QATs
Quality Assured Tests

Centre Number

Student Number

2015
HIGHER SCHOOL CERTIFICATE
TRIAL EXAMINATION

Mathematics General 2

General Instructions

- Reading time – 5 minutes
- Working time – 2 ½ hours
- Write using black or blue pen
- Board-approved calculators may be used
- A formulae and data sheet is provided at the back of this paper
- In Questions 26-30, show relevant mathematical reasoning and/or calculations
- Use the multiple-choice answer sheet provided
- Write your Centre Number and Student Number at the top of this page, page 15 and page 35

Total marks – 100

| Section I | Pages 2-13 |

25 marks
- Attempt Questions 1-25
- Allow about 35 minutes for this part

| Section II | Pages 15-32 |

75 marks
- Attempt Questions 26-30
- Allow about 1 hour and 55 minutes for this section

2015 HIGHER SCHOOL CERTIFICATE
TRIAL EXAMINATION
MATHEMATICS GENERAL 2

Section I – 25 marks
Attempt Questions 1-25
Allow about 35 minutes for this part

Use the multiple-choice answer sheet provided on page 35 for Questions 1-25.

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   ●   D ○   ○

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

A   ● B   ✖   D ○   ○

If you have changed 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:

correct

A   ✖ B   ✖   D ○   ○

1   Gavin's normal rate of pay is $36.40 per hour. In one week he worked 24 hours at normal rate, 4 hours at time-and-a-half, and 4.5 hours at double time. He was also paid $94.80 for the week for working under extreme and isolated conditions.

What was his pay for the week?

(A) $1277.80

(B) $1419.60

(C) $1514.40

(D) $1587.20

2 Two students are selected from a group of 4 to form a committee. How many different committees can be formed?

(A)   6
(B)   8
(C)   12
(D)   16

3 A spinner with different coloured sectors is spun 32 times. The results are recorded in the table.

	Colour obtained	Frequency
(A)	Red	4
(B)	Blue	8
(C)	Green	
(D)	Black	16

What is the relative frequency of obtaining the colour green?

(A)   0.125
(B)   0.25
(C)   4
(D)   12

4 A car is travelling at a constant speed. It takes 4 hours to complete a journey when travelling at 75 km/h.

How long would the same journey take if the car was travelling at 120 km/h?

(A)   2 hours and 5 minutes
(B)   2 hours and 30 minutes
(C)   2 hours and 45 minutes
(D)   2 hours and 50 minutes

5 Tom drew a correct diagram that gave the solution for solving simultaneously the equations $y = 5 - 3x$ and $y = 2x - 1$.

Which diagram did he draw?

(A)

(B)

(C)

(D)
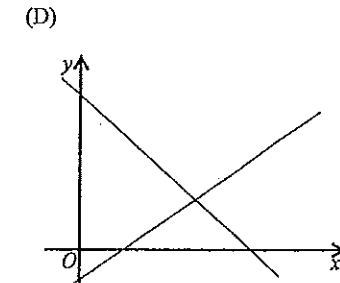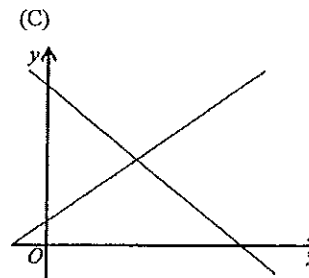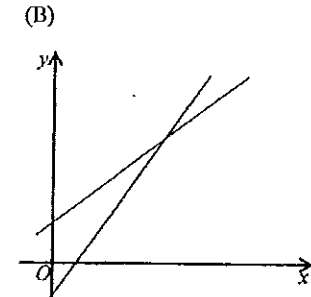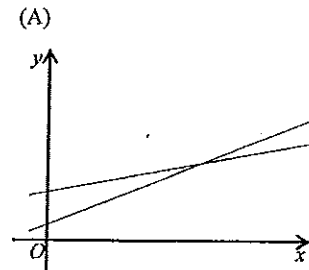
6 Ann deposits $8000 into a savings account that pays 6% p.a. interest compounded monthly.
What is the value of her investment after 3 years correct to nearest dollar?

(A) $8121

(B) $9440

(C) $9528

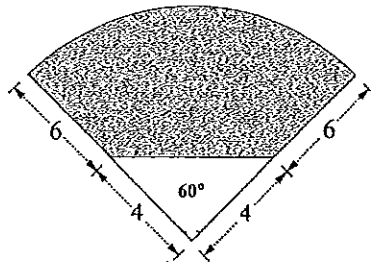(D) $9573

7 What is the area of the shaded part of this sector, to the nearest square centimetre?

NOT TO SCALE

All measurements are in centimetres.

60°

(A) 4

(B) 12

(C) 44

(D) 45

8 The graph of call charges for a mobile phone plan with call increments of one minute, is shown below. Jo wants to call Chris.

How much would Jo save by making one phone call of 8 minutes rather than three separate calls, each lasting 2 minutes?

Time   (minutes)
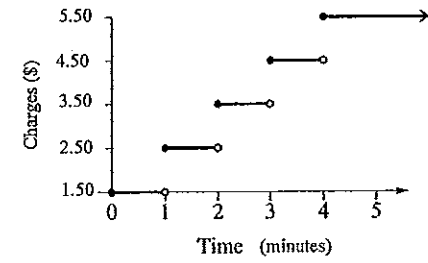
(A) $2

(B) $3

(C) $4

(D) $5

9 The mean of a set of ten scores is 18. Another two scores are included and the new mean is 20.

What is the mean of the two additional scores?

(A) 20

(B) 30

(C) 40

(D) 60

10 A bag contains some marbles. The probability of selecting a red marble at random from this bag is 5/8.

Which of the following could describe the marbles that are in the bag?

(A) 5 red, 8 black

(B) 5 red, 4 yellow, 4 black

(C) 5 red, 3 black

(D) 5 red, 3 yellow, 3 black

11 Hewlett plays a game of chance with the following outcomes.

- 1/5 chance of winning $8
- 1/2 chance of winning $5
- 3/10 chance of losing $10

The game has a $2 entry fee.

What is her financial expectation from this game?

(A) Lose $0.90

(B) Lose $2.90

(C) Win $1.10

(D) Win $7.10

12 Energy from wind turbines provides 7200 GWH of electricity annually. This is 2.2% of Australia's electricity needs. What is Australia's annual electricity consumption in GWH correct to three significant figures?

(A) 327000

(B) 327272.727

(C) 704000

(D) 704160.000

13 Cosmo drew a graph to show the height (h) in cm of water in a tank, related to time (w) in weeks for it to fill. What is the equation of the line?
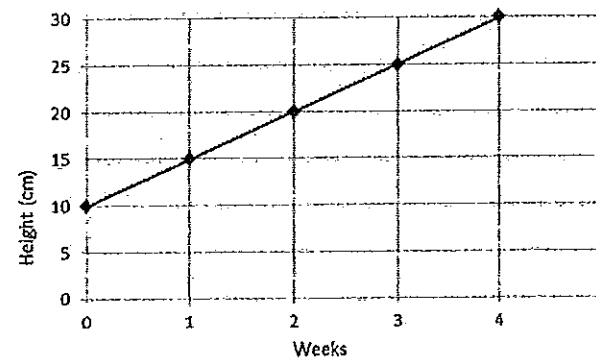
(A) $h = 10w + 5$

(B) $w = 5h + 10$

(C) $w = 10h + 5$

(D) $h = 5w + 10$

14 Sandra weighs 60 kg and she consumes 4 standard drinks from 8.30pm until 10.15pm while at a party. What is her blood alcohol concentration (BAC) at 10.15pm?

(A) 0.066

(B) 0.071

(C) 0.081

(D) 0.088

15 Josephine is flying a kite that is attached to a string. The string makes an angle of 35° with the horizontal. The kite is 15 metres above the ground.

If Josephine is 1.55 metres tall, how long to the nearest metre is the string?
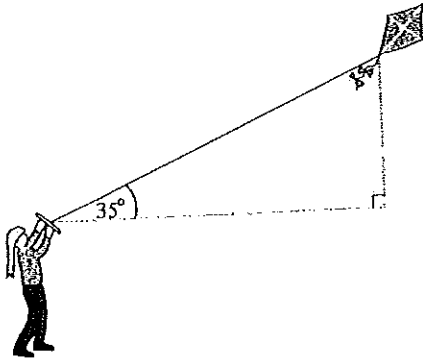
NOT
TO
SCALE

(A) 8
(B) 9
(C) 23
(D) 26

16 There are 1600 athletes competing in a marathon. How many athletes would be expected to score a result between 1 and 2 standard deviations above the mean if the results are normally distributed?

(A) 216
(B) 254
(C) 520
(D) 544

17 How many square centimetres are in 0.0035 square metres?

(A) 0.35
(B) 35
(C) 350
(D) 3500

18 What is the area of this right trapezoidal block of land to the nearest hectare?

1.45 km

945 m

NOT
TO
SCALE

862 m
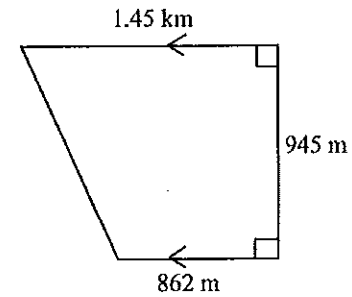
(A) 48
(B) 55 .
(C) 109
(D) 1090

19 An amount of $4000 is invested at 10% per annum, compounded six-monthly. Use the table to find the value of this investment at the end of two years.

Compounded values of $1					
Interest rate per period					
Periods	1%	5%	10%	15%	20%
1	1.010	1.050	1.100	1.150	1.200
2	1.020	1.103	1.210	1.323	1.440
3	1.030	1.158	1.331	1.521	1.728
4	1.041	1.216	1.461	1.750	2.074

(A) $4412

(B) $4840

(C) $4864

(D) $5844

20 In a particular town the maximum temperature for each day has been recorded.
The mean of these temperatures during autumn is 23.9°C, and their standard deviation is 3.6.

What temperature has a z- score of -1?

(A) 5.6°C

(B) 20.3°C

(C) 27.53°C

(D) 86.0°C

21 In order to save money on water Francine decides to buy a new 3 star washing machine which is 25% more efficient than her current 2 star washing machine which uses 95 Litres/load. Francine has 5 loads of washing each week.
How much money does Francine save in 3 years if water costs $2.08 / kL?

(A) $38.53

(B) $51.38

(C) $115.60

(D) $154.13

22 Which of the following correctly expresses x as the subject of $1 = \frac{x^2}{a^2} + \frac{y^2}{b^2}$?

(A) $x = \sqrt{a^2\left(1 - \frac{y^2}{b^2}\right)}$

(B) $x = \pm\sqrt{a^2\left(1 - \frac{y^2}{b^2}\right)}$

(C) $x = a\left(1 - \frac{y}{b}\right)$

(D) $x = a\left(\frac{y}{b} - 1\right)$

23 What is the adult dosage of medicine using Young's formula to the nearest mL if the child is 5 years and 3 months old and the child's dosage is 6 mL?

Young's formula:

$$\text{Dosage for children} = \frac{\text{age of child in years} \times \text{adult dosage}}{\text{age of child in years} + 12}$$

(A) 18

(B) 19.6

(C) 19.7

(D) 20.4

24   The roof of this greenhouse is a square pyramid with identical triangular faces.
The sides of the greenhouse are rectangles. The dimensions of the greenhouse are
shown on the diagram.

What is the volume of the greenhouse to the nearest cubic metre?
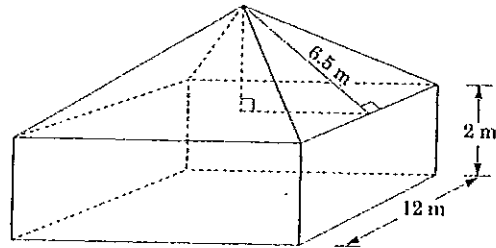
(A)   384

(B)   408

(C)   588

(D)   600

25   Heather purchased 1000 shares in a company at $3.17 per share, with a dividend yield
of 4.5%. One year later she sold the shares for $4.50 per share. Her stockbroker
charges brokerage of 1.5% for buying and 1.2% for selling a parcel of shares.

What are Heather's total earnings over the year after costs?

(A) $1330

(B) $1371

(C) $1419

(D) $1473

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2015 HIGHER SCHOOL CERTIFICATE
TRIAL EXAMINATION

QATs

Centre Number

Student Number

Mathematics General 2
Section II – 75 marks
Attempt Questions 26 - 30
Allow about 1 hour and 55 minutes for this part

Answer the questions in the spaces provided.
Your responses should include relevant mathematical reasoning and/or calculations.
Extra writing space is provided on page 33 and 34. If you use this space, clearly indicate
which question you are answering.
Write your Centre Number and Student Number at the top of this page.

Question 26 (15 marks)

A set of 24 scores is displayed in a stem and leaf plot.

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

(a) (i) What is the median?   1

(ii) What is the upper quartile?   1

(iii) What is the interquartile range?   1

Question 26 (a) (continued)

(iv) Is the score of 98 an outlier? Justify your answer with calculations.   1

(v) Draw a box-and-whisker plot for this data.   2
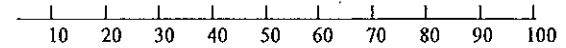
(vi) Is the distribution of scores for this data symmetrical, positively skewed or
negatively skewed?   1

Question 26 (continued)

(b) A bike race follows the triangular course shown in the diagram. The course from P to Q is 3.6 km on a true bearing of 042°. At Q the course changes direction. The course from Q to R is 4.9 km and $\angle PQR$ is 74°, marked on the diagram.

R• — 4.9 km — N, Q, 74°, N, 3.6 km, P
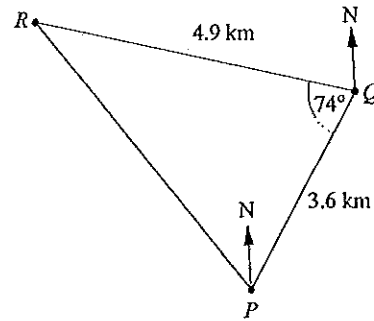
(i) What is the distance from P to R?   2

(ii) What is the area of triangle PQR?   1

(iii) What is the bearing of R from Q?   2

Question 26 (continued)

(c) Solve this equation $\frac{7x}{4} - \frac{2x+1}{3} = 2 - x$.   3

End of Question 26

Question 27 (15 marks)

The capture- recapture technique was used to estimate the size of a population of penguins. 40 penguins were caught, tagged and released. Later 180 penguins were caught and 25 of these had been tagged.

(a)   What was the estimated population for 2014?   **2**

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(b)   Lynne is in Nanyuki, (0°, 37° E) and wants to take a flight to Yaren (0°, 167° E).

    (i)   What is the distance, to the nearest kilometre, between the two towns?   **2**

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    (ii)   Lynne's plane travels at an average speed of 875km/h. How long will the flight take correct to the nearest hour?   **1**

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    (iii)   Lynne departs from Nanyuki at 7am on Tuesday morning. What day and time will she arrive in Yaren?   **2**

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Question 27 (continued)

(c)   Solve algebraically these simultaneous equations to find x and y: **3**

$$y = 7 - 3x$$
$$2x + 3y = -14$$

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(d)   (i)   Mia was travelling at a speed of 60 km/h in dry conditions and has a reaction time of 2.5 seconds.

       What was Mia's reaction-time distance to the nearest metre?   **2**

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Question 27 (continued)

(d)   (ii)   The breaking distance d can be calculated using the formula:

$d = 0.01v^2$
where d is the breaking distance in metres
v is the speed of the car in km/h

Calculate the breaking distance of the car.   2

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(iii)   Calculate the stopping distance of the car.   1

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End of Question 27

Question 28 (15 marks)

(a)   Fiona downloads a 14.3 MB file in 3 minutes and 14 seconds.

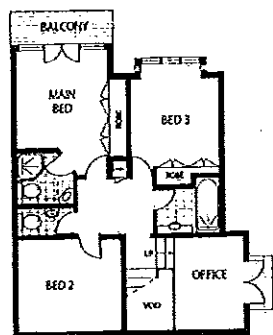(i)   How many kilobits are in 14.3 MB?   2

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(ii)   What is the download speed correct to the nearest kbps?   2

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Question 28 continues over the page

Question 28 (continued)

(b) This is the scale diagram of the first floor of a terrace house.

Scale
1 : 200

(i) What are the internal measurements of bedroom 2?   **2**
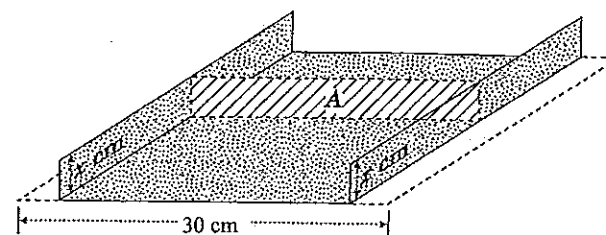
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(ii) What is the cost of carpeting bedroom 2 if carpet costs $34/m²?   **2**

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Question 28 continues over the page

Question 28 (continued)

(c) A long rectangular sheet of cardboard 30cm wide is to be made into the base of a doll's house by turning up sides of equal height x cm, perpendicular to the base.

(i) Show that a formula for the cross-sectional area, A, is
$A = 30x - 2x^2$.   **1**

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(ii) Explain why the formula in part (i) is only valid for values of x between 0 and 15.   **1**

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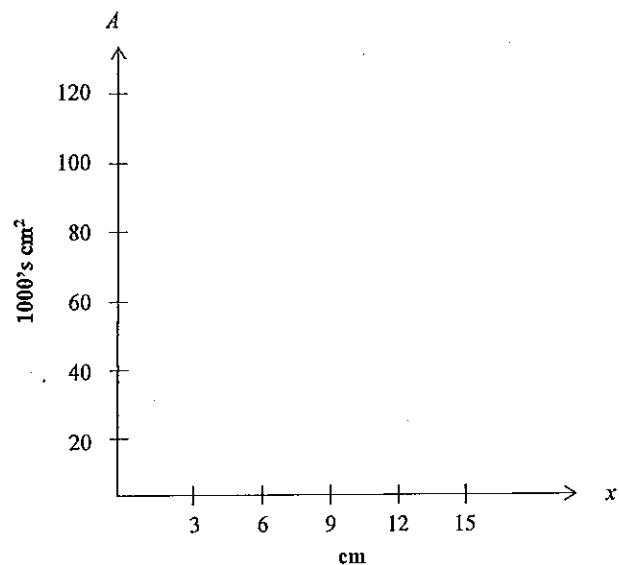_____

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Question 28 continues over the page

Question 28 (continued)

(iii) Complete the table below for $A = 30x - 2x^2$.　　　　　　**1**

x	0	3	6	7.5	12	15
A	0	72	108			

(iv) Using the values from the table and any others that may be appropriate, draw the graph showing the relationship between x and A.　　　**3**

(v) What is the maximum value of A?　　　　　　**1**

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End of Question 28

Question 29 (15 marks)

Luke buys a car which costs $20 000. He has $4500 and borrows $15 500 at 8% per annum reducible interest. He makes payments of $188 per month. The term of the loan is 10 years.

Luke has constructed this spread sheet so that he can keep account of his payments.

Loan table				
	Amount =$15500		This table assumes the same number of days in each month, ie Interest=Rate/12 × Principal	
	Annual interest rate = 8%			
	Monthly repayment (R) =$188			
N	Principal (P)	Interest (I)	$P + I$	$P + I - R$
1	15500	103.33	15603.33	15415.33
2	15415.33	102.77	15518.10	15330.10
3	15330.10	102.20	15432.30	15244.30
4	15244.30			

(a) (i) Complete the next row in the table ie when $N = 4$.　　　　**2**

(ii) What is the total amount that Luke has to pay for this loan over the ten year period?　　　**1**

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(iii) In addition to the sale price, Luke has to pay:
- Transfer of registration $30
- Stamp duty which is calculated at $3 for every $100, or part thereof, of the sale price.

How much will Luke spend altogether on the purchase of his car?　　　**3**

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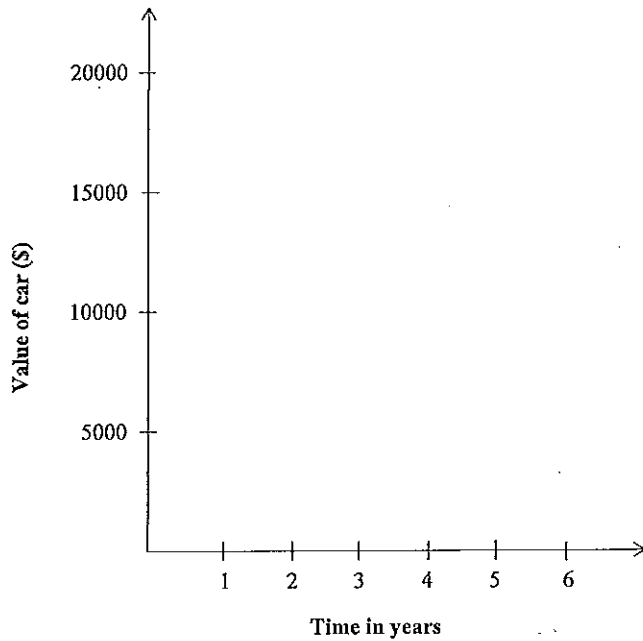
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Question 29 continues over the page

Question 29 (continued)

(b)   (i)   Using the declining balance method of depreciation, the value of Luke's car, $20000, will depreciate at the rate of 25% per annum.
What is the value of the car six years after it was purchased?   2

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(ii)   With one further calculation to find a third point, sketch a graph to show the value of the car over the 6 years.   3
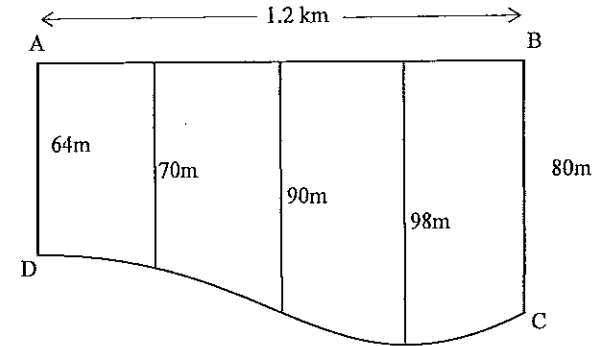

Question 29 continues over the page

Question 29 (continued)

(c)   (i)   Use Simpson's rule twice to find the area of the lake ABCD to the nearest square metre.   2

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(ii)   What is the capacity of the lake in kilolitres if it has a uniform depth of 47m?   2

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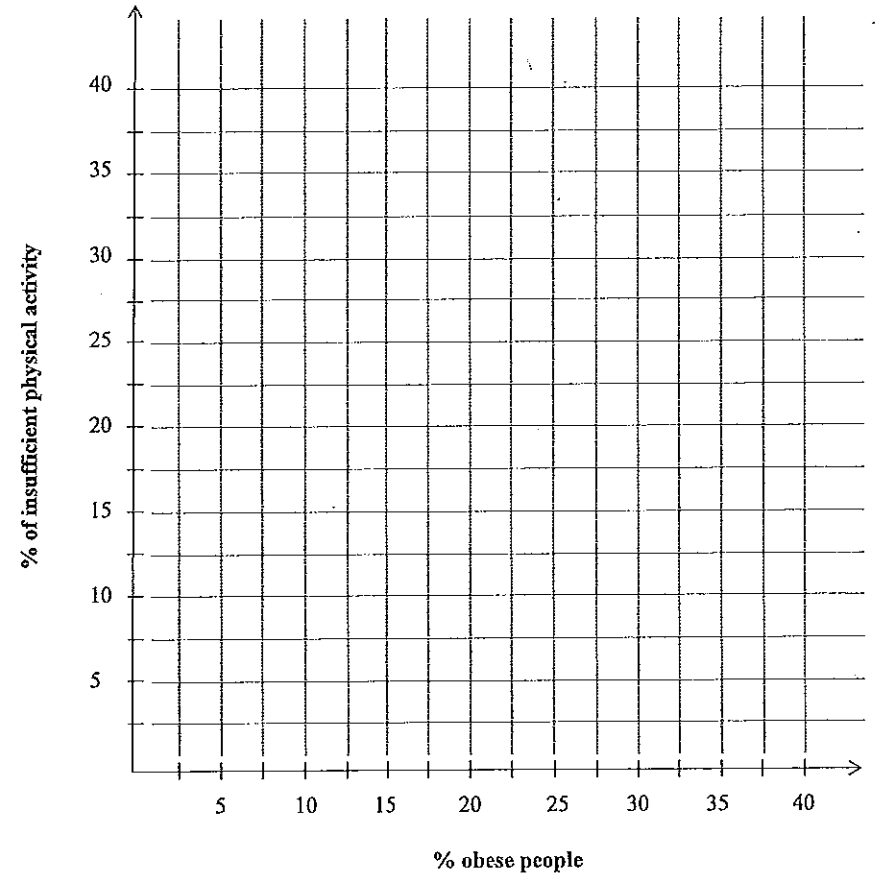_____

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End of Question 29

Question 30 (15 marks)

(a) Data from World Health Organisation has been collected on percentage of people
in 10 countries who are classified as physically inactive and the corresponding
percentage of people who are classified as obese. The data for the countries is
shown in the table.

% of population who are obese	% of population who are physically inactive
5	6
10	20
15	18
20	24
24	28
25	32
28	22
29	27
30	34
34	20

Question 30 (continued)

(a) (ii) Find for the given data, the correlation coefficient r correct to two decimal places. **1**

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(iii) What does this indicate about the relationship between obesity and physical inactivity? **1**

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(iv) Complete the table below by calculating the mean and standard deviation of these data. Calculate values correct to two decimal places. **2**

	Mean	Standard deviation
% of people who are obese	$\bar{x} = 22$	$\sigma_x =$
% of people with insufficient physical activity	$\bar{y} =$	$\sigma_y = 7.60$

Question 30 continues over the page

Question 30 (continued)

(a) (v) Using the values from the table in part (iv) and the value of r in part (ii) show that the equation of the least-squares lines of best fit is $y = 0.6x + 10$. **3**

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(vi) Draw the least-squares line of best fit, on your scatterplot. **2**
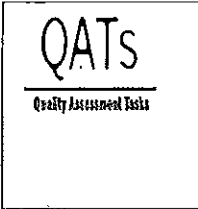
(b) Katie plans to have $30 000 in an investment account in 10 years for her beauty business.

The interest rate for the investment account will be fixed at 4% per annum compounded monthly.

Calculate the amount she will need to deposit into the account now in order to achieve her plan. **4**

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End of Question 30

2015 HIGHER SCHOOL CERTIFICATE
TRIAL EXAMINATION

MATHEMATICS GENERAL 2
Marking Guidelines

Question	Answer
1	C
2	A
3	A
4	B
5	D
6	D
7	D
8	D
9	B
10	C
11	A
12	A
13	D
14	C
15	C
16	A
17	B
18	C
19	C
20	B
21	A
22	B
23	C
24	B
25	B

Section II

Question 26 (a) (i)

Criteria	Mark
• Correct answer	1

Sample answer
Median is 46.

Question 26 (a) (ii)

Criteria	Mark
• Correct answer	1

Sample answer
Upper quartile is 65.

Question 26 (a) (iii)

Criteria	Mark
• Correct answer	1

Sample answer
65-38=27.

Question 26 (a) (iv)

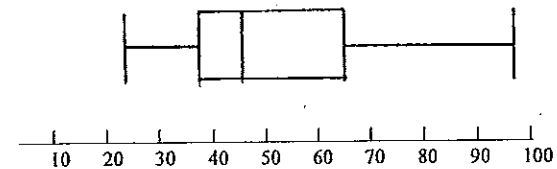| Criteria	Mark
• Shows correct substitution with correct conclusion	1

Sample answer
65+1.5x27=105.5.
No this is not an outlier as it is not greater than 105.5.

Question 26(a) (v)

Criteria	Marks
• Draws correct box-and-whisker plot	2
• Progress towards correct answer	1

Sample answer

Question 26 (a) (vi)

Criteria	Mark
• Correct answer from graph	1

Sample answer
Positively skewed.

Question 26 (b) (i)

Criteria	Marks
• Correct solution	2
• Correct substitution into the cosine rule	1

Sample answer
$PR^2 = 4.9^2 + 3.6^2 - 2 (4.9) (3.6) \cos 74°$
$\quad = 27.2455 \ldots$
$PR = 5.2$

Question 26 (b) (ii)

Criteria	Mark
• Correct substitution into the sine rule	1

Sample answer

$A = 1/2 \times 4.9 \times 3.6 \times \sin74°$
$\quad = 8.5 \text{ km}^2$

Question 26 (b) (iii)

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer

$42 + 74 + 180 = 296°T.$

Question 26 (c)

Criteria	Marks
• Provides correct solution	3
• Demonstrates more than one correct algebraic step	2
• Demonstrates a correct algebraic step	1

Sample answer
$3 (7x) - 4 (2x + 1) = 12 (2 - x)$
$21x - 8x - 4 = 24 - 12x$
$25x = 28$
$x = 1.12$

Question 27 (a)

Criteria	Marks
• Correct solution	2
• Progress towards correct solution	1

Sample answer
$40/x = 25/180$
$x = 288$

Question 27 (b) (i)

Criteria	Marks
• Provides correct answer	2
• Provides correct longitude difference	1

Sample answer
$167° - 37° = 130°$
$130/360 \times 2\times\pi\times6400 = 14521 \text{km}$

Question 27 (b) (ii)

Criteria	Mark
• Provides correct answer	1

Sample answer
$T = 14521/875$
$\quad = 16.6$
$\quad = 17 \text{ h}$

Question 27 (b) (iii)

Criteria	Marks
• Provides correct answer	2
• Provides correct longitude difference	1

Sample answer
$130° = 130 \times 4$ minutes
$\quad = 520$ minutes
$\quad = 8h\ 40$ minutes
$17h + 8h\ 40$ minutes $= 25\ h\ 40$ minutes
Wednesday at 8.40 am

Question 27 (c)

Criteria	Marks
• Calculates correct values of x and y	3
• Demonstrates correct method	2
• Evaluates one value correctly	
• Shows substitution or equivalent	1

Sample answer
$2x + 3(7 - 3x) = -14$
$2x + 21 - 9x = -14$
$-7x = -35$
$x = 5$

$y = 7 - 3x5$
$y = -8$

Question 27 (d) (i)

Criteria	Marks
• Correct answer	2
• Converts speed to metres/ second	1

Sample answer
60 km/h $= 16.7$ m/s
$D = 16.7 \times 2.5$
$\quad = 42$ m

Question 27 (d) (ii)

Criteria	Marks
• Correct answer	2
• Correct substitution into formula	1

Sample answer
$d = 0.1 \times 60^2$
$\quad = 36$ m

Question 27 (d) (iii)

Criteria	Mark
• Correct answer	1

Sample answer
42 m $+ 36$ m $= 78$ m

Question 28 (a) (i)

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer
$14.3 \times 1024 \times 1024 \times 8 \div 1000 = 119957$ kb

Question 28 (a) (ii)

Criteria	Marks
• Correct answer	2
• Progress towards correct answer	1

Sample answer

3 minutes 14 seconds $= 180 + 14$ seconds
$\qquad\qquad\qquad = 194$ seconds

$119957 \div 194 = 618$ kbps

Question 28 (b) (i)

Criteria	Marks
• Correct actual measurements	2
• Correct measurements in cm	1

Sample answer
1.9 cm by 1.7 cm

3.8 m by 3.4 m

Question 28 (b) (ii)

Criteria	Marks
• Correct answer	2
• Correct area	1

Sample answer

$A = 3.8 \times 3.4$
$\quad = 12.92$ m^2 $\times \$34$
$\quad = \$439.28$

Question 28 (c) (i)

Criteria	Mark
• Provides correct conclusion with appropriate calculations	1

Sample answer
$A = x(30 - 2x)$

Question 28 (c) (ii)

Criteria	Mark
• Gives a correct reason	1

Sample answer
Any value <0 or any value > 15 will result in a negative value for Area.

Question 28 (c) (iii)

Criteria	Mark
• Correct answer	1

Sample answer

x	0	3	6	7.5	12	18
A	0	72	108	112.5	72	0

Question 28 (c) (iv)

Criteria	Marks
• Correct graph	3
• Plot all points correct from table	2
• Plot some points corresponding to values in table	1
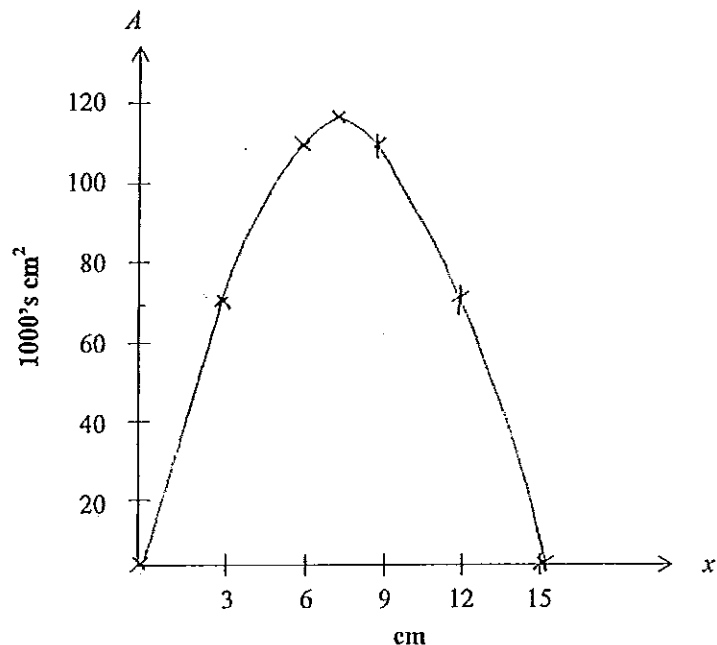
Question 28 (c) (v)

Criteria	Mark
• Correct answer	1

Sample answer
Maximum value for Area is 112.5 cm².

Question 29 (a) (i)

Criteria	Marks
• Provides all correct values	2
• Provides 1 correct value	1

Sample answer

4	15244.30	101.63	15345.93	15157.93

Question 29 (a) (ii)

Criteria	Mark
• Provides correct solution	1

Sample answer
$188 x 12 x 10 = $22560.

Question 29 (a) (iii)

Criteria	Marks
• Correct answer	3
• More than one calculation correct	2
• One calculation correct	1

Sample answer
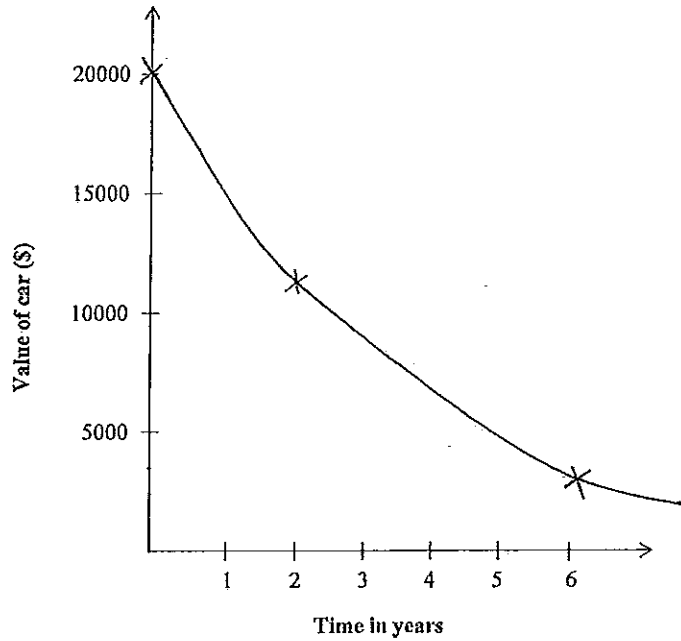$ 22560 + $4500 + $30 + $3 x 20000/100
= $ 27690

Question 29 (b) (i)

Criteria	Marks
• Provides all correct values	2
• Provides 1 correct value	1

Sample answer
$S = \$ 20000 \times (1 - 0.25)^6$
= $ 3559.57

Question 29 (b) (ii)

Criteria	Marks
• Correct graph	3
• Plots three points correctly	2
• Finds one further point	1

Question 29 (c) (i)

Criteria	Marks
• Correct solution	2
• Correct substitution into Simpson's rule	1

Sample answer

h=1.2 km ÷4 = 300 m

A = 300/3 (64 + 4x70 +90) + 300/3 (90 + 4x98 + 80)

= 99600 m²

Question 29 (c) (ii)

Criteria	Marks
• Expresses volume in kL	2
• Finds correct volume	1

Sample answer

V = 99600 x 47

= 4681200 m³

= 4681200 kL

Question 30 (a) (i)

Criteria	Marks
• Plots all points correctly	2
• Plots some points correctly	1

Sample answer
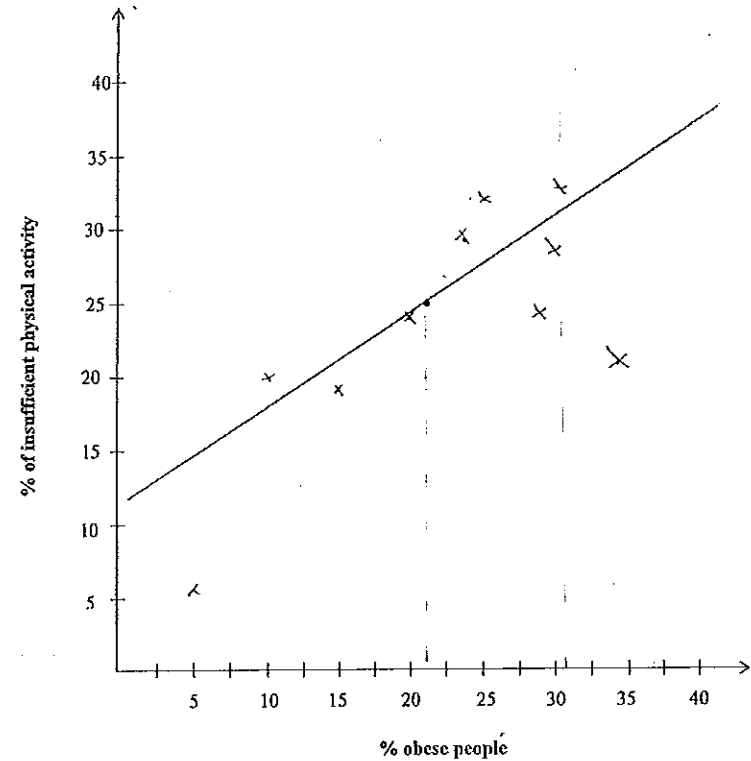
Question 30 (a) (ii)

Criteria	Mark
• Correct answer	1

Sample answer
r = 0.69

Question 30 (a) (iii)

Criteria	Mark
• Correct answer	1

Sample answer
Moderate positive correlation

Question 30 (a) (iv)

Criteria	Marks
• Finds both values correctly	2
• Finds one correct value	1

Sample answer

	Mean	Standard deviation
% obese (x)	22	8.90
% physically inactive (y)	23.1	7.60

Question 30 (a) (v)

Criteria	Marks
• Finds correct values for gradient and y intercept	3
• Finds either gradient or y intercept	2
• Correct substitution into one formula	1

Sample answer
Gradient = 0.69 x 7.60/8.90
$\qquad$ = 0.6 (correct to one decimal place)
y intercept = 23.1 – 0.6 x 22
$\qquad$ = 9.9
$\qquad$ = 10 to the nearest integer
y= 0.6x + 10

Question 30 (a) (vi) 2 marks

See (a) (i)
Correct y intercept with correct gradient or point (22, 23) with correct gradient.

Question 30 (b)

Criteria	Marks
• Provides correct solution	4
• Substitutes correct value for r and n into correct formula	3
• Substitutes correct value for r or n into correct formula	2
• Converts rate or time	1

Sample answer
FV = $ 30000
r = 4/1200
n = 120

PV = 30000 ÷ (1 + 4/1200)^{120}
$\qquad$ = $20122.98