

NSW INDEPENDENT SCHOOLS

2016
Higher School Certificate
Trial Examination

General Mathematics 2

General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using black pen
- Board-approved calculators may be used
- Draw diagrams using pencil
- A Formulae Sheet is provided
- Write your student number and/or name at the top of every page

Total marks – 100

Section I – Pages 2–14
25 marks

- Attempt Questions 1–25
- Allow about 35 minutes for this section

Section II – Pages 15–30
75 marks.

- Attempt Questions 26–30
- All questions are of equal value
- Allow about 1 hour 55 minutes for this section

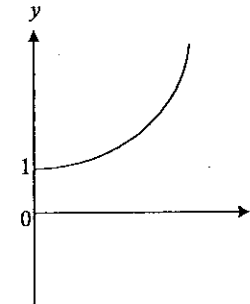
This paper MUST NOT be removed from the examination room

STUDENT NUMBER/NAME:

1 An area of 0.01 hectares is equivalent to which one of these?

- (A) 1 m^2
- (B) 10 m^2
- (C) 100 m^2
- (D) 1000 m^2

2 Which of the equations could be represented by the graph?



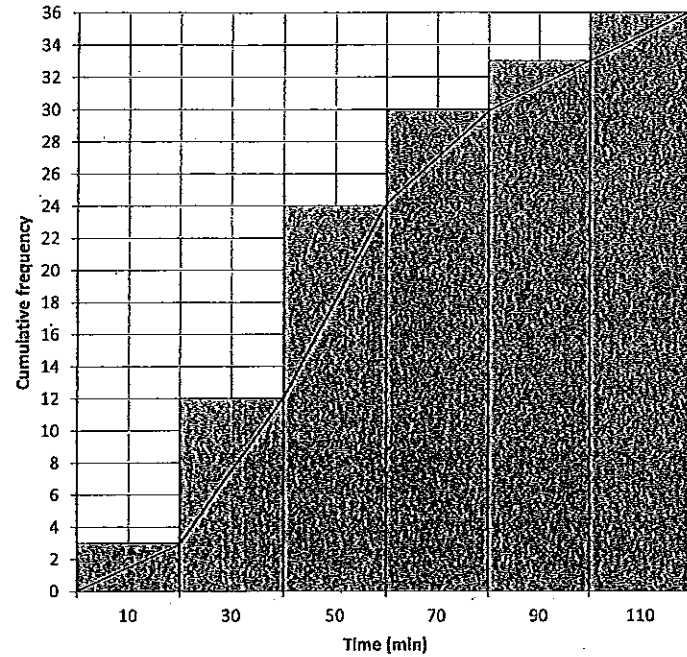
- (A) $y = 2t$
- (B) $y = \frac{2}{t}$
- (C) $y = 2^t$
- (D) $y = 2t^2$

3 A 1 kilowatt cooling fan operates between 11:15 am and 1:15 pm every day in a household.

If electricity is charged at the rate of 22.1 cents per kilowatt hour, what is the cost of running the fan from June 1 to August 31 (inclusive)?

- (A) \$39.34
- (B) \$39.78
- (C) \$40.22
- (D) \$40.66

- 4 The times (in minutes) that planes were late for take-off at an international airport on a particular morning, were recorded in a cumulative frequency histogram, shown below.

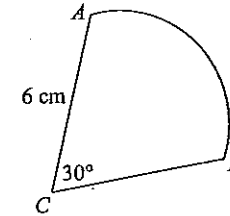


Which of these statements about the information conveyed in the graph is correct?

- (A) 110 planes were late for take-off during the morning.
 (B) The median time that planes were late for take-off was 50 minutes.
 (C) 36 planes were recorded as being 110 minutes late for take-off.
 (D) 15 planes were recorded as being less than 30 minutes late for take-off.
- 5 If $a = -3$ and $b = 2$, what is the value of $\frac{b - a^2}{b - a}$?

- (A) -1.4
 (B) 0.2
 (C) 2.2
 (D) 3

- 6 In terms of π , what is the length of the arc AB of this sector?



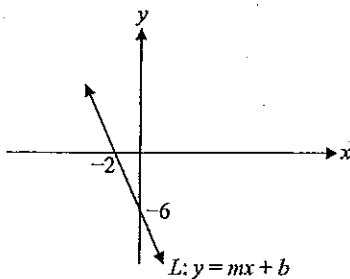
- (A) $\frac{\pi}{2}$
 (B) $\frac{\pi}{3}$
 (C) π
 (D) 2π
- 7 A builder provided a written quotation of \$18 250 to complete some renovations requested by a homeowner.

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) $\$18\,250 \times 0.1$
 (B) $\$18\,250 \div 0.1$
 (C) $\$18\,250 - 1.1$
 (D) $\$18\,250 \div 11$

- 8 In the diagram, the line L has equation $y = mx + b$.

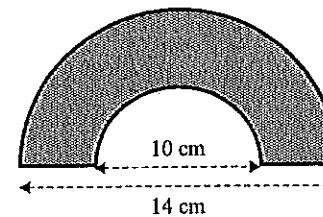


What are the correct values for m and b ?

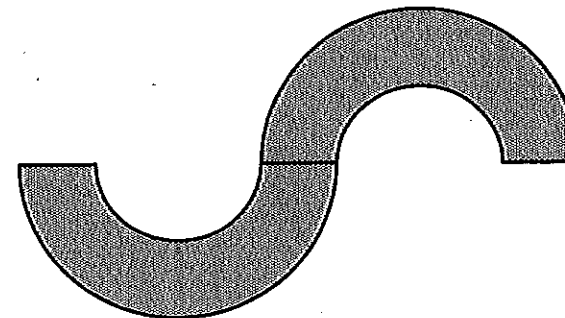
- (A) $m = -3, b = -6$ (B) $m = -3, b = -2$
 (C) $m = \frac{-1}{3}, b = -6$ (D) $m = \frac{1}{3}, b = -2$

- 9 A shape in the form of a semi-circular arch is cut from a piece of cardboard.

The outer and inner diameters of the shape are given.



Two of these semi-circular arch shapes are later joined to make a design, shown below.



In terms of π , what is the perimeter (in cm) of the design?

- (A) $12\pi + 2$
 (B) $12\pi + 6$
 (C) $24\pi + 4$
 (D) $24\pi + 8$
- 10 The probability that the temperature will fall below -10° on any day through winter at a particular city in the Northern Hemisphere is 0.85.
- Which calculation will give the probability that the temperature in this city will fall below -10° on at least one day of a weekend?
- (A) $1 - (0.15)^2$
 (B) $1 - (0.85)^2$
 (C) $(1 - 0.15)^2$
 (D) $2 \times 0.85 \times 0.15$

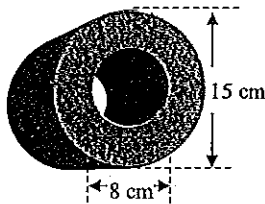
- 11 A car's petrol consumption (C) in litres/100 km can be estimated by using the formula:

$$C = 0.01S^2 - S + 33$$

where S is the speed (in km/hr) at which the car is being driven.

What is the change in petrol consumption if the speed at which a car is being driven increases from 60 km/hr to 80 km/hr?

- (A) A decrease of 8 L/100 km
 (B) An increase of 8 L/100 km
 (C) A decrease of 17 L/100 km
 (D) An increase of 13.2 L/100 km
- 12 A concrete pipe shown below has length 1.25 m. Which of these calculations would correctly give the volume of concrete used to make the pipe?

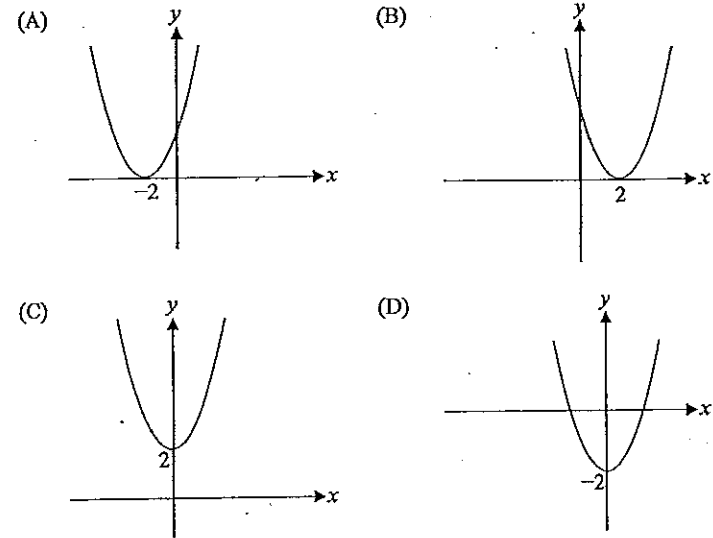


- (A) $\pi \times (0.15 - 0.08)^2 \times 1.25$
 (B) $\pi \times (0.075^2 - 0.04^2) \times 125$
 (C) $\pi \times (15^2 - 8^2) \times 1.25$
 (D) $\pi \times (0.075^2 - 0.04^2) \times 1.25$
- 13 A doctor prescribes a patient 750 g of medication per day to be taken every 4 hours. A bottle of this medication from the chemist contains a concentration of 50 g/5 mL.

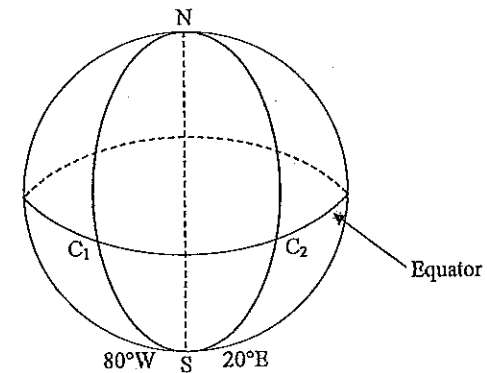
How many millilitres does the patient need to take in each dose?

- (A) 12.5
 (B) 13.5
 (C) 15
 (D) 18.75

- 14 Which graph best represents $y = (x - 2)^2$?



- 15 Cities C_1 and C_2 are both located on the equator with respective longitudes shown. The local time in C_2 is 2:20 am on August 1st.



What is the local time in C_1 ?

- (A) 9:00 pm July 31
 (B) 9:40 pm July 31
 (C) 7:40 pm July 31
 (D) 6:00 am August 1

- 16 A new factory test has been designed to determine whether cars at the end of the production process have an electrical defect.

A number of cars known to have an electrical defect, as well as some cars known to have no electrical defect, were subjected to the new factory test.

The table below shows the results of the test, which does not always give accurate results.

	Test Results	
	Accurate	Not Accurate
Number of cars with electrical defects	75	10
Number of cars without electrical defects	250	15

If a car was selected at random from those tested, what is the probability (%) that the test indicated this car had an electrical defect?

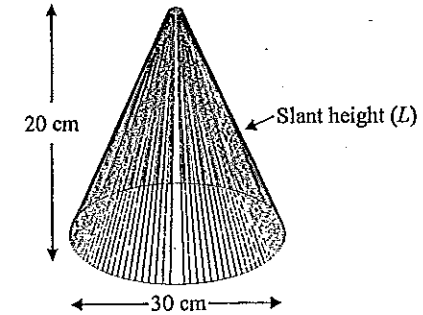
- (A) 23.1
 (B) 25.7
 (C) 27.7
 (D) 95.4
- 17 Menka calculated her Z-score to be 1.85 after receiving her assessment task result of 68%. The results on the task were normally distributed.

If the standard deviation on the task was 8.5, what was the mean?

- (A) 52.275
 (B) 56.375
 (C) 57.65
 (D) 58.25

- 18 A child's party hat is made in the shape of a cone of height 20 cm and diameter 30 cm.

The slant height (L) of the cone is the length from the top, to any point on the circumference of the base.



The surface area (in square centimetres of the cone) can be given by the formula:

$$\text{Surface area} = \pi rL \quad (\text{where } r \text{ is the radius})$$

In terms of π , what is the surface area of the cone?

- (A) 300π
 (B) 375π
 (C) 525π
 (D) 750π
- 19 If $a > 0$, which of the following correctly expresses a as the subject of $r = \sqrt{\frac{v}{a^2}}$?

- (A) $a = \frac{\sqrt{v}}{r}$
 (B) $a = \frac{v}{\sqrt{r}}$
 (C) $a = \sqrt{vr}$
 (D) $a = \sqrt{\frac{v}{r}}$

- 20 A table of future value interest factors up to 4 periods is shown below.

Table of future value interest factors					
Interest rate per period					
Period	1%	2%	3%	4%	5%
1	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0200	2.0300	2.0400	2.0500
3	3.0301	3.0604	3.0909	3.1216	3.1525
4	4.0604	4.1216	4.1836	4.2465	4.3101

Using the figures in the table, what amount of interest would have been added at the end of 3 years to an annuity of \$2500 per year at 4% pa?

- (A) \$260
 (B) \$304
 (C) \$459
 (D) \$530
- 21 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
- 22 Water is emptying from a tank, initially full, according to the equation:

$$V = -6t + 120$$

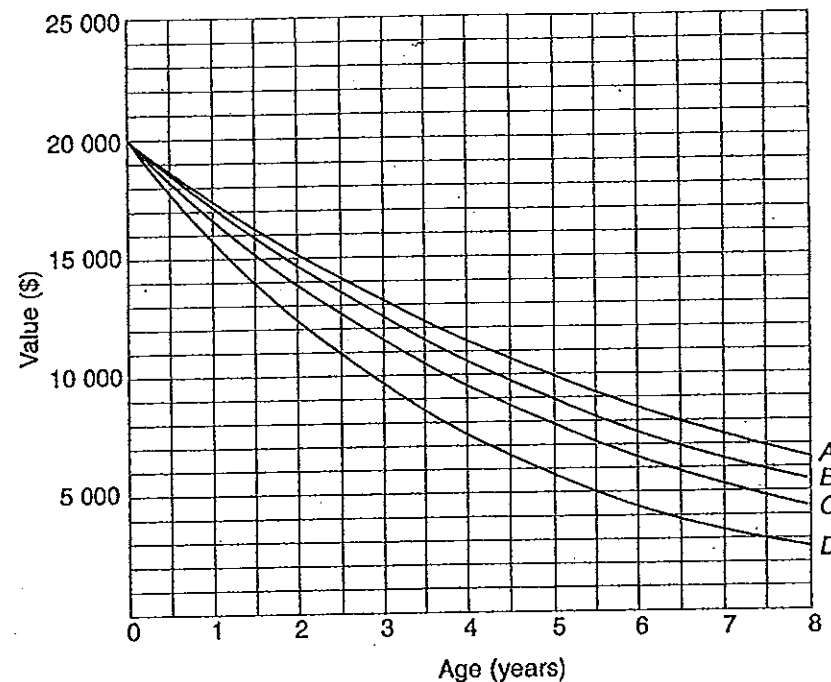
where V is the quantity of water (in litres) in the tank at any time t (minutes).

After how many minutes does the tank have 40% of its full capacity?

- (A) 6
 (B) 10
 (C) 12
 (D) 15

- 23 The value of a motor vehicle, purchased new for \$20 000, is calculated over 8 years using the declining balance method of depreciation.

The graphs (A), (B), (C) and (D) below show the calculated values over this period, with 4 different rates of depreciation applied.



Which graph best shows the value of the motor vehicle when depreciated at 22% p.a.?

- (A) A
 (B) B
 (C) C
 (D) D

- 24 The number of bacteria (N) in a petri dish is growing according to the equation:

$$N = 10\,000(1.15)^t$$

where t is time measured in days.

After approximately how many days will the bacteria in the petri dish have doubled?

- (A) 3
 (B) 4
 (C) 5
 (D) 6
- 25 Which of the following quadratic expressions has a maximum value of 900?

- (A) $60x - x^2$
 (B) $30x - x^2$
 (C) $x^2 + 60x$
 (D) $x^2 + 30x$

End of Section I

Section II

75 marks

Attempt Questions 26–30

Allow about 1 hour 55 minutes 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 30. If you use this space, clearly indicate which question you are answering.

Question 26 (15 marks)

Marks

- (a) A person decided to measure the lateness of four buses. He recorded the elapsed time in minutes, from the scheduled departure- to the bus leaving the depot. This data is recorded in the stem-and-leaf plot shown below.

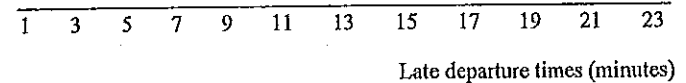
0	2	2	3	5	9	9	9	9
1	0	0	1	1	1	4		
2	2							

- (i) What was the mean late departure time? 1

- (ii) What was the median late departure time? 1

- (iii) Calculate the inter-quartile range. 2

- (iv) In the space below, draw a box-and-whisker plot using the scale. 2



Question 26(a) continues on the next page

Question 26(a) (continued)

Marks

- (v) Describe the skewness of the distribution of late departure times. 1

- (vi) With the use of calculations, explain why the late departure time of 22 minutes could be considered an outlier for the data presented. 2

- (vii) If the late departure time of 22 minutes was not included in the data, what effect would this have on the mean? 1

Question 26 continues on the next page

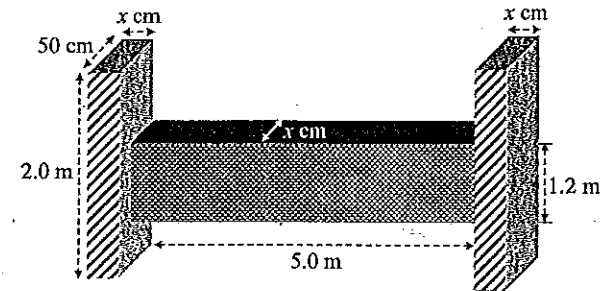
Question 26 (continued)

Marks

- (b) A company manufactures steel beams.

The diagram shows one of these beams consisting of 3 sections each of the same thickness of x cm.

The beam has 2 identical end sections and 1 centre section with dimensions as shown.



- (i) The volume of steel in the beam is 0.36 m^3 .

Calculate the thickness (x) of the beam. 3

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- (ii) The mass of steel in the beam is measured at a rate of 7900 kg/m^3 .

Calculate the mass (in tonnes) of steel in the beam, writing your answer correct to one decimal place. 2

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End of Question 26

Question 27 (15 marks)

Marks

- (a) A triangular pyramid is constructed from 4 pieces of glass and placed vertically on its base.

Two of the glass pieces APQ and BPQ are right-angled and meet the base piece ABQ at Q , as shown.

The distance PQ is the height of the pyramid (h cm), $AQ = 25$ cm, $\angle PAQ = 69^\circ$, $\angle PBQ = 63^\circ$ and $\angle AQB = 115^\circ$.

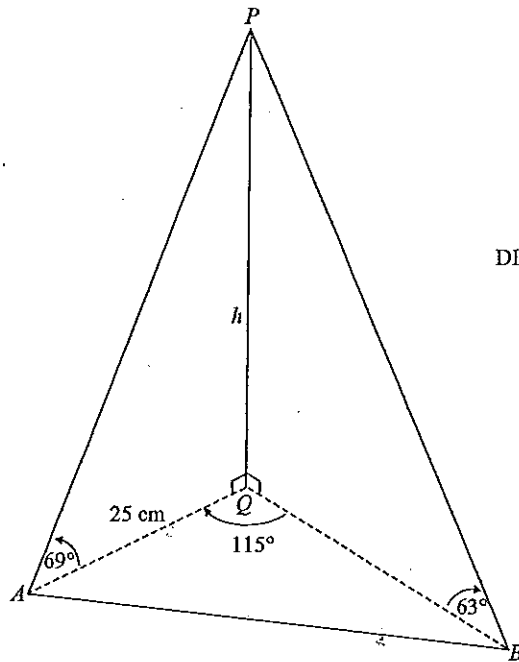


DIAGRAM NOT TO SCALE

Question 27(a) continues on the next page

Question 27(a) (continued)

Marks

- (i) Use the measurements in triangle APQ to show that h is approximately 65 cm. 2

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- (ii) Show that the length of BQ is approximately 33 cm. 2

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- (iii) Calculate the length (to the nearest centimetre) of the edge AB of the base of the pyramid. 3

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- (iv) Calculate the area of the base ABQ of the pyramid, giving your answer correct to the nearest square centimetre. 2

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- (v) Calculate the capacity of the pyramid to the nearest litre. 2

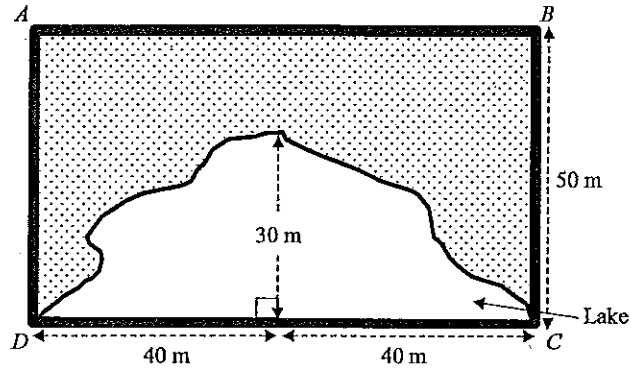
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Question 27 continues on the next page

Question 27 (continued)

Marks

- (b) An artificial lake is to be constructed within a rectangular enclosure $ABCD$ in a new estate.



- (i) Calculate the area (in square metres) of the surface of the lake. 2

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- (ii) What percentage of the rectangular enclosure does the lake cover? 2

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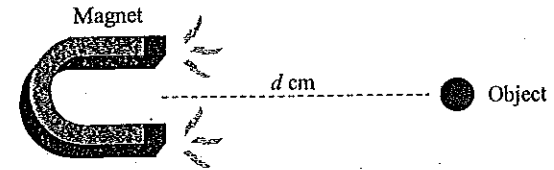
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End of Question 27

Question 28 (15 marks)

Marks

- (a) The diagram shows an object d cm from a magnet.



The force (attraction) F of the magnet (measured in Newtons) required to move the object is directly proportional to the square root of the distance the object is from it, and can be given by the formula:

$$F = k\sqrt{d} \quad \text{where } k \text{ is a constant.}$$

- (i) If a magnet with a force of 15 Newtons can attract an object 9 cm away, show that 'k' in the above formula has a value of 5. 2

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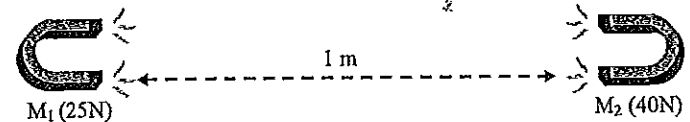
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- (ii) Using $k = 5$, show that a magnet requires a force of 20 Newtons to attract an object 16 cm from it. 1

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- (iii) Two magnets M_1 and M_2 with respective forces of 25N and 40N are placed 1 metre apart.



Where should an object be placed between the magnets so that it will not be attracted to either magnet? (Justify your answer with suitable calculations). 2

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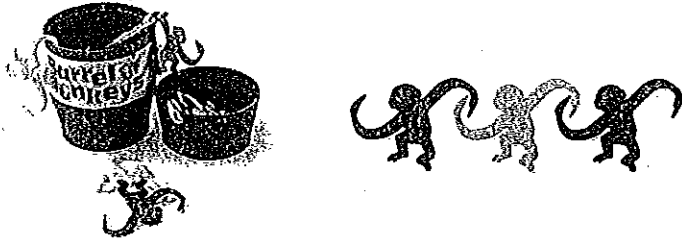
Question 28 continues on the next page

Question 28 (continued)

Marks

- (b) 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 either both green or both 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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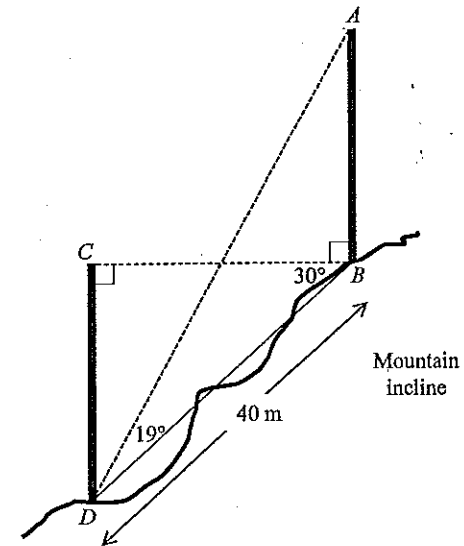
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Question 28 continues on the next page

Question 28 (continued)

Marks

- (c) The diagram shows two telegraph poles AB and CD 40 metres apart and of equal height, standing vertically on the side of a mountain incline.



Both angle ABC and angle BCD are right angles.

Angle CBD is 30° and angle ADB is 19° .

- What is the distance (to the nearest metre) between A and D ? 4

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End of Question 28

Question 29 (15 marks)

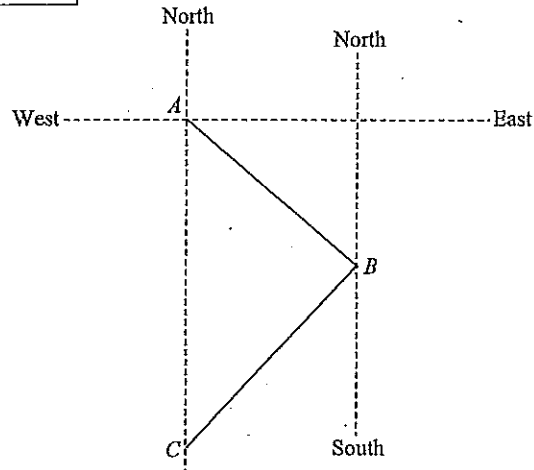
Marks

- (a) Marissa walks 2.5 km from A to B on a bearing of 110° . She then walks 6.9 km from B to C on a bearing of 200° .

C is due south of A .

The diagram below shows the positions of A , B and C .

Diagram not to scale.



- (i) On the diagram, insert the distances Marissa walked and show the two given bearings. 2
- (ii) What is the size of $\angle BAC$? 1
-
- (iii) What is the bearing of B from C ? 1
-
- (iv) What is the bearing of A from B ? 1
-
- (v) How far (correct to one decimal place) is C south of A ? 2
-
-
-

Question 29 continues on the next page

Question 29 (continued)

Marks

- (b) A company's cost ($\$C$) equation for the manufacture of n items is given by:

$$\$C = 2350 + 200n$$

The income ($\$I$) received from the sale of these items is given by:

$$\$I = 250n$$

- (i) Show that the equation for the company's profit ($\$P$) from the sale of the items can be given by:

$$\$P = 50n - 2350$$

2

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- (ii) How many items must the company sell in order to break even? 2

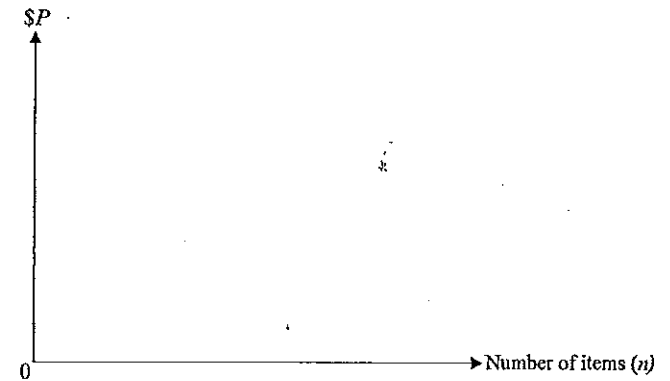
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- (iii) Calculate the profit the company makes from the sale of 120 items. 1

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- (iv) Using the information in (i), (ii) and (iii), draw the graph of the profit equation in the space below, labelling all relevant details. 2



- (v) Explain what the gradient of the graph represents. 1

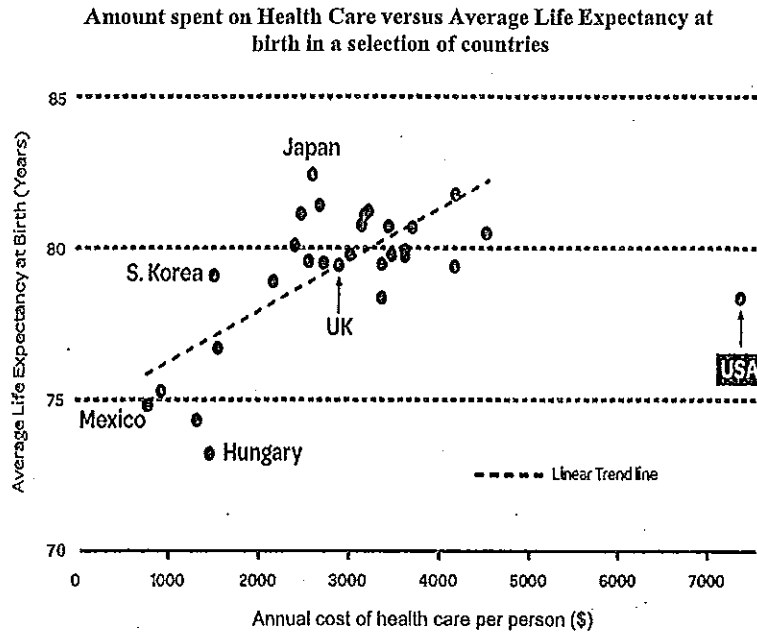
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End of Question 29

Question 30 (15 marks)

Marks

- (a) The data in the scatterplot below shows the amount spent on health care and the life expectancy in a number of countries, with 6 countries labelled.



- (i) Which of the specified countries has the lowest amount spent on health care per person? 1
-
- (ii) Approximately, how much longer is a person living in South Korea expected to live than a person living in Hungary? 1
-
-
- (iii) Compare and contrast the data presented for Japan and the USA. 2
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-
-

Question 30(a) continues on the next page

Question 30(a) (continued)

Marks

- (iv) If the data for the USA was not included on the graph, comment on the effect on the correlation coefficient between the amount spent on health care and life expectancy. 1

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- (v) The following table gives some values of calculations from the data in the graph.

	Mean	Standard Deviation
Amount spent on health care	\$2836.79	\$1308.81
Average life expectancy	79.33 years	2.31 years
Correlation coefficient	$r = 0.48$	

Use the figures in the table to calculate the gradient of the trend line. (Give your answer correct to four decimal places). 2

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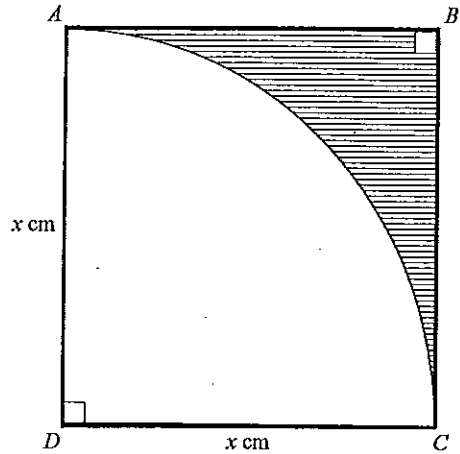
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Question 30 continues on the next page

Question 30 (continued)

Marks

- (b) A sector ACD with radius x cm and centre D , is cut from a square $ABCD$, as shown in the diagram.



Show that the area of the shaded section ABC can be given by: $\frac{x^2(4-\pi)}{4}$ cm².

3

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Question 30 continues on the next page

Question 30 (continued)

Marks

- (c) Evan borrows \$650 000 (referred to as the Principle (P)) for the purchase of a home. Interest (I) is charged monthly on the amount owing on the loan at an annual rate of 4.35%.

Evan is required to repay (R) \$2850 per month off the loan.

Let the amount Evan owes on the loan at the end of each month be $\$A$.

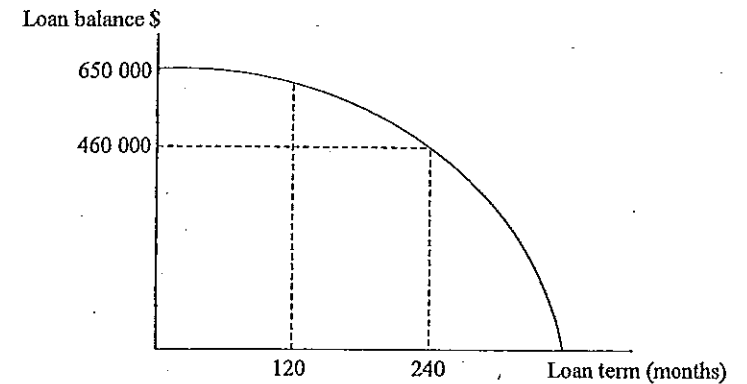
- (i) Using: $A = P + I - R$, show that Evan owes \$649 506.25 after his first repayment. 2

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- (ii) A graph showing Evan's loan balance over the term of the loan, is shown.



How much interest has Evan paid on his loan after 20 years of repayments? 3

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End of paper

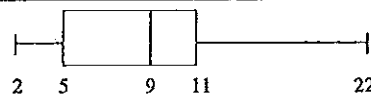
**NSW INDEPENDENT TRIAL EXAMS – 2016
GENERAL MATHEMATICS 2 (YR 12 TRIAL EXAM)
MARKING GUIDELINES**

Section I

Question	Answer	Assessed Outcome	Band
1.	C	FSRe2, MG2H-5	3
2.	C	AM5, MG2H-3	3
3.	D	FSRe3, MG2H-5	3
4.	B	DS4, MG2H-2	3
5.	A	AM1, MGP-2	3
6.	C	MM6, MG2H-4/5	3
7.	D	MM1, MGP-6	3
8.	A	AM2, MGP-3	3
9.	C	MM2, MGP-4	4
10.	A	PB1/PB2, MGP-5, MG2H-2	4
11.	B	AM5, MG2H-3	4
12.	D	MM4, MG2H-5	4
13.	A	FSHe2, MG2H-5	4
14.	B	AM5, MG2H-3	4
15.	C	MM6, MG2H-4	4
16.	B	DS4, MG2H-2, PB1, MGP-2	4
17.	A	DS5, MG2H-2	4
18.	B	MM4, MG2H-5	4
19.	A	AM3, MG2H-3	5
20.	B	FM5, MG2H-6	5
21.	B	PB2, MG2H-8	6
22.	C	AM4, MG2H-3	6
23.	D	FSDr2, MGP-3	6
24.	C	AM5, MG2H-3	6
25.	A	AM5, MG2H-3	6

Section II

Question 26

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)	Mean: $137 \div 15 = 9.13$ minutes	1	DS3, MGP-2	3
(ii)	Median: 9 minutes	1	DS3, MGP-2	3
(iii)	I.Q.R: Upper quartile – lower quartile = 11 mins – 5 mins = 6 mins	1 1	DS2, MGP-2	3
(iv)		2	DS2, MGP-2	3
(v)	The distribution has a positive skew since the upper 25% of the data has a greater range ($22 - 11 = 11$) than the lower 25% of the data ($5 - 2 = 3$)	1	DS4, MGP-10	4
(vi)	A score is considered an outlier if its value is greater than $Q_U + 1.5 \times IQR$ In the data presented, $Q_U = 11$ and $IQR = 6$ So $Q_U + 1.5 \times IQR = 11 + 1.5 \times 6 = 20$ Since 22 minutes is greater than 20 minutes, it could be regarded as an outlier	1 1	DS4, MG2H-2/10	5
(vii)	Including 22 minutes, the mean is 9.13 minutes. If 22 minutes is not included, the new mean is: $115 \div 14 = 8.21$. So the mean would decrease by $9.13 - 8.21 = 0.92$.	1	DS3, MGP-10	4
(b)(i)	Volume of ends = $(2 \times 2 \times 0.5 \times x) = 2x$ Volume of centre section = $(5 \times 1.2 \times x) = 6x$ Hence, $8x = 0.36 \text{ m}^3$ $x = 0.045 \text{ m} = 4.5 \text{ cm}$	1 1 1	MM4, MG2H-5	4
(ii)	Density = $7900 \times 0.36 = 2844 \text{ kg} = 2.8 \text{ tonnes}$	1 1	MM4, MG2H-4	4

Question 27

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)	In $\triangle APQ$, $\tan 69^\circ = \frac{h}{25}$ $h = 25 \times \tan 69^\circ$ $= 65.127$ $= 65 \text{ cm}$	1 1	MM3, MGP-4	4
(ii)	In $\triangle PQB$, $\angle BPQ = 27^\circ$ So $\tan 27^\circ = \frac{BQ}{h}$ $= \frac{BQ}{65}$ $BQ = 65 \times \tan 27^\circ$ $= 33 \text{ cm}$	1 1	MM3, MG2H-4	4
(iii)	Using the Cosine rule: $AB^2 = 25^2 + 33^2 - (2 \times 25 \times 33 \times \cos 115^\circ)$ $= 2411.32$ $AB = \sqrt{2411.32}$ $= 49 \text{ cm}$	1 1 1	MM5, MG2H-4	4
(iv)	$A = 0.5 \times 25 \times 33 \times \sin 115^\circ$ $= 373.85$ $= 374 \text{ cm}^2$	1 1	MM5, MG2H-4	4
(v)	$V = \frac{1}{3} \times AH$ $= \frac{1}{3} \times 374 \times 65$ $= 8103.33 \text{ cm}^3$ $= 0.00810333 \text{ m}^3$ Capacity is $0.00810333 \times 1000 \text{ L}$ $= 8 \text{ L}$ (to the nearest litre)	1 1	MM4/MM2, MGP-4	5
(b)(i)	Using Simpson's Rule: Area $= \frac{40}{3} (0 + (4 \times 30) + 0)$ $= 1600 \text{ m}^2$	1 1	MM4, MG2H-4	4
(ii)	Area of enclosure $= 50 \text{ m} \times 80 \text{ m} = 4000 \text{ m}^2$ Percentage covered by surface of lake $= \frac{1600}{4000} \times 100$ $= 40\%$	1 1	MM1, MGP-4	4

Question 28

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)	Using $F = 15$ and $d = 9$, $15 = k \times \sqrt{9}$ $k = 15 \div 3$ $= 5$	1 1	AM4, MG2H-9	4
(ii)	We need to determine the value of F , where $F = 5\sqrt{16}$ i.e. $F = 5 \times 4$ $= 20 \text{ Newtons}$	1	AM3, MG2H-9	4
(iii)	The distance that the object needs to be from M_1 in order for it to be attracted is no more than: d where $25 = 5\sqrt{d}$ i.e. $d = 25 \text{ cm}$. The distance that the object needs to be from M_2 in order for it to be attracted is no more than d where $40 = 5\sqrt{d}$ i.e. $d = 64 \text{ cm}$. (Note that there is an 11 cm range for the object to be within for it not to be attracted to either Magnet. ($100 \text{ cm} - (64 \text{ cm} + 25 \text{ cm}) = 11 \text{ cm}$)) Hence, the object must be between 25 cm and 36 cm from M_1 , or between 64 cm and 75 cm from M_2 .	1 1	DS5, MG2H/10	5
(b)(i)	$\frac{4}{12} = \frac{1}{3}$	1	PB1, MGP-8	3
(ii)	$P(G, G)$ or $P(Y, Y)$ $= \left(\frac{2}{12} \times \frac{1}{11}\right) + \left(\frac{4}{12} \times \frac{3}{11}\right)$ $= \frac{14}{132}$ $= \frac{7}{66}$	1 1	PB2, MG2H-8	4
(iii)	$3 \times 2 \times 1 = 6 \text{ ways}$	1	PB2, MG2H-8	4
(iv)	$P(Y, G, R)$ or $P(Y, R, G)$ or $P(G, Y, R)$ or $P(G, R, Y)$ or $P(R, G, Y)$ or $P(R, Y, G)$ $= 6 \times P(Y, G, R)$ $= 6 \times \frac{4}{12} \times \frac{2}{11} \times \frac{6}{10} = \frac{12}{55}$	1 1	PB2, MG2H-8	5
(c)	In $\triangle ABD$, $\angle DBA = 90^\circ + 30^\circ = 120^\circ$ Hence $\angle BAD = 180^\circ - (120^\circ + 19^\circ)$ $= 41^\circ$ Using the Sine Rule: $\frac{AD}{\sin 120^\circ} = \frac{40}{\sin 41^\circ}$ $AD = \sin 120^\circ \times \frac{40}{\sin 41^\circ}$ $= 53 \text{ m}$ (to the nearest metre)	1 1 1 1	MM5, MG2H- 4/5	6

Question 29

Part	Answers	Mark	Outcome Assessed	Band
(a)(i)		2	MM5, MG2H-10	4
(ii)	$\angle BAC$ is the supplement of 110° which is 70°	1	MM5, MG2H-5	3
(iii)	$\angle SBC = 20^\circ$ ($200^\circ - 180^\circ$) Hence $\angle ACB = 20^\circ$ (alternate to $\angle SBC$) So the required bearing of B from C is 020°	1	MM5, MG2H-5	4
(iv)	$\angle ABC = 180^\circ - (70^\circ + 20^\circ) = 90^\circ$ Bearing of A from B is $200^\circ + 90^\circ = 290^\circ$	1	MM5, MG2H-4	5
(v)	Since $\angle ABC = 90^\circ$, triangle ABC is right angled at B. Using Pythagoras' Theorem: $AC^2 = 2.5^2 + 6.9^2$ $= 53.86$ $AC = \sqrt{53.86}$ $= 7.3\text{km}$	1 1	MM3, MGP-4	4
(b)(i)	Profit = Income - Costs $SP = 250n - (2350 + 200n)$ $= 50n - 2350 - 200n$ $= 50n - 2350$	1 1	AM4, MG2H-9	5
(ii)	For the company to break even $C = I$ or $P = 0$ Using $P = 0$, $50n - 2350 = 0$ $50n = 2350$ $n = 47$ items	1 1	AM4, MG2H-10	5
(iii)	Let $n = 120$, then $P = 50(120) - 2350 = \$3650$	1	AM1, MGP-9	4

Question 29 continues on the next page

Question 29 (continued)

Part	Answer	Mark	Outcome assessed	Band
(iv)		2	AM4, MGP-9/10	5
(v)	The gradient of the graph (50) indicates the profit made on the sale of each item after 47 are sold.	1	AM4, MG2H-10	5

Question 30

Part	Answer	Mark	Outcome Assessed	Band
(a)(i)	Mexico	1	FSHe3, MG2H-2	4
(ii)	Hungary: approximately 73 years South Korea: approximately 79 years Another 6 years. Note: Allow some slight variation in this answer.	1	FSHe3, MG2H-2	4
(iii)	USA has the highest amount (of any country) spent on Health Care per person with \$7500 annually compared to Japan with only \$2600 annually. USA has a lower life expectancy than Japan by about 5 years (even though it spends more on health care).	2	FSHe2, MG2H-10	4
(iv)	If the data for the USA were excluded from the analysis, the correlation coefficient would be higher for the remaining data.	1	FSHe3, MG2H-7	5
(v)	The gradient of the trend line is given by: Gradient = correlation coefficient $\times \frac{SD \text{ of } y \text{ scores}}{SD \text{ of } x \text{ scores}}$ $= 0.48 \times \frac{2.31}{1308.81}$ $= 0.000847$ $= 0.0008$ (correct to 4 decimal places)	1 1	FSHe1, MG2H-2, -9	5
(b)	Area of shaded section = Area of square – area of sector $= x^2 - \frac{1}{4} \times \pi \times x^2$ $= x^2 - \frac{\pi x^2}{4}$ $= \frac{4x^2 - \pi x^2}{4}$ $= \frac{x^2(4-\pi)}{4}$	1 1 1	MM4/AM3 MG2H-4	6
(c)(i)	The interest charged before Ewan makes his first repayment is: $I = (4.25 \div 12 \div 100) \times \$650\,000$ $= \$2356.25$ Ewan owes: $P + I - R$ $= \$650\,000 + \$2356.25 - \$2850$ $= \$649\,506.25$	1 1	FM4, MG2H-3/6	6
(ii)	After 20 years of repayments Ewan owes \$460 000. He has, in effect, paid \$650 000 – \$460 000 $= \$190\,000$ off the principle of the loan. He has repaid $240 \times \$2850 = \$684\,000$ over the 20 years. So the interest that has been charged after 20 years $= \$684\,000 - \$190\,000$. $= \$494\,000$.	1 1 1	FM5, MG2H-6, -9	6