NSW INDEPENDENT SCHOOLS

2016
Higher School Certificate
Trial Examination

General Mathematics 1

General Instructions

- Reading time – 5 minutes
- Working time – 1½ hours
- Write using black pen
- Board-approved calculators may be used
- Draw diagrams using pencil
- Write your student number and/or name at the top of every page

Total marks – 60

Section I – Pages 2–12
20 marks
- Attempt Questions 1–20
- Allow about 30 minutes for this section

Section II – Pages 13–22
40 marks
- Attempt Questions 21–24
- All questions are of equal value
- Allow about 1 hour for this section

This paper MUST NOT be removed from the examination room

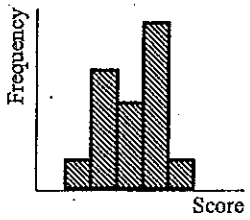
STUDENT NUMBER/NAME: .....

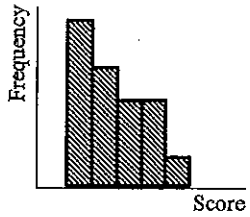
1 Petra's hourly rate of pay is $42.80. During a particular week, Petra is paid for 25 normal hours, 4 hours at the time and a half rate and 2 hours at the double time rate.

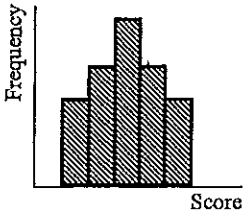
How much was Petra paid for her 31 hours work this week?

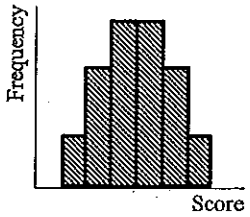
(A) $1177
(B) $1326.80
(C) $1455.20
(D) $1498

2 Which of these frequency distributions shows data that is bi-modal?

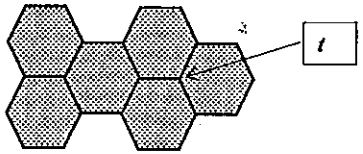
(A)


(B)


(C)


(D)


3 The diagram shows a tessellation of a regular hexagon.



If 'a' represents the number of sides of one hexagon and 'b' represents the number of sides that meet at a vertex within the tessellation (t), what is the value of $(a-2)(b-2)$?

(A) 1
(B) 2
(C) 4
(D) 6

4 A person's lung capacity (in litres) can be estimated using the formula:

$$\textit{Lung capacity} = 0.041 \times \textit{Height}\ (\text{cm}) - 0.018 \times \textit{age} - 2.69$$

where age is measured in years.

Bertina is 20 years old and her height is 169 cm.

What is her lung capacity?

(A) 3.9
(B) 4.3
(C) 4.9
(D) 5.2

5 Rainfall from Aswan's roof is collected in a rainwater tank with a capacity of 5000 L.

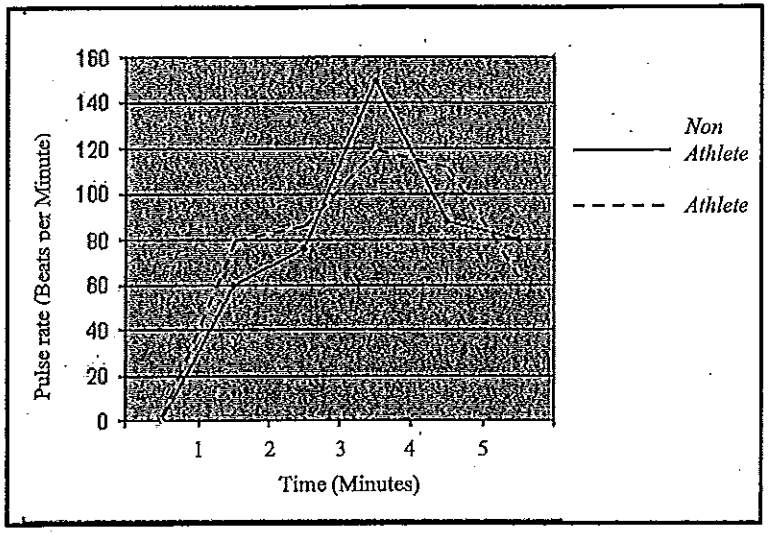
The roof is 18.5 m × 14.25 m. 1 mm of rainfall on the roof is equivalent to 1 litre/m^2.

Approximately what percentage of the rainwater tank's capacity would 4 mm of water from Aswan's roof fill?

(A) 12
(B) 16
(C) 21
(D) 30

6 The graph shows the differences in the pulse rate of an athlete and a non-athlete throughout the same 6 minute exercise program.

Pulse rate during exercise



After how many minutes did the greatest difference between the pulse rates of the athlete and non-athlete occur?

(A) 2.5
(B) 3.5
(C) 5
(D) 6

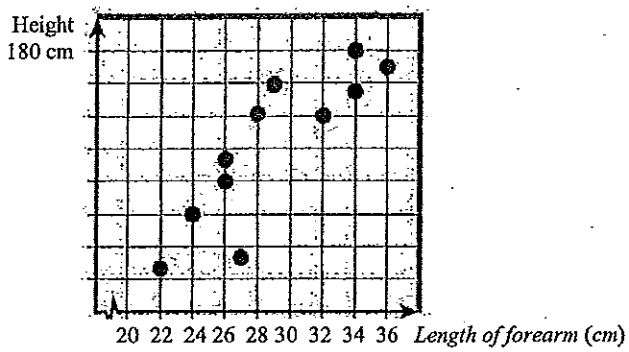
7 A builder provided a written quotation of $18 250 to complete some renovations requested by a homeowner.

The quotation included a G.S.T of 10%.

Which of these calculations would give the amount of the G.S.T included in the quotation?

(A) $18 250 ÷ 11
(B) $18 250 ÷ 0.1
(C) $18 250 – 1.1
(D) $18 250 × 0.1

8 This scatterplot shows the relationship between the height and the length of the forearm of a number of people selected at random.



How would the correlation between height and forearm length best be described?

(A) Random

(B) Positive

(C) Non-linear

(D) Negative

9 The following two-way table records the results of driving tests over a six month period:

	Males	Females	*Total*
Passed on first attempt	61	59	120
Passed on second attempt	15	13	28
Total	76	72	148

What is the probability that if a person who completed the driving test was chosen at random, this person would be female and passed the test on the second attempt?

(A) $\frac{13}{72}$

(B) $\frac{13}{28}$

(C) $\frac{13}{148}$

(D) $\frac{7}{37}$

10 The table shows different blood types and the people who can be given this blood, if required.

Blood type	*People who can be given this blood*
O	O, A , B, AB
A	A, AB
B	B, AB
AB	AB only

Four different people and their blood types are shown.

	Blood type
Sharma	B
Mahar	A
Jaime	AB
Carl	O

Which statement is correct?

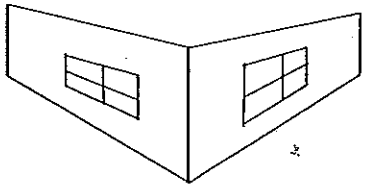
(A) Mahar can donate the blood type required by Sharma

(B) Sharma can donate the blood type required by Mahar

(C) Carl can donate the blood type required by Jamie

(D) Jaime can donate the blood type required by Carl

11 The diagram showing the corner of a building is in perspective.



How many vanishing points does the drawing have?

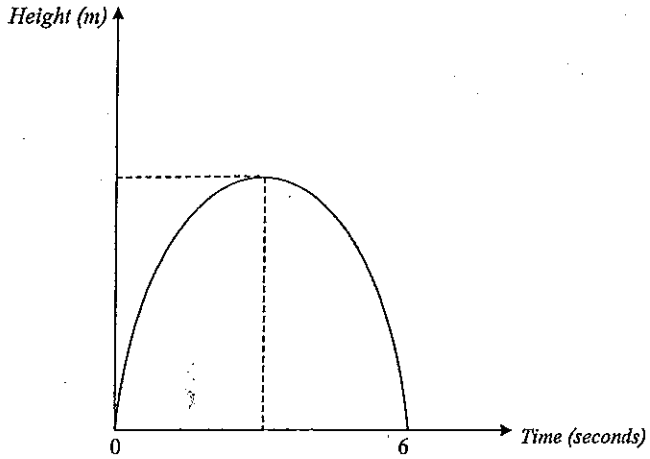
(A) 0

(B) 1

(C) 2

(D) 3

12 The height (h) in metres of a cricket ball hit into the air is given by the equation: $h = 12t - 2t^2$ where t is time in seconds. The graph of this equation is shown below.



What was the maximum height the ball reached?

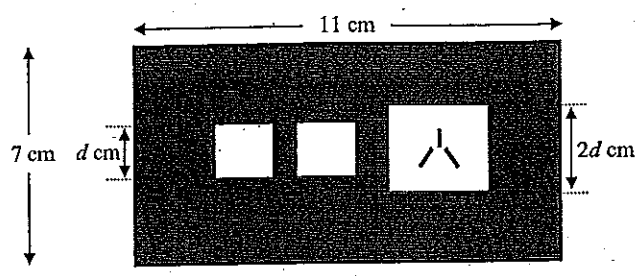
(A) 6
(B) 9
(C) 12
(D) 18

13 It is estimated that an antique collection will appreciate in value at a rate of 6% per annum.

If the collection is worth $42 500 today, what will be its predicted value in 5 years time?

(A) $55 250
(B) $56 875
(C) $66 250
(D) $80 100

14 An 11 cm × 7 cm rectangular power point cover plate is shown.

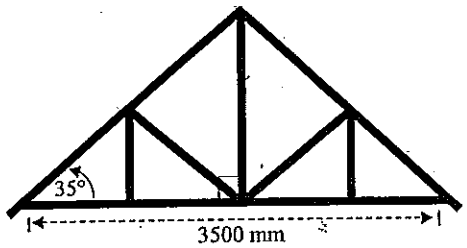


Three squares, two of edges d cm and one with edge $2d$ cm are cut from the plate to allow for the on/off switch, internet connection and power.

What is the area of the plate remaining in square centimetres, after the squares are cut?

(A) $71 - d^2$
(B) $73 - d^2$
(C) $77 - 4d^2$
(D) $77 - 6d^2$

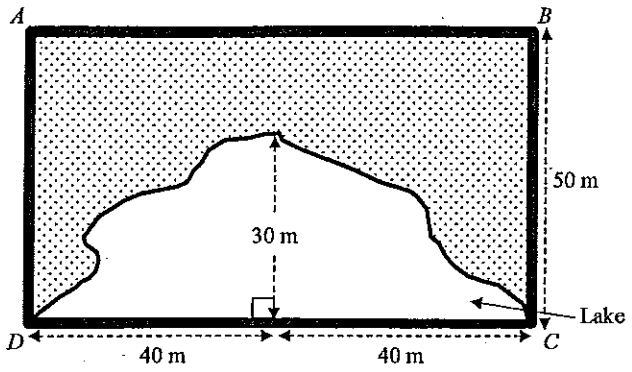
15 A roof truss with a pitch of 35° is shown below.



What is the height of the truss to the nearest millimetre?

(A) 1225
(B) 1435
(C) 2008
(D) 2451

16 An artificial lake is to be constructed within a rectangular enclosure *ABCD* in a new estate.



What percentage of the area of the rectangular enclosure does the lake cover?
(Note: Simpson's Rule: $A = \frac{h}{3}(d_f + 4d_m + d_l)$).

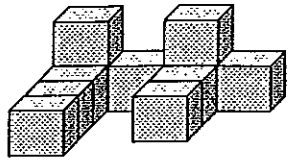
(A) 20
(B) 25
(C) 35
(D) 40

17 There are 34 numbers and 2 winning symbols on a prize wheel for a charity.
If the wheel stops on one of the winning symbols, $10 is paid. Thomas pays $2 to spin the wheel.

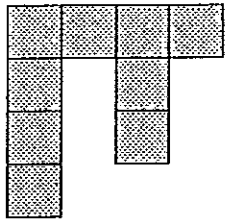
What is Thomas's financial expectation from spinning the wheel?

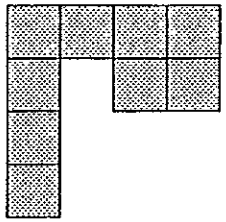
(A) −$1.29
(B) −$1.33
(C) −$1.94
(D) $1.35

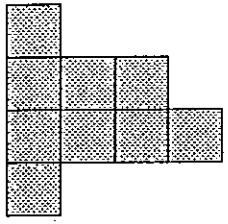
18 A solid is made from a number of cubes.

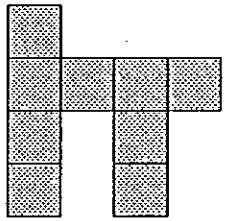


Which of these diagrams correctly shows the top view of the solid?

(A)


(B)


(C)


(D)


19 The amount owing on Abraham's credit card when he received his statement was $2450.

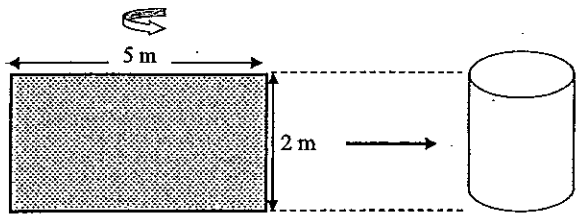
The minimum amount Abraham must pay is 2.5%, and the balance owing attracts an annual interest rate of 20% added to his account daily until this balance is paid in full.

Abraham pays the minimum amount required this month by the required date and makes no further purchases.

What will be the amount Abraham owes on his credit card 15 days after paying the minimum amount?

(A) $1837.50
(B) $2403.85
(C) $2408.38
(D) $2470.94

20 A rectangular sheet of thin aluminium is rolled into an open cylindrical drum, as shown.



What is the volume (in cubic metres correct to one decimal place) of the drum?

(A) 4.0

(B) 10.0

(C) 31.4

(D) 62.8

Section II

40 marks
Attempt Questions 21–24
Allow about 1 hour for this section

Answer the questions in the spaces provided.

Your responses should include relevant mathematical reasoning and/or calculations.

Extra writing space is provided on page 22. If you use this space, clearly indicate which question you are answering.

Question 21 (10 marks) **Marks**

(a) Calculate the volume (in cm^3) of this 3 dimensional shape. 3

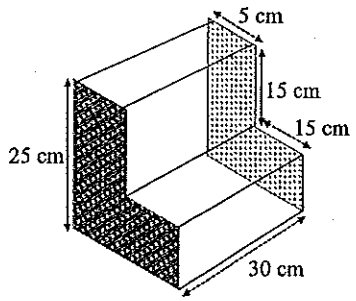


DIAGRAM
NOT TO SCALE

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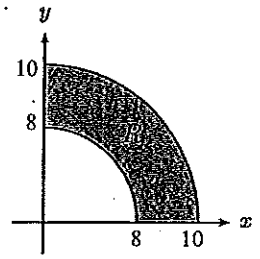
Question 21 continues on the next page

Question 21 (continued) **Marks**

(b) The diagram shows part of an annulus drawn on the x-y number plane.



Use the formula: $R = \frac{\pi}{4}(r_1 + r_2)(r_1 - r_2)$ where r_1 is the outer radius and r_2 is the inner radius, to calculate R, the area of the part annulus.

(Give your answer correct to the nearest whole number). **2**

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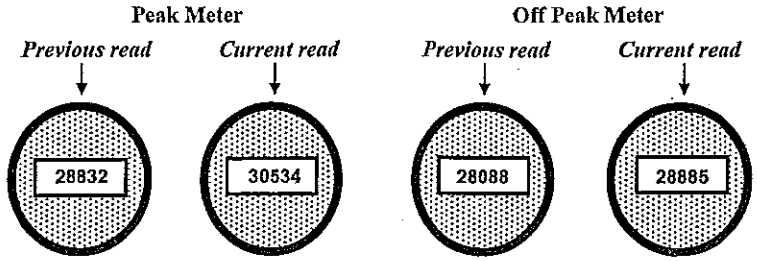
Question 21 continues on the next page

Question 21 (continued) **Marks**

(c) The two electricity meters installed in Brett's home are shown with the previous and current readings (in kWh).



The electricity company has the following charges for electricity usage:

Peak Usage:	First 0–1074 kWh	21.81c/kWh
	Next 1075–1879	21.22c/kWh
	Supply charge:	74.32c/day
Off Peak Usage:	6.92c/kWh	
	Supply charge:	4.96c/day

There were 98 days between the previous and current readings on Brett's meters.

(i) What are the total kilowatt hours (kWh) Brett used over the 98 days? **1**

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(ii) What is Brett's average daily usage of electricity in his home? **1**

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(iii) Calculate the total amount Brett will need to pay his electricity company for his use of electricity during the 98 days (include usage, supply charges and 10% G.S.T). **3**

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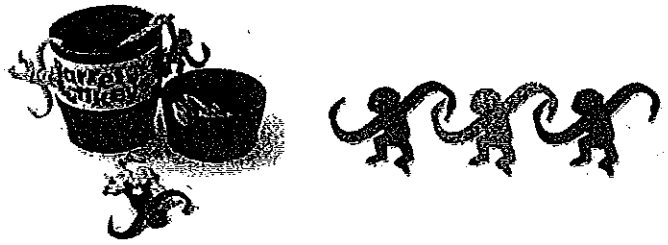
End of Question 21

STUDENT NUMBER/NAME: .....

Question 22 (10 marks) **Marks**

(a) A barrel of 12 plastic toy monkeys has 6 red, 4 yellow and 2 green.

Three of these monkeys when taken out of the barrel are linked, as shown.



(i) What is the probability that the first monkey in the link is yellow? **1**

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(ii) What is the probability that the first two linked monkeys are yellow? **2**

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(iii) If the three monkeys are of different colours, in how many ways can they be linked? **1**

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(iv) What is the probability that all 3 linked monkeys are of different colours? **2**

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Question 22 continues on the next page

Question 22 (continued) **Marks**

(b) Solve the equation: $\frac{2-10p}{5}=4$ **2**

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(c) Write down TWO properties of normally distributed data. **2**

1. .....

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2. .....

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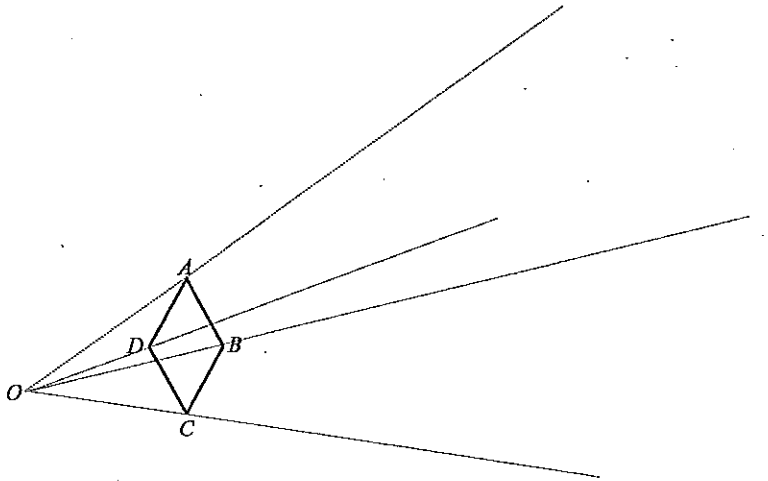
End of Question 22

STUDENT NUMBER/NAME: .....

Question 23 (10 marks) **Marks**

(a) Kaleb has begun an enlargement of $ABCD$ by drawing guidelines from a point O through each of the vertices, as shown.

Kaleb has been asked to enlarge $ABCD$ by a factor of 3 and to label the image $A^1B^1C^1D^1$.



(i) Using instruments and a pencil, complete the enlargement using the guidelines. **3**

(ii) What is the ratio of OA to OA^1? **1**

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(iii) What is the ratio of the area of $ABCD$ to the area of $A^1B^1C^1D^1$? **1**

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Question 23 continues on the next page

STUDENT NUMBER/NAME: .....

Question 23 (continued) **Marks**

(b) The following table shows the monthly repayments on a \$1000 loan for different interest rates and different terms (number of years).

Annual interest rate	*10 years*	*15 years*	*20 years*	*25 years*
5%	\$10.61	\$7.91	\$6.60	\$5.85
5.25%	\$10.73	\$8.04	\$6.74	\$5.99
5.5%	\$10.85	\$8.17	\$6.88	\$6.14
5.75%	\$10.98	\$8.30	\$7.00	\$6.29
6.00%	\$11.10	\$8.44	\$7.16	\$6.44

Jackson wants to take out a loan of \$450 000 at an annual interest rate of 5.5%.

(i) What would be Jackson's monthly repayments on this loan over a 20-year term? **1**

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(ii) What total amount would Jackson repay over the 20-year term? **1**

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(iii) How much interest would be charged on Jackson's loan over the 20-year term? **1**

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(iv) How much interest would Jackson save if he repaid his loan over 15 years instead of 20 years? (The same 5.5% interest rate applies). **2**

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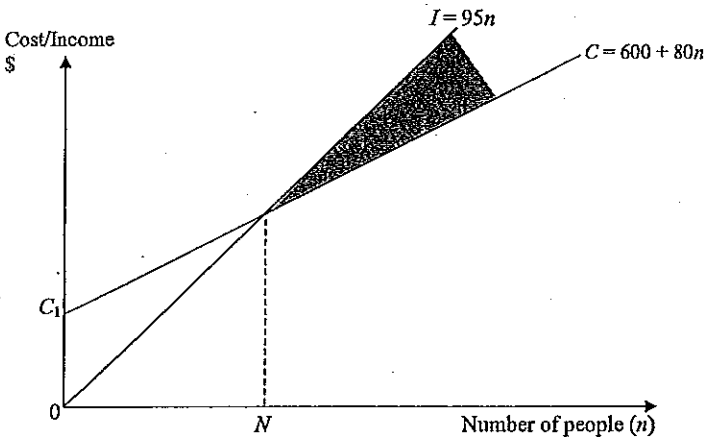
End of Question 23

STUDENT NUMBER/NAME: .....

Question 24 (10 marks) **Marks**

(a) A company operates harbour cruises on its luxury yacht.

The graphs below show the company's cost (C) and income (I) functions for the number of people who book a cruise on the yacht.



(i) What value is represented at C_1? **1**

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(ii) How much is each passenger charged to take the harbour cruise? **1**

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(iii) If 20 people booked a cruise, calculate the profit or loss made by the company. **2**

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(iv) Explain what the shaded section on the graph represents. **1**

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(v) By solving an equation, determine the value of N and hence, write down the minimum number of people required to book a cruise for the company to make a profit. **2**

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Question 24 continues on the next page

STUDENT NUMBER/NAME: .....

Question 24 (continued) **Marks**

(b) A home theatre has floor dimensions 4500 mm × 5250 mm and the floor to ceiling height is 2700 mm.

Soundproofing material is to be installed on all 4 walls and the ceiling of the theatre at a cost of \$250/m^2. (The door to the theatre is also to be soundproofed).

Calculate the total cost of soundproofing the theatre. **3**

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End of paper

NSW INDEPENDENT TRIAL EXAMS – 2016
GENERAL MATHEMATICS 1 (YR 12 TRIAL EXAM)
MARKING GUIDELINES

Section I

Question	Answer	Assessed Outcome	Band
1.	D	FM1, MGP-6	3
2.	D	DS4CEC, MG1H-3	3
3.	C	FSDe2CEC, MG1H-4	3
4.	A	FSHu3CEC, MG1H-3	3
5.	C	FSPe1CEC, MG1H-3	3
6.	B	FSHu1CEC, MG1H-2	3
7.	A	FSHo2CEC, MG1H-6	3
8.	B	FSHu2CEC, MG1H-2	3
9.	B	DS5CEC, MG1H-2	4
10.	C	FSHu1CEC, MG1H-2	4
11.	C	FSDe1CEC, MG1H-4	4
12.	D	AM4CEC, MG1H-3	4
13.	B	FM2, MGP-6	4
14.	D	AM3CEC, MG1H-9	4
15.	A	FSDe1CEC, MG1H-4	4
16.	D	MM4CEC, MG1H-4	5
17.	B	PB2CEC, MG1H-3	5
18.	A	FSDe1CEC, MG1H-4	5
19.	C	FM4CEC, MG1H-6	6
20.	A	MM4CEC, MG1H-4	6

Section II

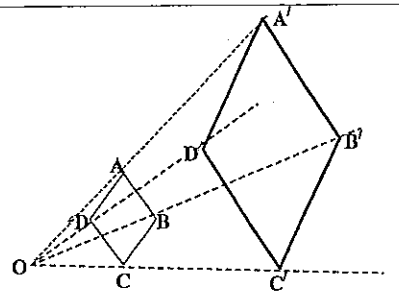
Question 21

Part	Answer	Mark	Outcome Assessed	Band
(a)	$V = AH$ $= ((25 \times 20) - (15 \times 15)) \times 30\ cm^3$ $= (500 - 225) \times 30\ cm^3$ $= \mathbf{8250\ cm^3}$ OR $((25 \times 5) + (15 \times 10)) \times 30$ $= 275 \times 30$ $= 8250\ cm^3$	1 1 1	MM2, MGP4	3
(b)	$R = \frac{\pi}{4}(10+8)(10-8)$ $= \frac{\pi}{4}(18)(2)$ $= 9\pi$ $= \mathbf{28\ cm^2}$	1 1	MM4CEC, MG1H-4	3
(c)(i)	Peak Usage: 30 534 – 28 832 kwh = 1702 kWh Off Peak: 28 885 – 28 088 kWh = 797 kWh **Total: 2499 kWh**	 1	FSPe2CEC, MG1H-3	3
(ii)	Daily average: 2499 kWh ÷ 98 **= 25.5 kWh**	1	FSPe2CEC, MG1H-7	4
(iii)	Peak usage: 1074 × 0.2181 + (1702 – 1074) × 0.2122 **= $367.50** Supply charge: 98 × 0.7432 = **$72.83** Off Peak usage: 797 × 0.069 = **$55.15** Supply charge: 98 × 0.0496 = **$4.86** **Total charges: $500.34** **Total charges + GST = $500.34 + 10%** **= $550.37**	 1 1 1	FSPe2CEC, MG1H-9	5

Question 22

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)	$\frac{4}{12}=\frac{1}{3}$	1	PB2CEC, MG1H-2	3
(ii)	$\frac{4}{12}\times\frac{3}{11}$ $=\frac{1}{11}$	1 1	PB2CEC, MG1H-2	3
(iii)	$3\times2\times1=6$ **ways**	1	PB2CEC, MG1H-3	4
(iv)	Since there are 6 ways of the colours being linked, required probability $=6\times P(R, Y, G)$ $=6\times\frac{6}{12}\times\frac{4}{11}\times\frac{2}{10}$ $=\frac{12}{55}$	1 1	PB2CEC, MG1H-2	5
(b)	$2-10p=20$ $-10p=18$ $P=-1.8$	1 1	AM3CEC, MG1H-3	4
(c)	1. **The mean, mode and median are all equal.** 2. If the distribution is represented by a histogram, **the resulting frequency graph (polygon) would be "bell" shaped.**	1 1	DS4CEC, MG1H-10	4

Question 23

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)	 Students must label image ($A'B'C'D'$) and ensure that all measurements are reasonably accurate: e,g. $OA' = 3OA$ etc. and that evidence of instruments have been used in the drawing in order to gain full marks.	3	FSDe2CEC, MG1H-4	4
(ii)	**1:3**	1	FSDe2CEC MG1H-4	3
(iii)	If an object is enlarged in the ratio 1:k, then the areas of the object and image are in the ratio $1:k^2$ Hence the ratio in this case is $1:3^2 = 1:9$	1	FSDe2CEC MG1H-4	5
(b)(i)	$450\times\$6.88 = \$3096$	1	FSHo1CEC MG1H-6	4
(ii)	$\$3096\times20\times12 = \$743\,040$	1	FSHo1CEC MG1H-6	4
(iii)	$\$743\,040 - \$450\,000 = \$293\,040$	1	FSHo1CEC MG1H-6	4
(iv)	Over 15 years, total repayments are: $450\times\$8.17\times15\times12 = \$661\,770$ Interest charged $= \$661\,770 - \$450\,000$ $= \$211\,770$ Saving in interest $= \$293\,040 - \$211\,770$ $= \$81\,270$	 1 1	FSHo1CEC MG1H-6	5

Question 24

Part	Answers	Mark	Outcome Assessed	Band
(a)(i)	**$600**	1	AM4CEC MG1H-9	4
(ii)	**From the income equation $I = 95n$, Each person would pay $95**	1	AM4CEC MG1H-3	5
(iii)	Let $n = 20$, then Income $I = 95 \times 20$ **= $1900** Costs $C = \$600 + (80 \times 20)$ **= $2200** **Since Costs exceed Income, the company would make a loss of $300**	 1 1	AM4CEC MG1H-10	5
(iv)	**The shaded section is where Income exceeds Costs when more than N people book a cruise. So this is the Profit the company makes.**	1	AM4CEC MG1H-3/10	4
(v)	Let $95n = 600 + 80n$ *(break-even point)* $15n = 600$ **$n = 40$** **Hence N = 40** which indicates the number of people booking a cruise where the company would "break-even" (Income = Costs). **So for the company to make a profit, at least 41 people must book a cruise.**	 1 1	AM4CEC MG1H-9	6
(b)	Total Area to be soundproofed is: 4 walls: $(2 \times 4.5\text{ m} \times 2.7\text{ m}) + (2 \times 5.25\text{ m} \times 2.7\text{ m})$ **= 52.65 m^2** Ceiling: $5.25\text{ m} \times 4.5\text{ m}$ **= 23.625 m^2** **Total cost of soundproofing:** **$(52.65 + 23.625) \times \$250$** **= $19 068.75**	 1 1 1	FSDe1CEC MG1H-4/5	6