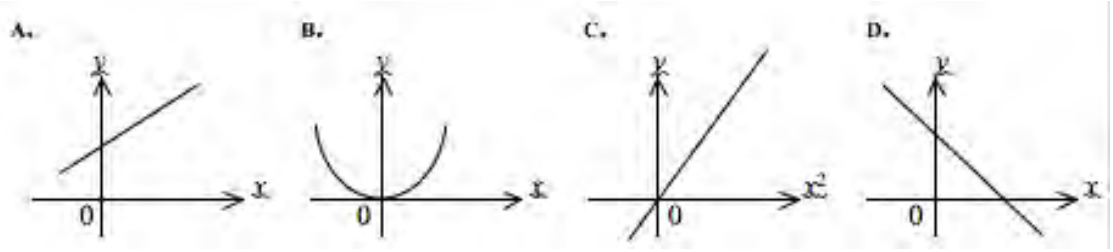
14.

2	1 1 3 6
3	☐ 2 3 4 5 9
4	1 2 4 6 7
5	3 4 5 8 9

The Interquartile range of the set of scores in the table is 18.
What will be the value represented by ☐ ?

A. 0
B. 1
C. 2
D. 3

15. Which of the following graphs indicate that y is directly proportional to x^2 ?



16. For a loan of $20 000 a deposit of $1600 is made and payments of $564 per month are paid for 4 years.

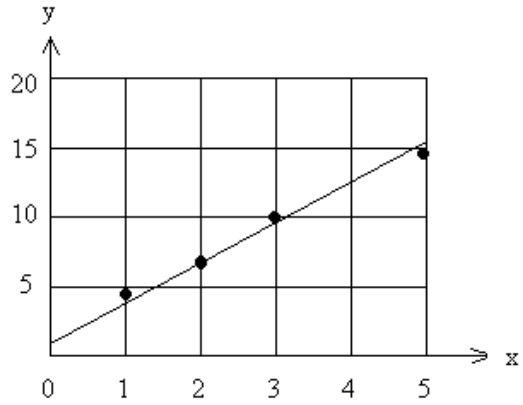
The total repaid is:

A. $2 256
B. $3 856
C. $27 072
D. $28 672

17. Given $s = ut + \frac{1}{3}at^2$, find the value of a if $s = 176$, $u = 30$ and $t = 4$.

A. 10.5
B. 55.125
C. 125.3
D. 298.7

18. A scatter plot is shown below.



The most likely equation to represent this line of best fit is given by:

A. $y = 2.5x + 2$
B. $y = 0.4x + 2$
C. $y = x + 3$
D. $y = -x + 3$

19. Mr Dogood represented the results from his class's test as a stem-and-leaf plot.

Females						Males					
			8	7	0	9					
9	7	6	4	3	1	1	3	5	7	8	
	8	7	5	1	2	1	3	6	6	7	9
	7	4	3	1	3	1	1	2			

The difference in the median for the females and males is:

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

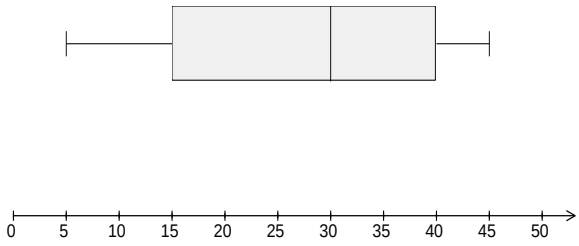
20. The table below shows the monthly repayments per $1000 on a bank home loan.

Term of Loan (years)	6.00%	6.25%	6.50%	6.75%	7.00%	7.25%	7.50%
5	$19.33	$19.45	$19.57	$19.68	$19.80	$19.92	$20.04
10	$11.10	$11.23	$11.35	$11.48	$11.61	$11.74	$11.87
15	$8.44	$8.57	$8.71	$8.85	$8.99	$9.13	$9.27
20	$7.16	$7.31	$7.46	$7.60	$7.75	$7.90	$8.06
25	$6.44	$6.60	$6.75	$6.91	$7.07	$7.23	$7.39

Determine the monthly repayment for a loan of $120 000 at 6·5% p.a. interest rate over 20 years.

A. $7.46
B. $89.52
C. $895.20
D. $7 460

21. Consider the following box-and-whisker plot:



What is the interquartile range for this data set?

A. 15
B. 25
C. 30
D. 40

22. Two cards are drawn from a standard pack of playing cards, the first being replaced before the second is drawn.

Find the probability that both are tens.

A. $\frac{1}{13}$

B. $\frac{1}{26}$

C. $\frac{168}{169}$

D. $\frac{1}{169}$

Section 2

78 marks
Attempt Questions 23-28
Allow about 2 hours for this section.
Answer each question in a SEPARATE writing booklet. Extra writing booklets are available.
ALL necessary working should be shown in every question.

Marks

Question 23 (13 marks) Use a SEPARATE writing booklet.

a) On a recent trip to Central Australia, a colony of bats was discovered in one of the caves. Wildlife officers tried to estimate the bat population by catching 90 bats and tagging them. These bats were then released and another 90 bats were caught, 9 of which had tags. Estimate the size of the bat population living in the cave in Central Australia. **3**

b) Scientists have shown that the mass (m) in grams of an egg varies directly with the cube of its length (l) in cms.

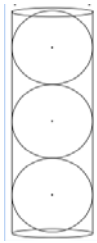
An egg 5cm in length has a mass of 90 grams.

i) Write an equation connecting m and l. **2**

ii) Find the mass of an egg with a length of 3.5 cm, correct to 1 decimal place. **1**

iii) Find the length of an egg with a mass of 60 grams, correct to 1 decimal place. **2**

c) A cylindrical can contains 3 tennis balls. Each tennis ball has a diameter of 8 cm.



i) Calculate the volume of each ball, correct to 2 d.p. **2**

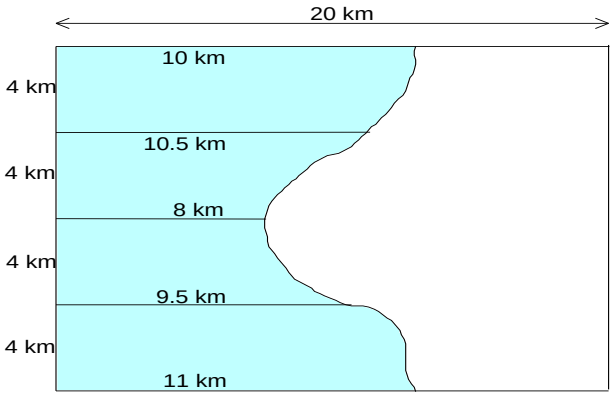
ii) The three balls fit exactly inside the can. How high is the can? **1**

iii) The can is open and made of stainless steel. Calculate the amount of stainless steel in the can (correct to the nearest whole number). **2**

Question 24 (13 marks) Use a SEPARATE writing booklet.

a) Research on locust plagues is investigating the damage to paddocks by the locusts.

The shaded region of the diagram below shows the area of a paddock affected by a locust plague.



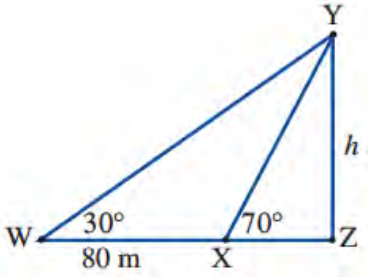
i) Calculate the area of the paddock affected, using two applications of Simpson's Rule, correct to 1 decimal place. **2**

ii) If the area of the paddock damaged occurred over a period of 15 days, how long to the nearest day, will it take for the whole area of the paddock to be affected if the damage continues at the same rate? **3**

iii) If 1 km^2 of produce from this paddock earns the farmer \$45, how much has the farmer lost after 15 days? **1**

b)

From a point, W, the angle of elevation to the top of a building, Y, is 30^0. From a point, X, 80 m closer to the building, the angle of elevation is 70^0.



i) Show that XY can be given by the expression $\frac{80sin30^0}{sin40^0}$ **2**

ii) Calculate the height of the building, *h*, correct to 1 decimal place. **2**

c) Look at the table of loan repayments per $1 000 shown below:

	Interest rate (p.a.)			
Term	**9%**	**10%**	**11%**	**12%**
10	$12.67	$13.22	$13.78	$14.35
15	$10.14	$10.75	$11.37	$12.00
20	$9.00	$9.65	$10.32	$11.01
25	$8.39	$9.09	$9.80	$10.53

Angus has a $120 000 mortgage at 10%p.a. over 10 years. After interest rates rise to 12%p.a. Angus extends the term of his loan to 15 years. What is the change in Angus' monthly repayments? **2**

d) The time taken for an investment to double in value when invested at 7.5% p.a. can be found by solving the equation **1**

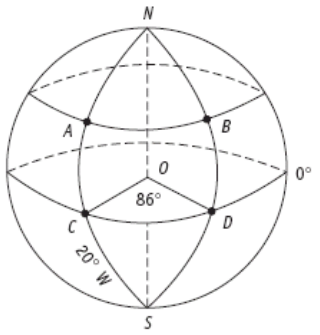
$$(1.075)^n = 2.$$

Find the solution to this equation, to 1 decimal place.

End of Question 24
Question 25 over page

Question 25 (13 marks) Use a SEPARATE writing booklet.

a) A, B, C and D are points on the Earth's surface. A and B lie on parallel of latitude 30^0 N. C and D lie on the Equator. O is the centre of the Earth. $\angle COD = 86^0$. A and C both have longitude 20^0W. B and D have the same longitude. (Use 1.852 km = 1M)



i) Find the longitude of B. **1**

ii) What is the distance from C to D, in nautical miles? **1**

iii) Find the distance from A to C, in kilometres. **2**

iv) If it is 4.30am at A, what time is it at B? **2**

v) Calculate the time taken for a ship to sail the shortest distance between A and C at an average speed of 40 knots. **3**

b) The standard deviation and mean for a geography examination are 5 and 84 respectively.

i) Calculate Andrew's *z*-score if his result was 79. **1**

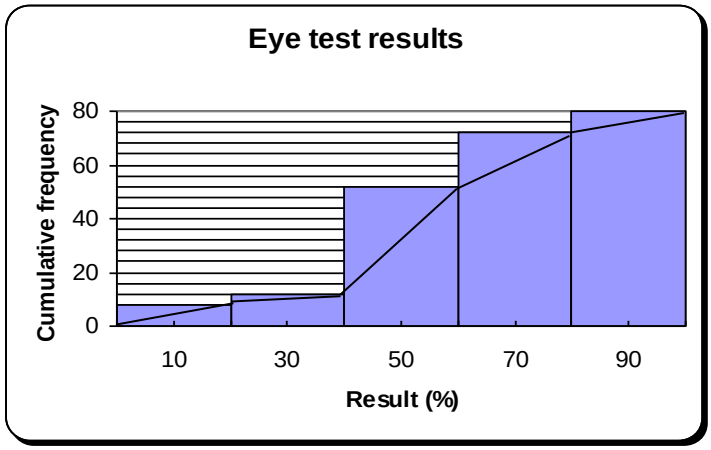
ii) What percentage of students scored more that Andrew? **2**

iii) How many more marks did he need to have scored in the top 2.5%? **1**

End of Question 25
Question 26 over page

Question 26 (13 marks) Use a SEPARATE writing booklet.

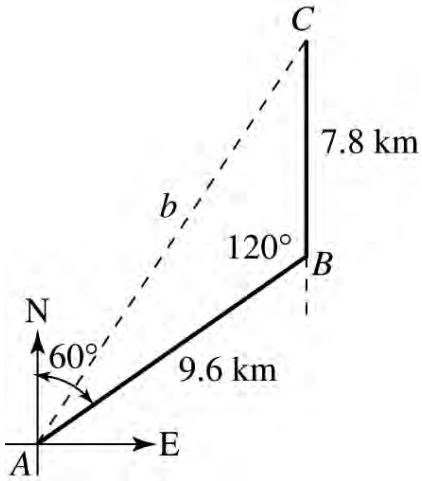
a) In a large city hospital 40 patients had their eyesight tested.
The results are summarised in the graph below.



i) Use the graph to estimate the median mark and the interquartile range of the 40 patients tested. **3**

ii) The lowest score was 19% and the highest score was 91%. Construct a box-and-whisker plot to show the results. **2**

b) In the diagram below, a speed boat leaves buoy A and travels in a direction of N60°E for a distance of 9.6 km to reach buoy B. It then heads due north for 7.8 km to buoy C.



i) How far is buoy C from buoy A, correct to 2 decimal places? **3**

ii) What is the bearing from buoy C back to his starting point as buoy A? **2**

c) Anna wants to retire from her current job in 5 years time and set up a small business from her home. She estimates that this will cost around $20 000 to set up.

How much must she invest today, at 12% p.a. compounding monthly, so that she will have $20 000 after 5 years? **3**

Question 27 (13 marks) Use a SEPARATE writing booklet.

a) The population of a Sydney suburb and the number of feral pigs caught by park rangers in Thredbo over 9 years are recorded below.

Year	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Population	1060	1300	1555	1900	2335	2525	3010	3630	4325
Number of feral pigs	28	35	36	39	47	49	51	57	64

i) From this data, on the graph paper provided, construct a median regression line. **4**
[Hint: make the horizontal axis for population and the vertical axis for feral pigs]

ii) What appears to be the relationship between population and the numbers of feral pigs? **1**

iii) Determine the equation of the median regression line. **3**

iv) From your equation, evaluate the number of feral pigs if the population is 3500. **1**

b) Rachel and Thomas swim 10 laps of the local pool every day. Their session times (in minutes) for one week are as follows:

Rachel: 22, 20, 22, 24, 38, 22, 20

Thomas: 18, 37, 17, 37, 21, 20, 18

i) Calculate the mean and sample standard deviation for Rachel (correct to 1 decimal place). **1**

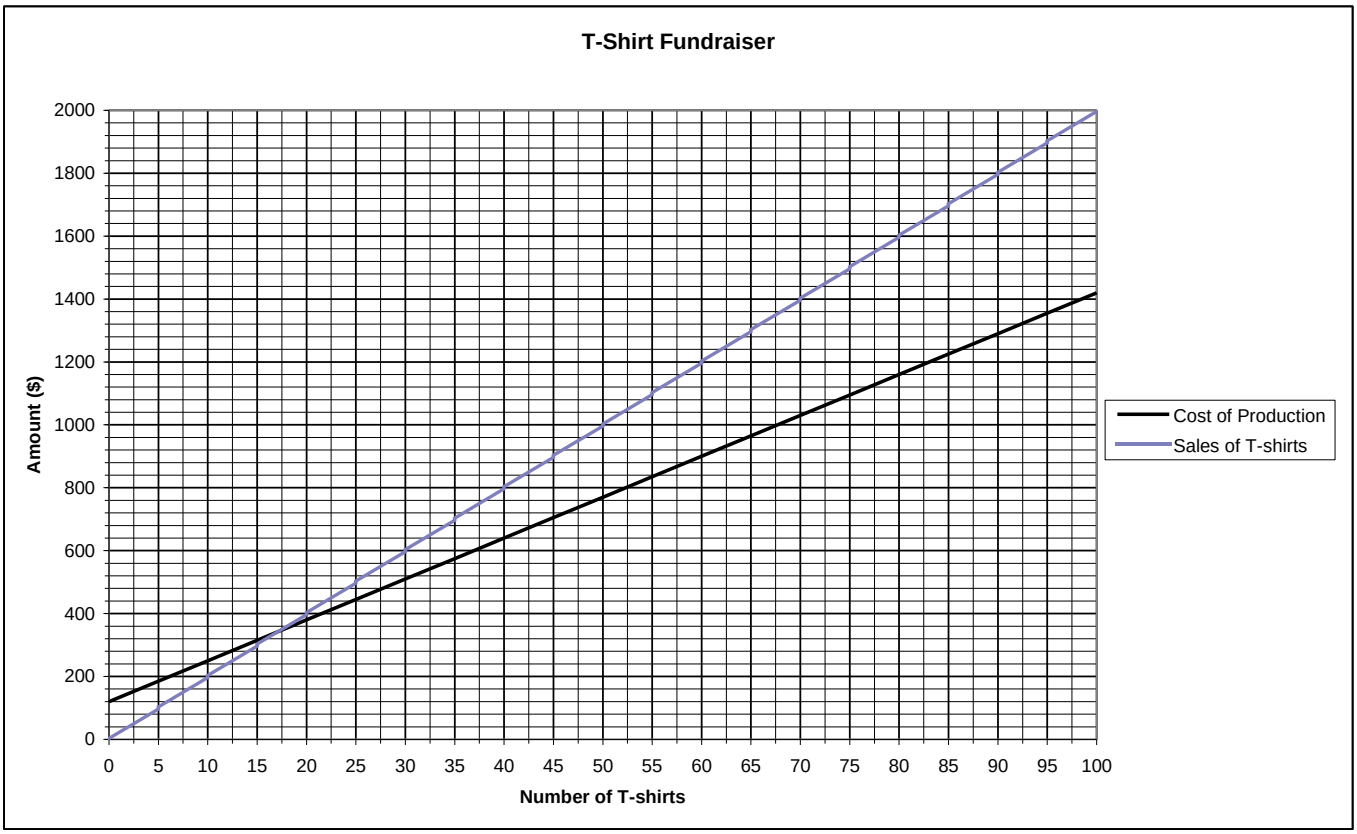
ii) Calculate the mean and sample standard deviation for Thomas (correct to 1 decimal place). **1**

iii) Which swimmer has a more consistent approach to their training? Explain your answer using your calculations from part (i) **2**

End of Question 27
Question 28 over page

Question 28 (13 marks) Use a SEPARATE writing booklet.

a) A waterpolo club has decided to print and sell t-shirts to raise money for an overseas tour.
The cost to print the t-shirts is \$120 for the setup fee, plus \$13 for every t-shirt printed. A graph showing this information is shown below:



i) Use the graph to determine the selling price per t-shirt. **1**

ii) How many t-shirts must be sold in order for the club to break-even? **1**

iv) What is the minimum number of t-shirts that need to be sold in order to make \$200 profit? **1**

b)

i) Solve the following equation

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

c) Felicity has a \$2, a \$1, a 50 cent and 20 cent coin in her pocket.
She removes 2 coins from her pocket at random.

(i) List all the possible coin combination amounts. **1**

(ii) What is the probability that she takes out \$1.50? **1**

Question 28 continued over page

d) The flight path of a model rocket is given by the equation:

$$h = 10t - 2t^2$$

where h is the height of the rocket above the ground (in metres) and t is the time (in seconds) since launch.

On the graph paper provided, graph the flight path of the rocket for the first 5 seconds. **3**
[Hint: make the horizontal axis for time and the vertical axis for height].

Answer the following questions by referring to your graph of

$$h = 10t - 2t^2$$

i) What is the height of the ball after 1.4 seconds? **1**

ii) What is the maximum height of the rocket (to the nearest metre)? **1**

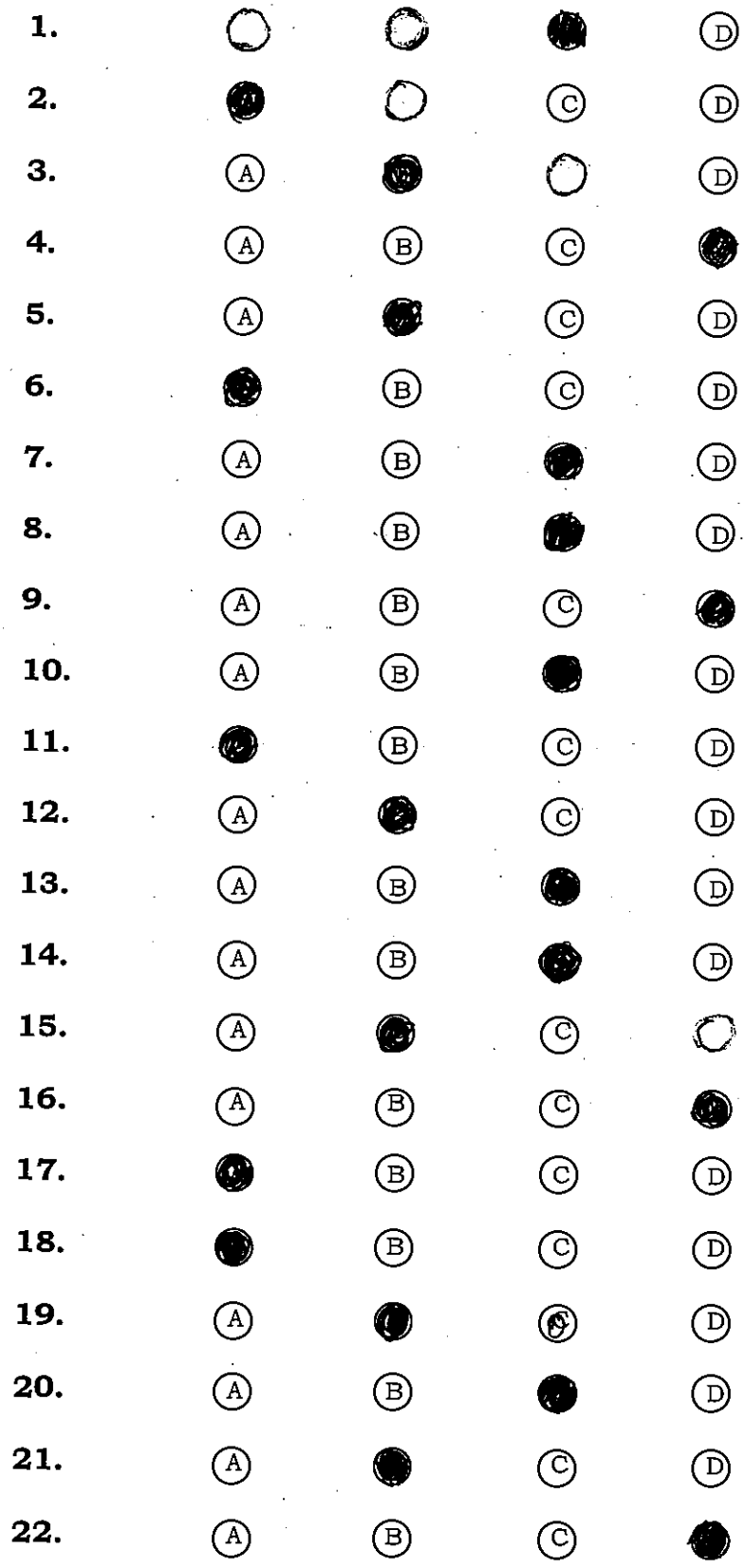
iii) How many seconds have passed when the rocket hits the ground? **1**

End of Examination

NAME: Correctos

MULTIPLE CHOICE ANSWER SHEET

For each question, choose the most correct answer and indicate your choice by shading in the appropriate space on the grid below.



Question 23 Name: _____

Teacher: _____

a) $\frac{90}{x} = \frac{9}{90}$ ①

$9x = 90 \times 90$

$x = \frac{90 \times 90}{9}$ ①

$= 900$ ①

∴ Pop^n bats ≈ 900

b) $m \propto l^3$ ①

i) $m = Rl^3$ (k is constant variation)

$m = 90, l = 5$

$90 = R \times 5^3$

$R = \frac{90}{5^3}$ ①

$= 0.72$

Equation $m = 0.72l^3$

ii) $l = 3.5$

$m = 0.72 \times 3.5^3$

$= 30.87$

$= 30.9g$ (to 1dp) ①

iii) $m = 60$

$60 = 0.72 \times l^3$

$l^3 = \frac{60}{0.72}$ ①

$l = \sqrt[3]{\frac{60}{0.72}}$

$= 4.3679...$ ①

$= 4.4$ cm (to 1dp)

Question _____ Name: _____

Teacher: _____

c) i) $V = \frac{4}{3}\pi r^3$ $d = 8cm$

$= \frac{4}{3} \times \pi \times 4^3$ ① $r = 4cm$

①

$= 268.08 cm^3$ (to 2dp)

ii) height $= 3 \times 8$

$= 24cm$ ①

iii) $\pi r^2 + 2\pi rh$

$= (\pi \times 4^2) + (2 \times \pi \times 4 \times 24)$

$= 50.265... + 603.185...$ ① ①

$= 653.451...$

$= 653 cm^2$ (to nearest whole number)

Question 24 Name: _____

Teacher: _____

a) i) $A_1 = \frac{h}{3}\{d_F + 4d_M + d_L\}$ ① ①

$= \frac{4}{3}\{10 + 4\times10.5 + 8\} + \frac{4}{3}\{8 + 4\times9.5 + 11\}$

$= 80 + 76$

$= 156.0 km^2$

ii) Total area $= 20 \times 16$

$= 320 km^2$ ①

$\therefore$ $15.6 km^2$ took 15 days

$320 km^2$ takes x days

$156x = 15 \times 320$

$x = \frac{15 \times 320}{156}$ ①

$= 30.769...$ ①

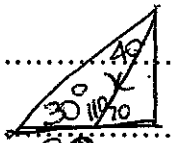
$= 31$ days (nearest day)

iii) $1 km^2 = \$45$

$156 km^2 = 156 \times 45$

$= \$7020$ ①

b) i)

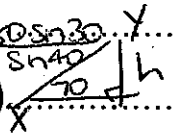


①

$\frac{80}{\sin 40^\circ} = \frac{x}{\sin 30^\circ}$ ①

$x = \frac{80 \sin 30}{\sin 40^\circ}$

ii)



$\sin 70^\circ = \frac{h}{xy}$ ①

$h = \frac{80 \sin 30^\circ}{\sin 40^\circ} \times \sin 70^\circ$

$= 58.476$ ①

$= 58.5$ m (1 dp)

Question _____ Name: _____

Teacher: _____

c) At 10% for 10 yrs = 13.22 × 120

= $1586.40

At 12% pa for 15yrs = 12.00 × 120

= $1440

Decreases by (1586.40 − 1440) ①

= $146.40 per month ①

d)

$1.075^n = 2$

$n \log 1.075 = \log 2$

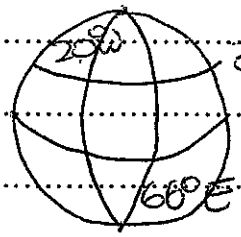
$n = \frac{\log 2}{\log 1.075}$

= 9.584...

= 9.6 years ①

Question 25 Name: _____

Teacher: _____

a) i) 

longitude B = 66°E (1)

ii) $1^\circ = 60$ M or Arc $= \frac{86}{360} \times \frac{2 \times \pi \times 6400}{1.852}$

$86^\circ = 60 \times 86$ (1)

$= 5160$ M $= 5186.98$ M

iii) $C = \frac{30}{360} \times 2 \times \pi \times 6400$ (1) or $1^\circ = 60$M

$30^\circ = 30 \times 60$

$= 1800$M (1)

$= 1800 \times 1.852$

$= 3351$ km (1) $= 3333.6$ km (1)

iv) $1^\circ = 4$ mins.

$86^\circ = 86 \times 4$

$= 344$ mins

$= 5$ hrs 44 mins (1)

4:30am + 5h 44 mins = 10:14 am (1)

v) $1^\circ = 60$M

$30^\circ = 30 \times 60$

$= 1800$ M $S = \frac{D}{T}$

$40 = \frac{1800}{T}$

$T = \frac{1800}{40}$

$= 45$ hrs

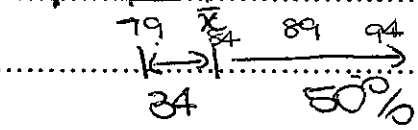
Question _____ Name: _____

Teacher: _____

b) $\sigma_n = 5$ $\bar{x} = 84$

i) $z = \frac{79 - 84}{5}$ ①

$= -1$

ii) 

greater than Andrew.

$= 84\%$

iii) top 25% 94 - 79

$= 15$ more marks.

Question 26 Name: _____

Teacher: _____

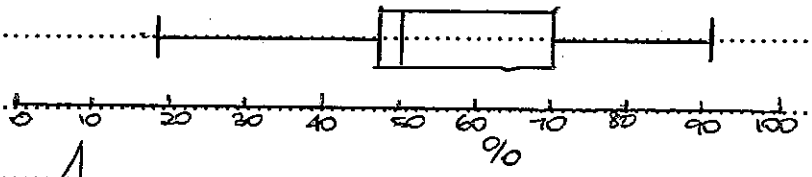
a) i) Median = 55 (±3) ①

IQR = $Q_3 - Q_1$

= 70 ① − 45 ①

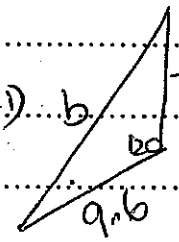
= 25 (±3)

ii)



②

b) i)

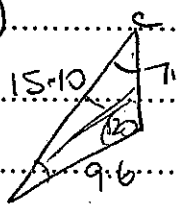


$b^2 = 9.6^2 + 7.8^2 - 2 \times 9.6 \times 7.8 \times \cos 120°$

$= 227.88$

$b = 15.10$ km

ii)



Cosine Rule

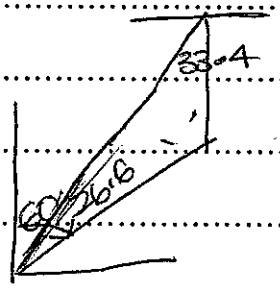
$\cos C = \frac{7.8^2 + 15.1^2 - c}{2 \times 7.8 \times 15.1}$

$\frac{9.6}{\sin C°} = \frac{15.10}{\sin 120°}$ ①

$\sin A = \frac{9.6 \times \sin 120°}{15.80}$

$\sin A = 0.5507\ldots$

$A = 33.417°$ ①



∴ Bearing = 180 + 33.4 ①

= 213°

(nearest degree)

Question _____ Name: _____

Teacher: _____

c) $N = P(1+r)^n$

$20\,000 = P(1+0.01)^{60}$ $r = 0.01$

$P = \dfrac{20\,000}{1.01^{60}}$

$= \$11\,008.99$

Question 27 Name: _____

Teacher: _____

a) i) see graph (4)

ii) linear (1)

iii) $m \overset{?}{=} \frac{62-23}{4000} \overset{?}{=} 0.00975$ (1)

$b = 23$ (1)

$N = 0.00975p + 23$ (1)

9

iv) $N = 0.00975p + 23$ when $p = 3500$

$N = 0.00975 \times 3500 + 23$

$= 57.125 \doteq 57$ pigs (1)

b) i) Rachel $\bar{x} = 24$ ii) Thomas $\bar{x} = 24$ (1)

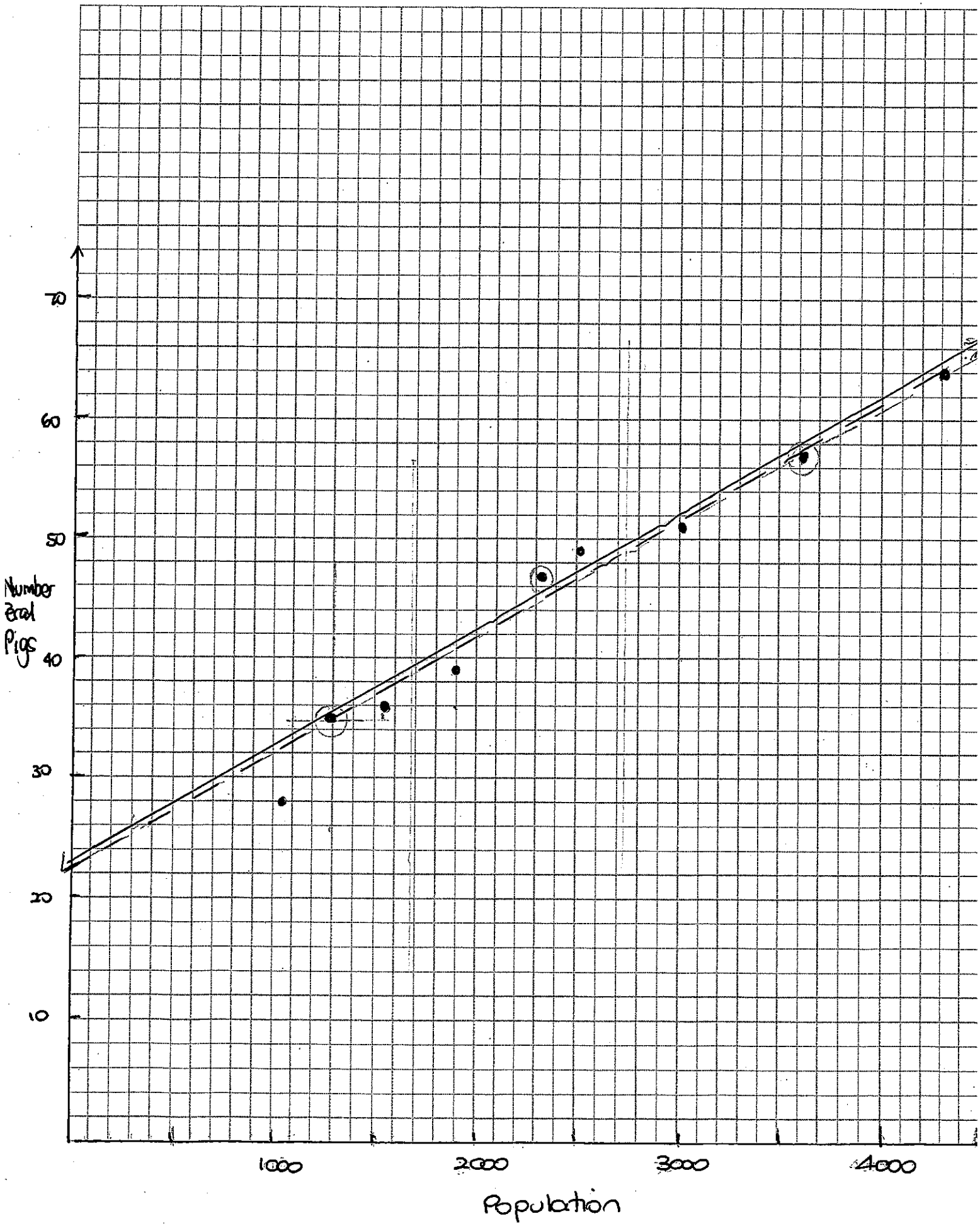
$\sigma_n = 5.9$ (1) $\sigma_n = 8.3$

4

iii) Rachel is more consistent (1)

as both have same mean her standard deviation is smaller which means results are more clustered around the mean (ie more consistent). (1)

Question 27 (a) **Candidate Number:** _____ Corrections



Question 28 Name: _____

Teacher: _____

a) i) $20 ①

ii) $\frac{1}{2}$ 17 ①

iii) 45 ①

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

$\frac{x+2}{5} = 2x - 6$

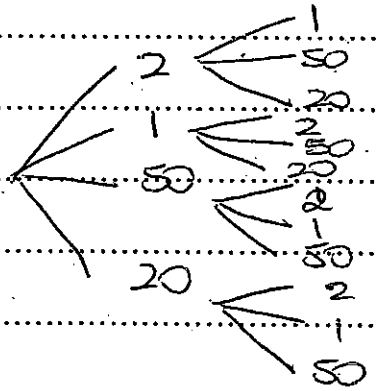
$x + 2 = 10x - 30$ ①

$-9x = -32$

$x = \frac{32}{9}$

$= 3\frac{5}{9}$ ①

c)



i) $2, $1

$2, 50¢

$2, 20¢

$1, $2

$1, 50¢ (*) ①

$1, 20¢

50¢, $2

50¢, $1 (*)

50¢, 20¢

20¢, $2

20¢, $1

20¢, 50¢

n(S) = 12

ii) $P(\$1.50) = \frac{2}{12}$

$= \frac{1}{6}$ ①

Question _____ Name: _____

Teacher: _____

graph (2)

d)

t	0	1	2	3	4	5
h	0	8	12	12	8	0

(1)

i) $h = 10 \times 1.4 - 2 \times 1.4^2$

$= 10.08\ m$ (1)

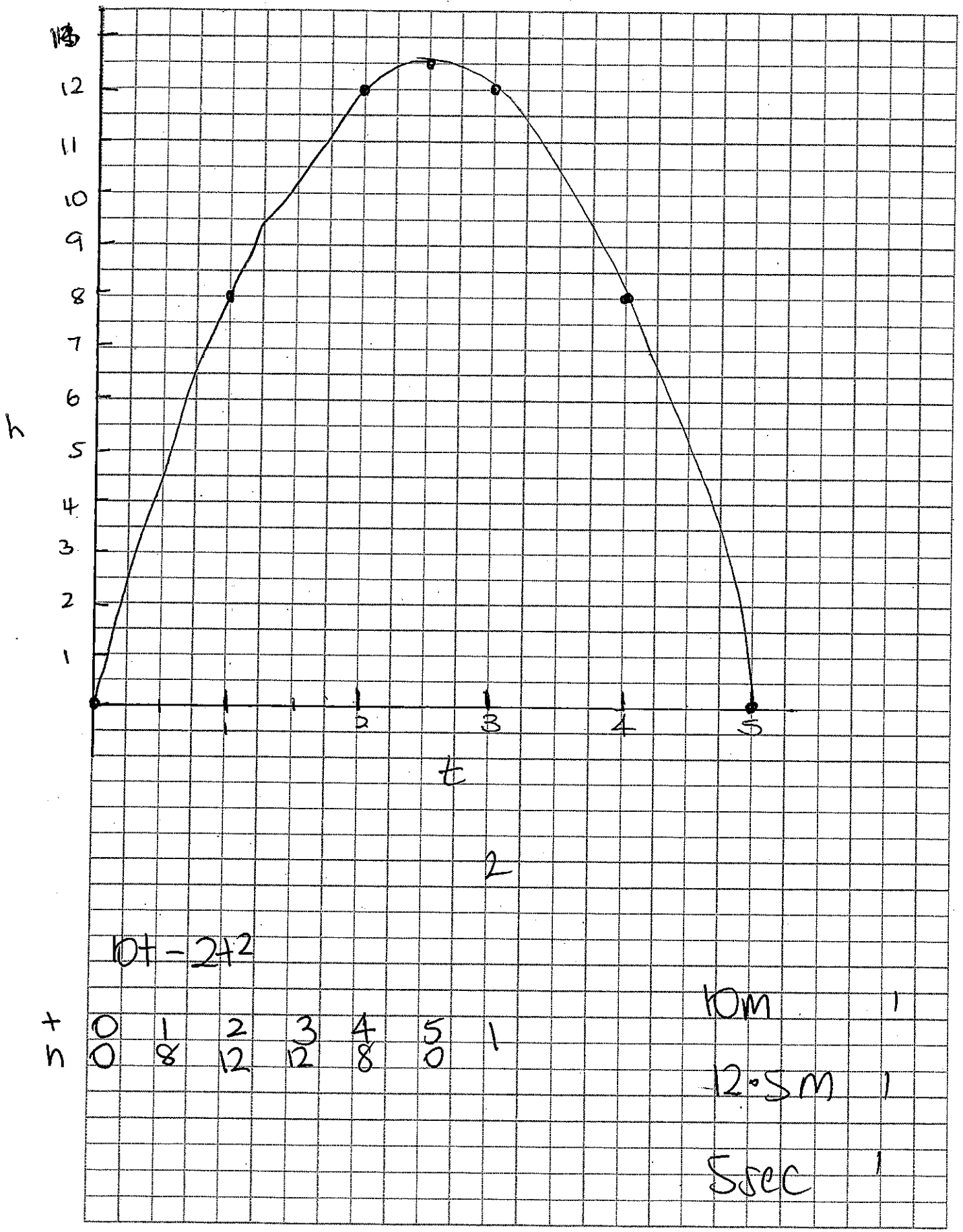
$\doteq 10\ m$ (from graph)

ii) $h = 10 \times 2.5 - 2 \times 2.5^2$ (1)

$= 12.5\ m$ (from graph)

iii) 5 seconds (1)

Question 28 (d) **Candidate Number:** Corrections



$10t - 2t^2$

t	0	1	2	3	4	5
h	0	8	12	12	8	0

10m 1

12.5m 1

5sec 1