MLC
School

2016

TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

Mathematics General 2

Student Number

General Instructions

- Reading time – 5 minutes
- Working time – $2\frac{1}{2}$ hours
- Write using black or blue pen
  Black pen is preferred
- 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
- Diagrams are not to scale unless stated otherwise

Total Marks – 100

Section I Pages 2 – 10

25 marks

- Attempt Questions 1 – 25
- Allow about 35 minutes for this section
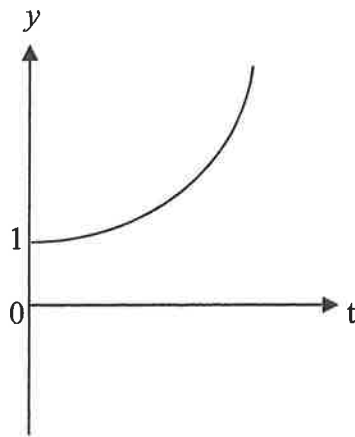
Section II Pages 12 – 28

75 marks

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

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) $y = \dfrac{2}{t}$

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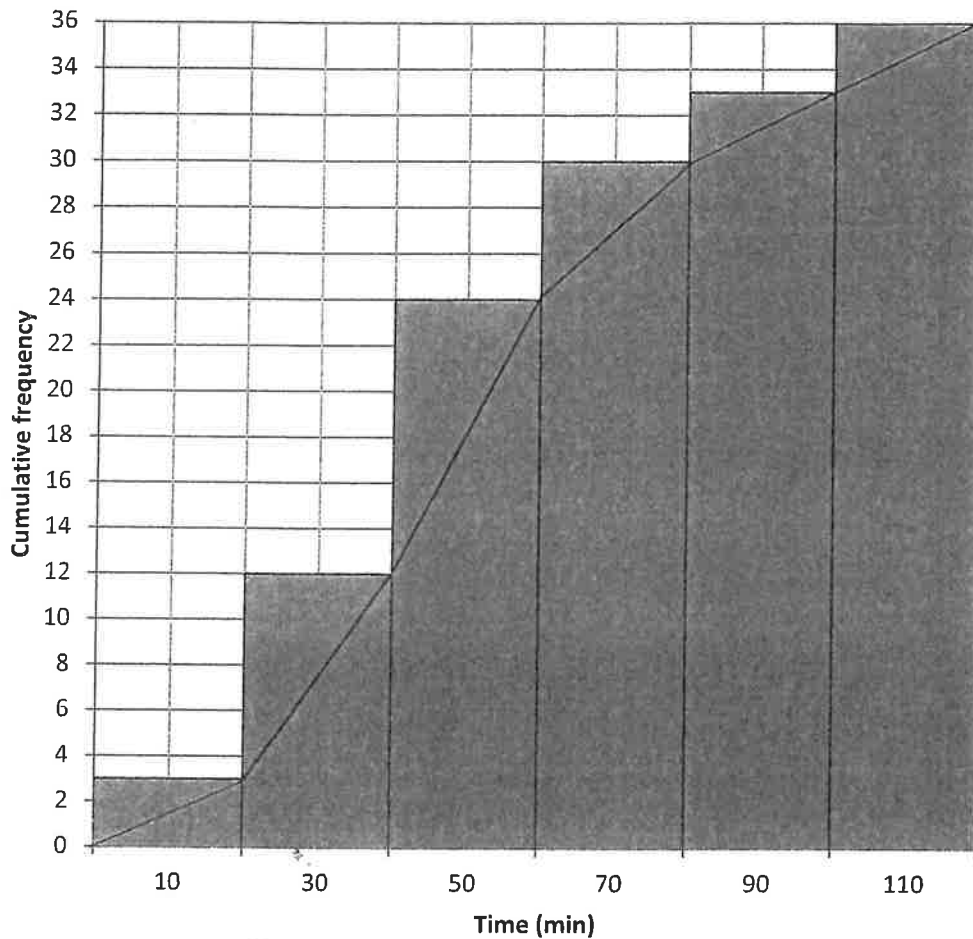
Which of these statements about the information conveyed in the graph is correct?

(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 $\dfrac{b - a^2}{b - a}$?

(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) $\dfrac{\pi}{2}$

(B) $\dfrac{\pi}{3}$

(C) π

(D) 2π
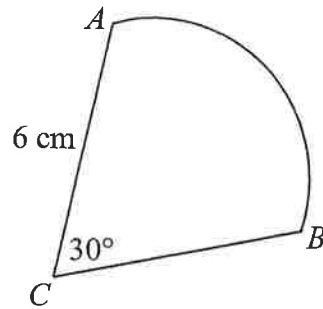
7 A builder provided a written quotation of $18 250 to complete some renovations requested by a homeowner.

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 × 0.1

(B) $18 250 ÷ 0.1

(C) $18 250 − 1.1

(D) $18 250 ÷ 11

8   In the diagram, the line L has equation $y = mx + b$.
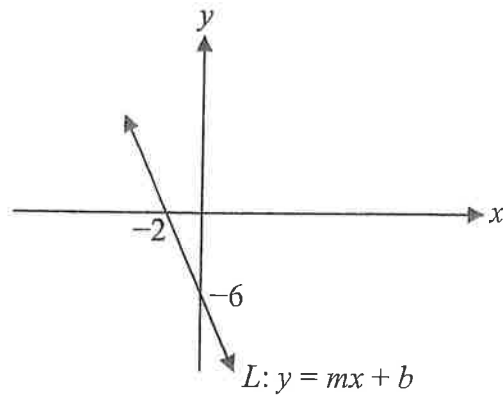
What are the correct values for m and b?

(A) $m = -3, b = -6$ (B) $m = -3, b = -2$

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

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.
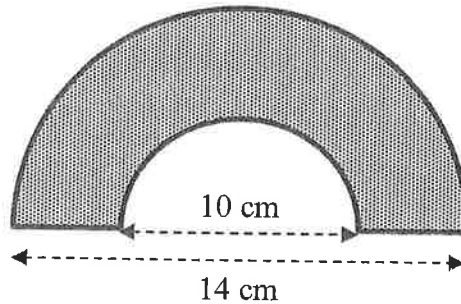
Two of these semi-circular arch shapes are later joined to make a design, shown below.
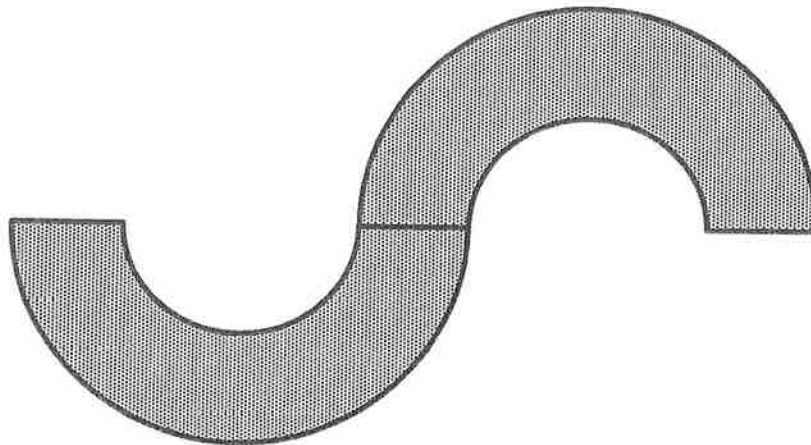
In terms of π, what is the perimeter (in cm) of the design?

(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?
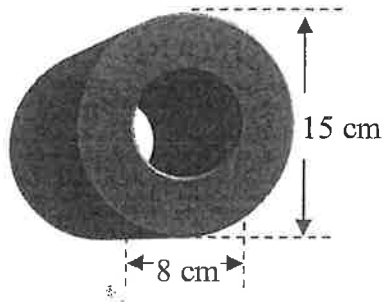
(A) $\pi \times (0.15 - 0.08)^2 \times 1.25$

(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 $y = (x - 2)^2$?

(A)
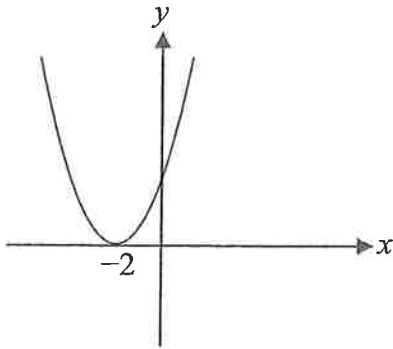
(B)
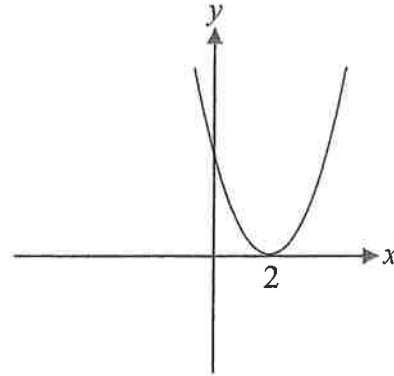
(C)
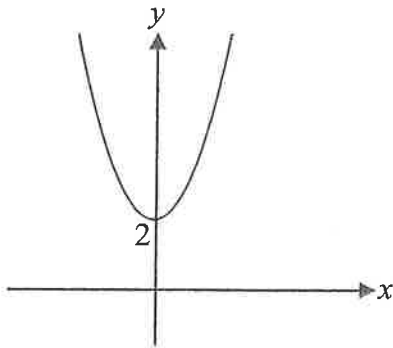
(D)
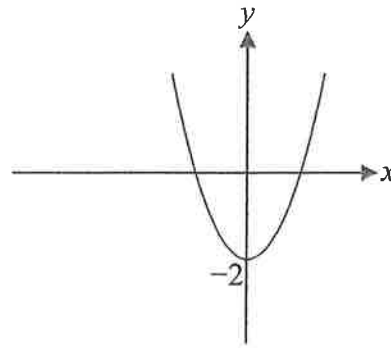
15 A student's height is measured to be 174 cm.

What is the percentage error in this measurement?

A. 0.057%

B. 0.287%

C. 0.575%

D. 3.48%

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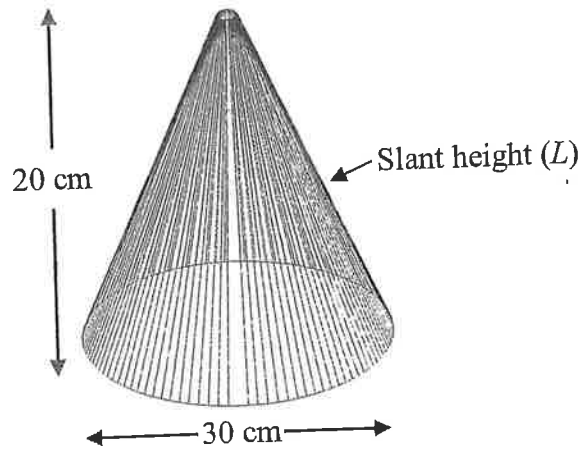
The surface area (in square centimetres of the cone) can be given by the formula:

Surface area = $\pi r L$ (where r 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 $r = \sqrt{\dfrac{V}{a^2}}$?

(A) $a = \dfrac{\sqrt{V}}{r}$

(B) $a = \dfrac{V}{\sqrt{r}}$

(C) $a = Vr$

(D) $a = \sqrt{\dfrac{V}{r}}$

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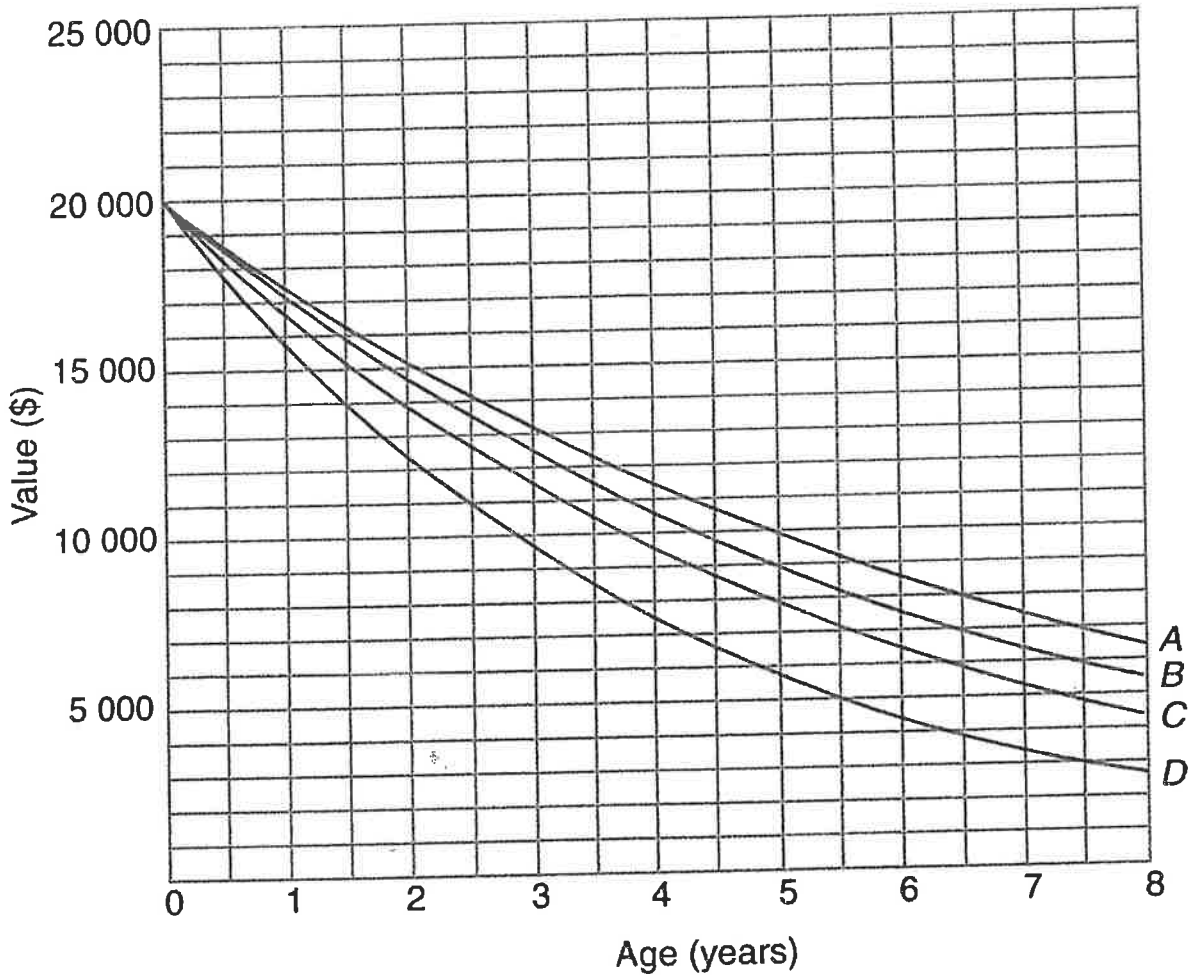
Which graph best shows the value of the motor vehicle when depreciated at 22% p.a.?

(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 tour 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.

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0 | 2  2  3  5  9  9  9  9
1 | 0  0  1  1  1  4
2 | 2
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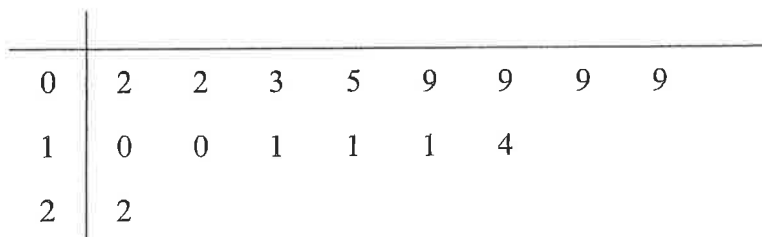
(i)   What was the mean late departure time?   1

....

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

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(iii) Calculate the inter-quartile range.   2

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

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 1   3   5   7   9   11   13   15   17   19   21   23
```
                                                     Late departure times (minutes)

Question 26(a) continues on the next page

15

Question 26(a) (continued)   **Marks**

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

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    (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**

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

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Question 26 continues on the next page

16

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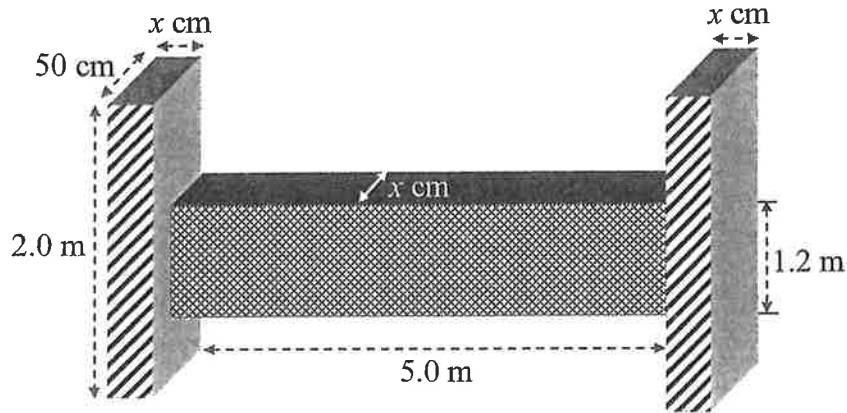
(i)   The volume of steel in the beam is 0.36 m^3.

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, $<PAQ = 69°$, $<PBQ = 63°$ and $<AQB = 115°$.

DIAGRAM NOT TO SCALE

P

h

25 cm

$69°$

A

Q

$115°$

$63°$

B

Question 27(a) continues on the next page

18
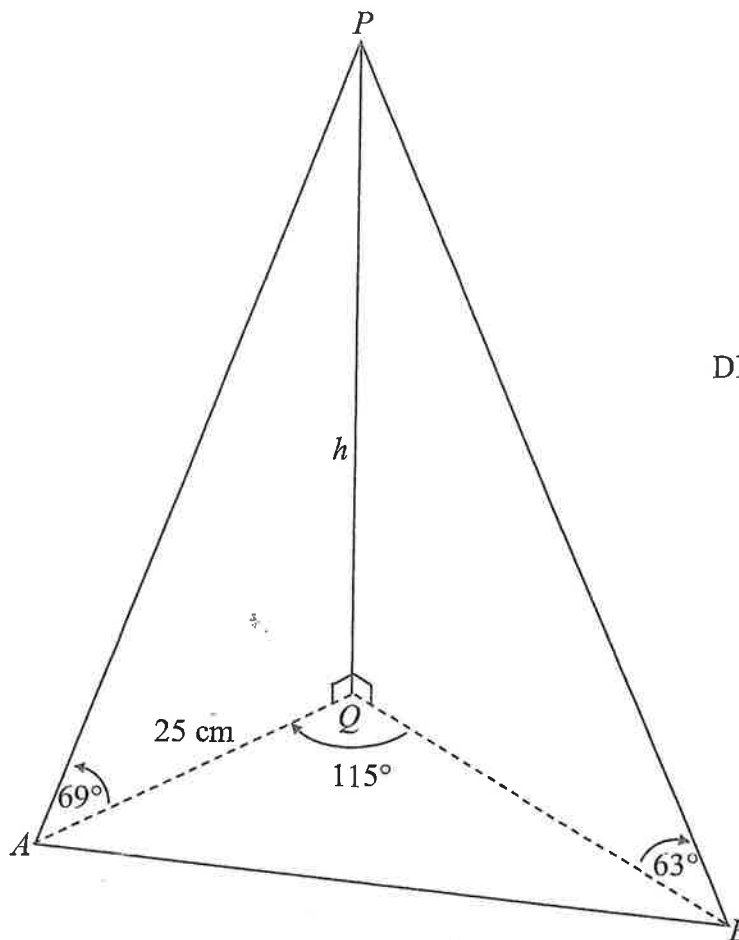
Question 27(a) (continued)   **Marks**

(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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19

Question 27 (continued)   **Marks**

(b)   An artificial lake is to be constructed within a rectangular enclosure *ABCD* in a new
       estate.
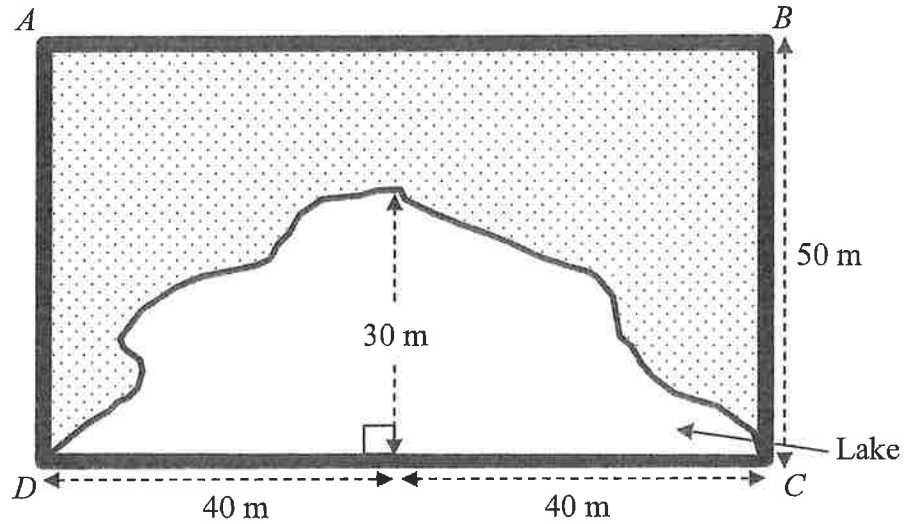
(i)   Calculate the area (in square metres) of the surface of the lake.   2

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

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End of Question 27

Question 28 (15 marks)   **Marks**

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

Magnet

d cm   Object

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:

$$F = k\sqrt{d}$$ where k 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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(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.

1 m

M_1 (25N) M_2 (40N)

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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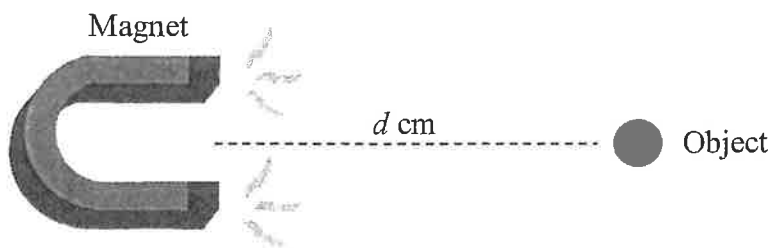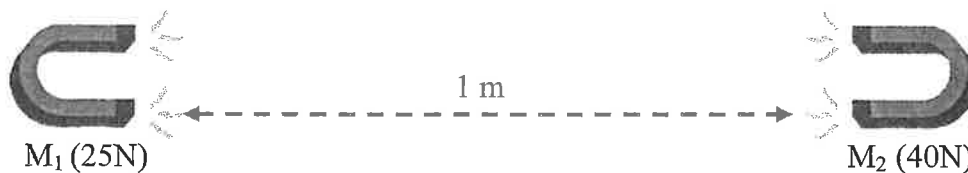
Question 28 continues on the next page

21

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   **2**
        both yellow?

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

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

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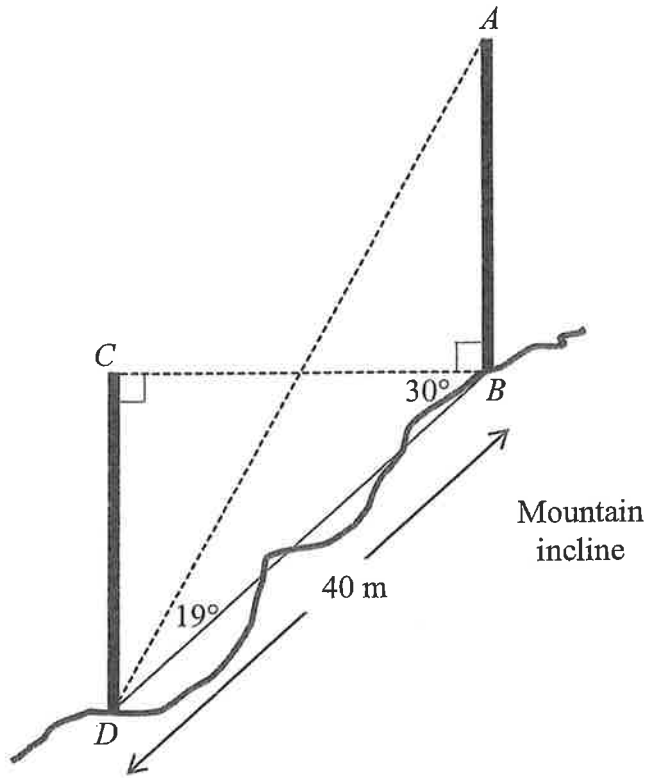
Question 28 continues on the next page

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

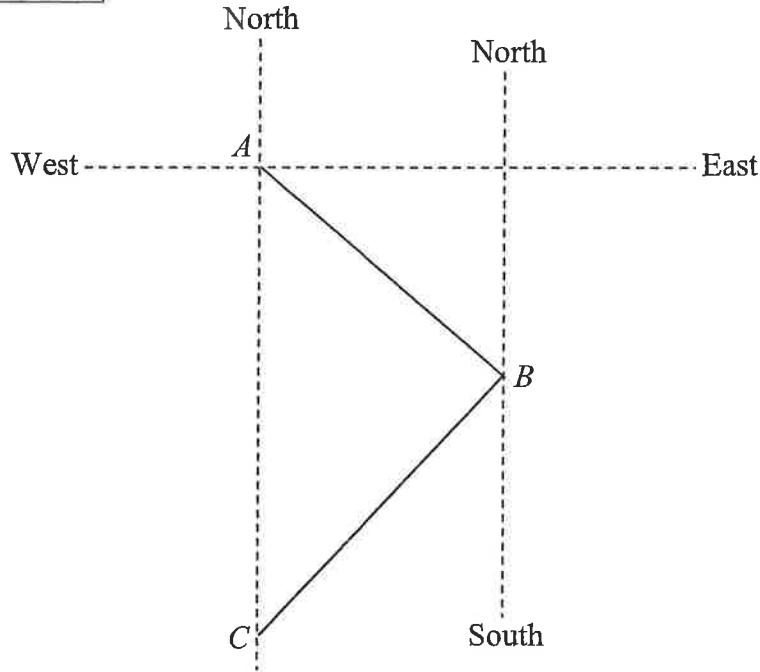**Question 29** (15 marks)   **Marks**

(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 <*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

        ....

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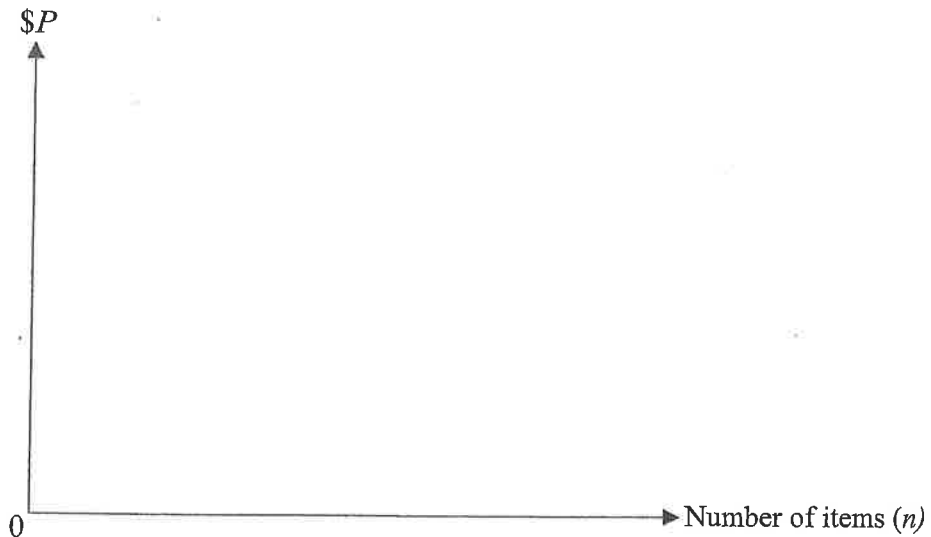
(v)   Explain what the gradient of the graph represents.   **1**

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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.

**Amount spent on Health Care versus Average Life Expectancy at
birth in a selection of countries**

‡ Annual cost of health care per person ($)
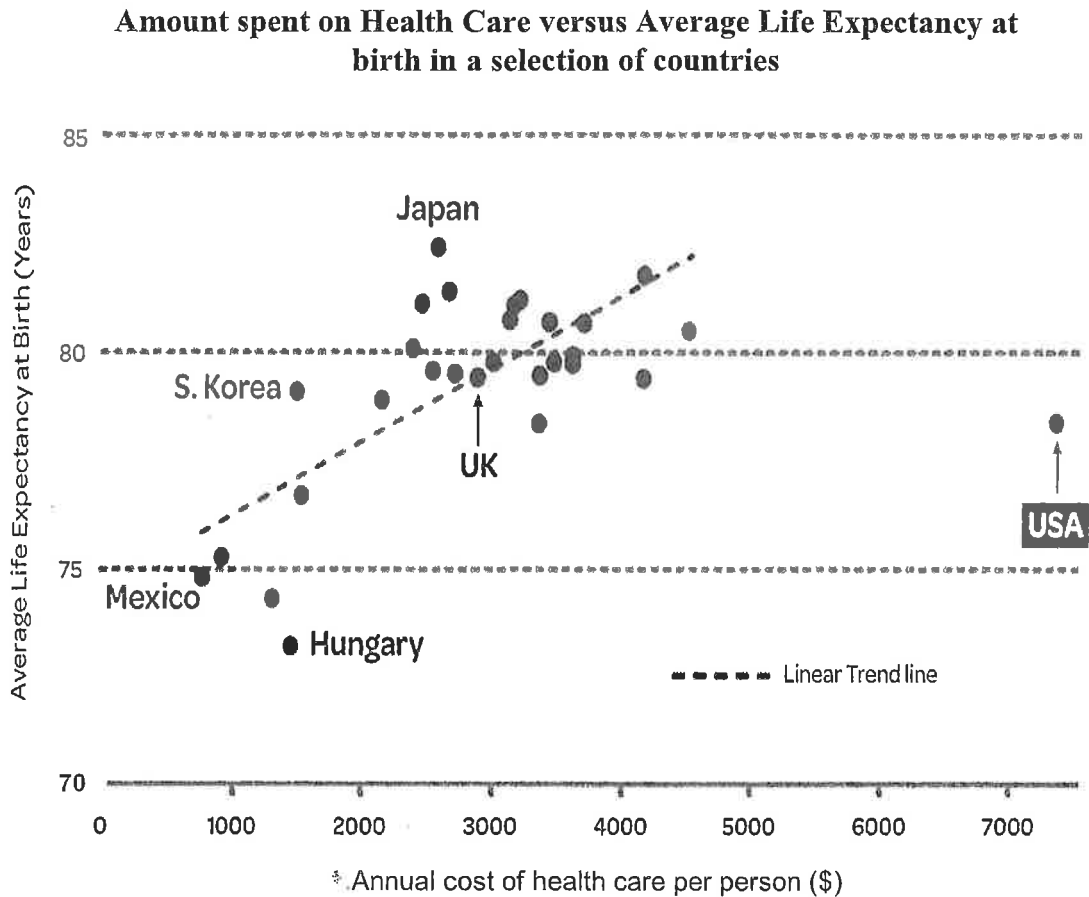
(i)   Which of the specified countries has the lowest amount spent on health care per
      person?   1

      ....

(ii) Approximately, how much longer is a person living in South Korea expected to live
      than a person living in Hungary?   1

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(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

26

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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.
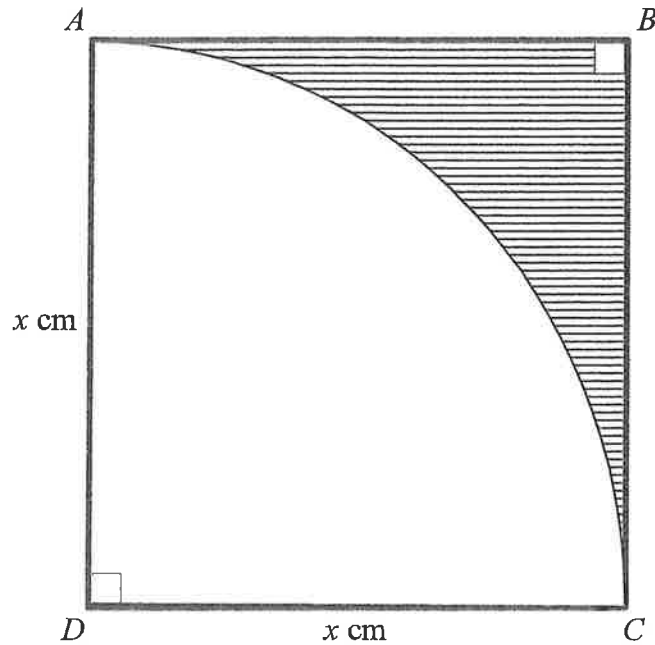
Show that the area of the shaded section ABC can be given by: $\dfrac{x^2(4-\pi)}{4}$ cm^2.   **3**

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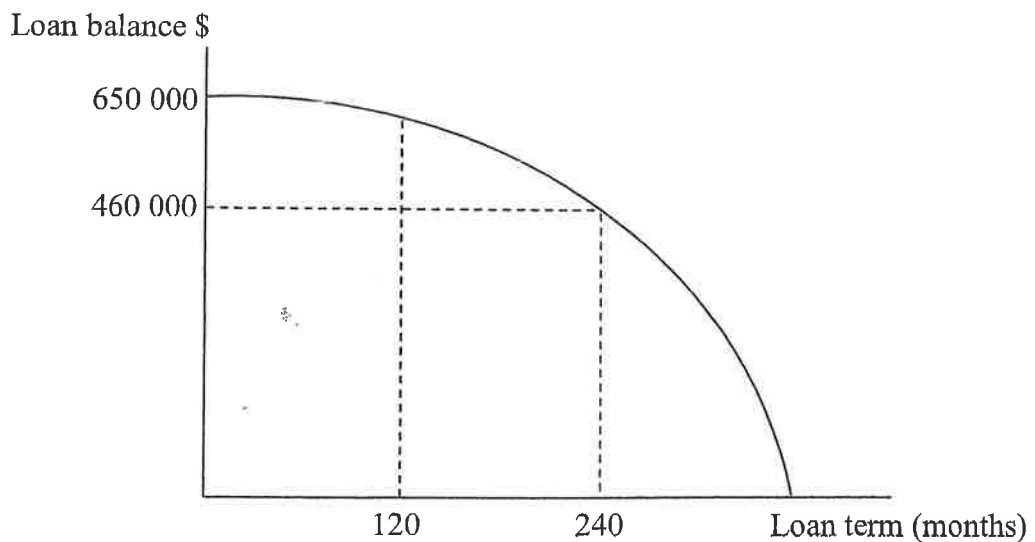
How much interest has Evan paid on his loan after 20 years of repayments?   **3**

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End of paper

Section II – Extra writing space

If you use this space, clearly indicate which question you are answering.

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GEN 2 TRIAL HSC 2016

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

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 tour 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							

Completed well ✓

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

9.13 minutes

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

9 minutes

✓

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

IQR = 11 - 5

= 6 minutes

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

| 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 |

Late departure times (minutes)

Question 26(a) continues on the next page

15
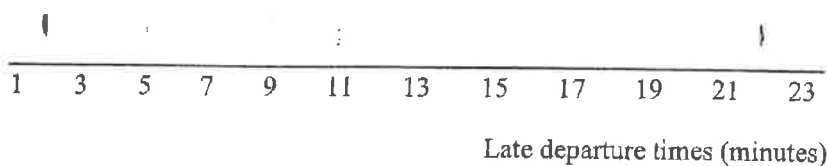
Question 26(a) (continued)   **Marks**

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

positive skew

Use of ✓ (vi) With the use of calculations, explain why the late departure time of 22 minutes
formula was   could be considered an outlier for the data presented.   2
good
11 + 1·5 × 6 = 20

22 > 20   an outlier

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

Great to see   The mean would decrease
some students
calculating the   **Question 26 continues on the next page**
new mean, hence
showing mean is lowered.

16

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.
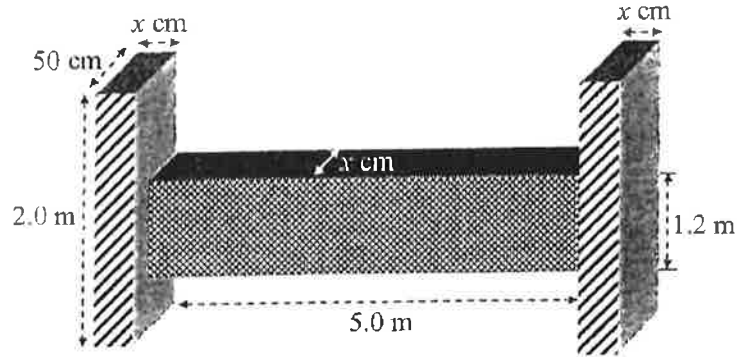
(i)   The volume of steel in the beam is 0.36 m³.   student tried to convert
                                                       $1 m^3 = 1 000 000 cm^3$
Calculate the thickness (x) of the beam.   3

Most students struggled with i) & ii)

$0.36 = (2 \times 0.5 \times x) \times 2 + 3 \times 1.2 \times x$ ✓

$0.36 = 2x + 3.6x$

$8x = 0.36$ progress

$x = 0.045 \, m$

$= 4.5 \, cm$ ✓

(ii) The mass of steel in the beam is measured at a rate of 7900 kg/m³.

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

$m = 7900 \times 0.36$ ✓

$= 2844 \, kg$

$= 2.844 \, t$ ✓

$= 2.8 \, t$

End of Question 26

17

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, $<PAQ = 69°$, $<PBQ = 63°$ and $<AQB = 115°$.
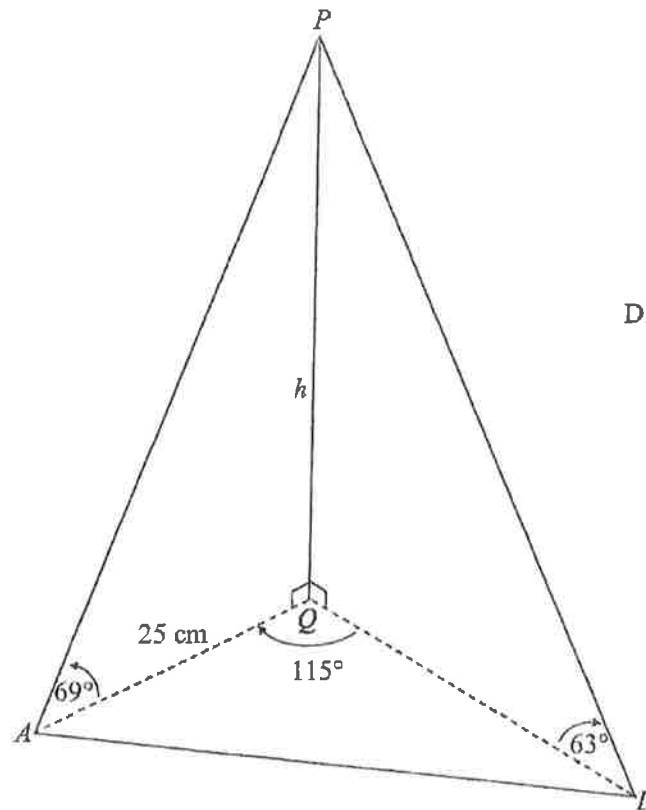
DIAGRAM NOT
TO SCALE

Question 27(a) continues on the next page

18

Question 27(a) (continued)   **Marks**

Fine ✓

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

$\tan 69 = \dfrac{h}{25}$ ✓

$h \quad 65\,cm$ ✓

✓(ii) Show that the length of BQ is approximately 33 cm. $\dfrac{x}{\sin 27} = \dfrac{65}{\sin 63}$ 2

$\tan 63 = \dfrac{h}{BQ}$ ✓

$BQ = \dfrac{65}{\tan 63}$ ∴ $BQ = 33$ ✓

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

$AB^2 = 25^2 + 33^2 - 2 \times 25 \times 33 \times \cos 115°$ ✓

$AB^2 = 2411.3$

$AB = 49.1\,cm$ ✓

$AB = 49\,cm$ ✓

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

$Area = \dfrac{1}{2} \times 25 \times 33 \times \sin 115$

$= 374\,cm^2$

· *Students did not* $\times \dfrac{1}{3}$

· *Most had difficulty converting*

$cm^3 = L$

$\boxed{1\,cm^3 = 1\,mL}$

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

$V = \dfrac{1}{3} \times 374 \times 65$

$= 8103\dfrac{1}{3}\,cm^3$

$= 8.16$

$= 8\,L$

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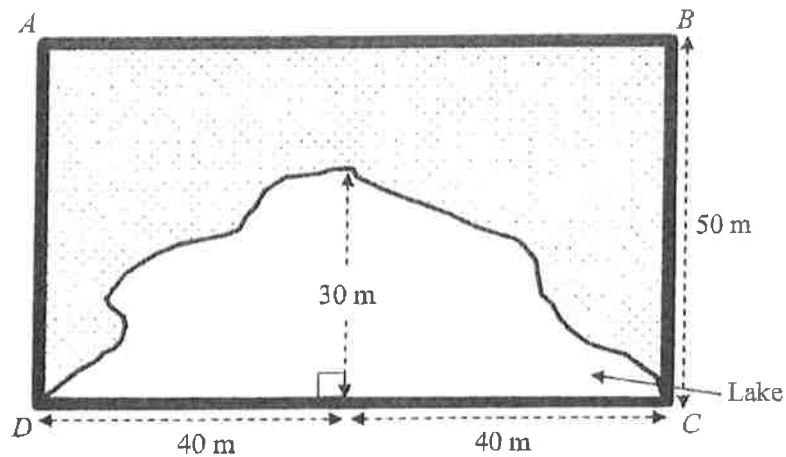
(i)   Calculate the area (in square metres) of the surface of the lake.   **2**

$$A \quad \frac{40}{3}\left\{0 + 4 \times 30 + 0\right\}$$

$$= 1600 \, m^2$$

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

$$A = 80 \times 50$$

$$= 4000 \, m^2$$

$$\frac{1600}{4000} \qquad 40\%$$

End of Question 27
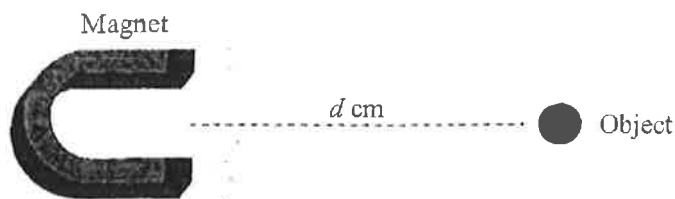
Question 28 (15 marks)   **Marks**

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

Magnet

d cm   Object

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:

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

Fine ✓
Proofs were not
set out correctly
need to refer

(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

$15 = k * \sqrt{9}$ ✓

$k = \dfrac{15}{3}$ 5 ✓

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

✓

$F = 5 * \sqrt{d}$

F 5 ...

F 20 N

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

Students
were challenged
with this
question
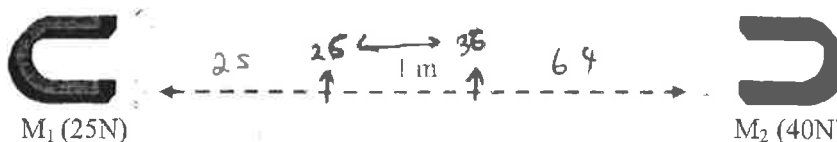
M_1 (25N)   25   26 ←→ 35   64 M_2 (40N)

1 m

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

$5\sqrt{d} = 25$ $5\sqrt{1} = 1$ 40 $5\sqrt{d}$

$\sqrt{d} = 5$ $\sqrt{1-d} = 8$

$d = 25$ $1-d = 64$

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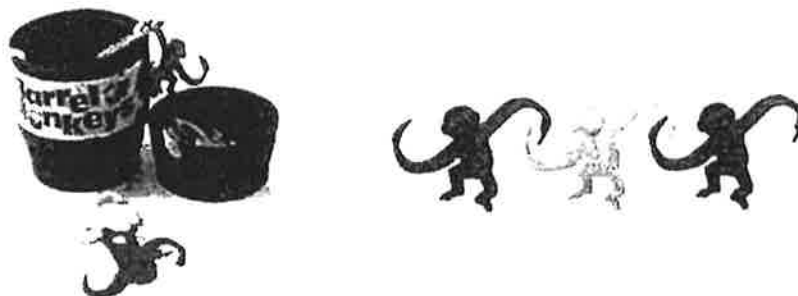
(i)   What is the probability that the first monkey in the link is yellow?   **1**

$$P(\text{Yellow}) = \frac{4}{12} = \frac{1}{3}$$

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

$$P(GG \text{ or } YY) = \frac{2}{12} \times \frac{1}{11} + \frac{4}{12} \times \frac{3}{11}$$

$$= \frac{2}{132} + \frac{12}{132}$$

$$= \frac{14}{132} \qquad \frac{7}{66} = 10\cdot\overline{60}\%$$

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

$$3 \times 2 \times 1 = 6$$

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

$$6 \times \left(\frac{6}{12} \times \frac{2}{11} \times \frac{4}{10} \right)$$

$$= 6 \times \frac{48}{1320}$$

$$= \frac{12}{55} = 21\cdot\overline{81}\%$$

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.
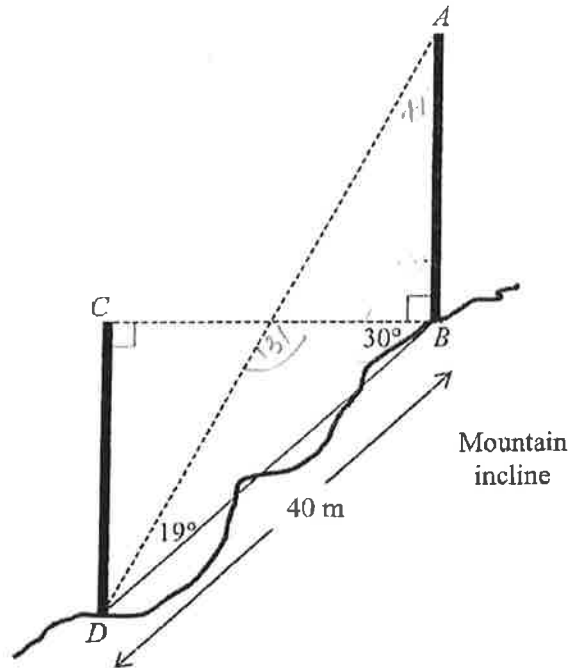
4

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**

$$\frac{AD}{\sin 120°} = \frac{40}{\sin 41°}$$

$$AD = \frac{40 \times \sin 120}{\sin 41}$$

$$AD = 53m$$

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.
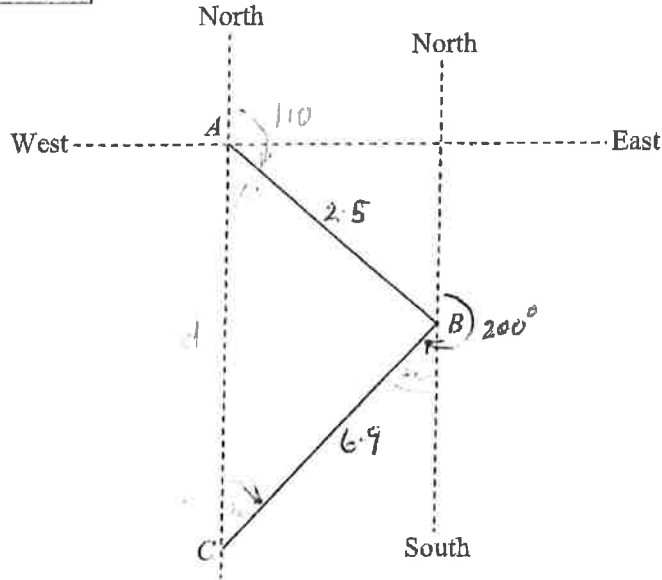
need to clearly show the bearings

1 angles
1 lengths

(i)   On the diagram, insert the distances Marissa walked and show the two given bearings.   2

(ii) What is the size of <*BAC*?   1

70°   ✓

A bearing is a 3 digit angle round to ...

(iii) What is the bearing of *B* from *C*?   1

020°   ✓

(iv) What is the bearing of *A* from *B*?   1

290°   ✓

(v)   How far (correct to one decimal place) is *C* south of *A*?   2

△ABC is right angled

$d^2 = 2.5^2 + 6.9^2$ ✓

$d^2 = 53.86$

$d = 7.3$ km   ✓

Question 29 continues on the next page

24

7

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: **2**
$$P = 50n - 2350$$

(handwritten:) $(\,P = \$I - \$C\,)$

$(I - C$ $250n - (2350 + 200n)$

$= 50n - 2350$

(ii)   How many items must the company sell in order to break even?   *Profit = \$0*   **2**

$50n - 2350 \leq 0$

$n = 47$

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

$P = 50 \times 120 - 2350 \quad = \quad \$3650$

(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**
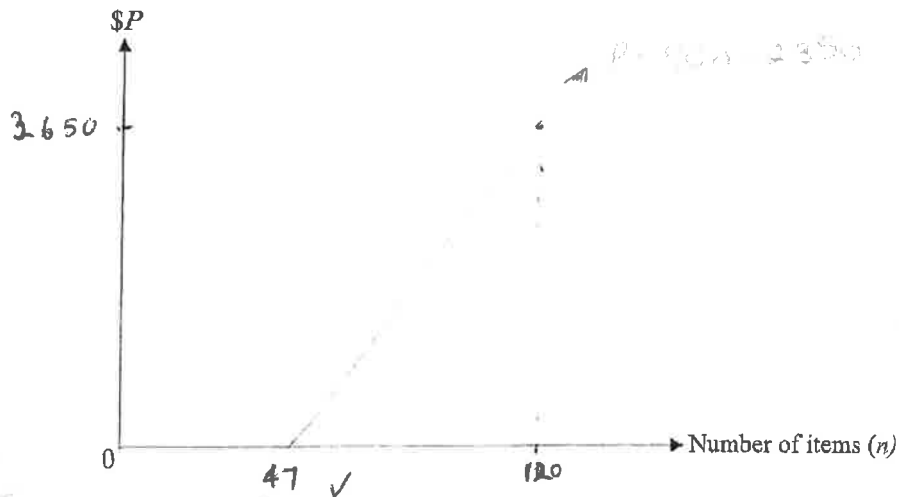
(handwritten note left:) Use vertical quantity over the horizontal

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

How much profit per item is made.

End of Question 29

(handwritten:) The rate at which profit is made.
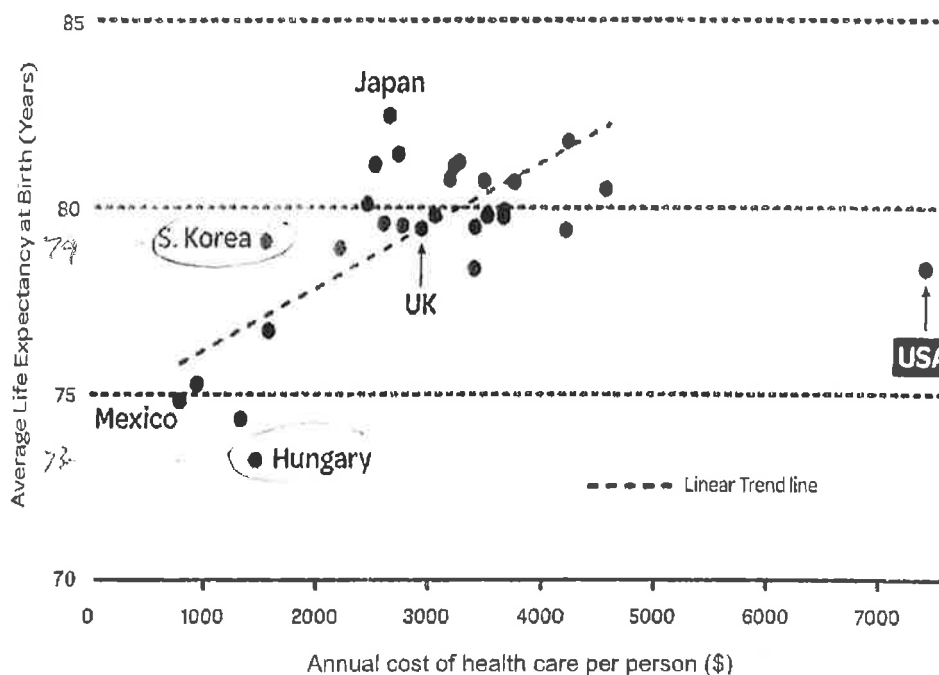
25

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.

Amount spent on Health Care versus Average Life Expectancy at birth in a selection of countries

(i)   Which of the specified countries has the lowest amount spent on health care per
      person?   1

      Mexico   ✓

(ii) Approximately, how much longer is a person living in South Korea expected to live
      than a person living in Hungary?   1

      79 - 73 = 6 years   ✓

(iii) Compare and contrast the data presented for Japan and the USA.   2

      Japan has lower health care cost by $5000 p.a.
      Japan has higher life expectancy by 4-5 year

*The question does
not ask you to
provide reasons
for the difference.
Stick to 3 lines only.*

Question 30(a) continues on the next page

26

4

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**

the correlation coefficient would be

closer to 1.

(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**

$m = r \times \dfrac{\sigma_y}{\sigma_x}$

$m = 0.48 \times \dfrac{2.31}{1308.81}$

$m = 0.0008$
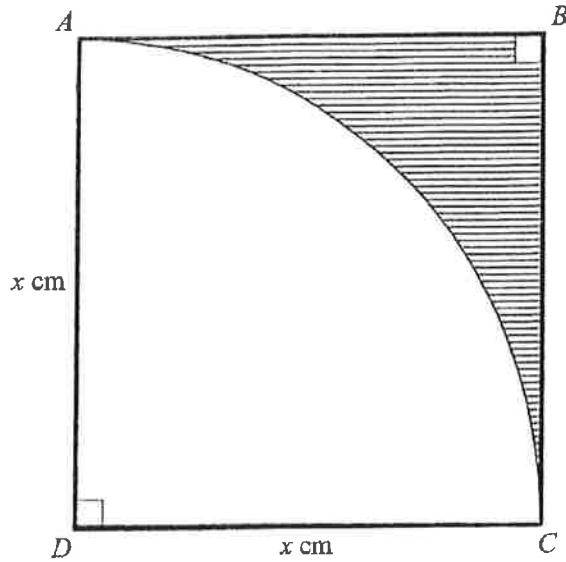
Question 30 continues on the next page

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.

A ⌐⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⎺⌐ B

x cm

D x cm   C

Show that the area of the shaded section ABC can be given by: $\dfrac{x^2(4-\pi)}{4}$ cm^2.   **3**

$A = x^2 - \left(\frac{1}{4} \pi x^2\right)$

$\dfrac{4x^2 - \pi x^2}{4}$

$= \dfrac{x^2(4-\pi)}{4}$

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.

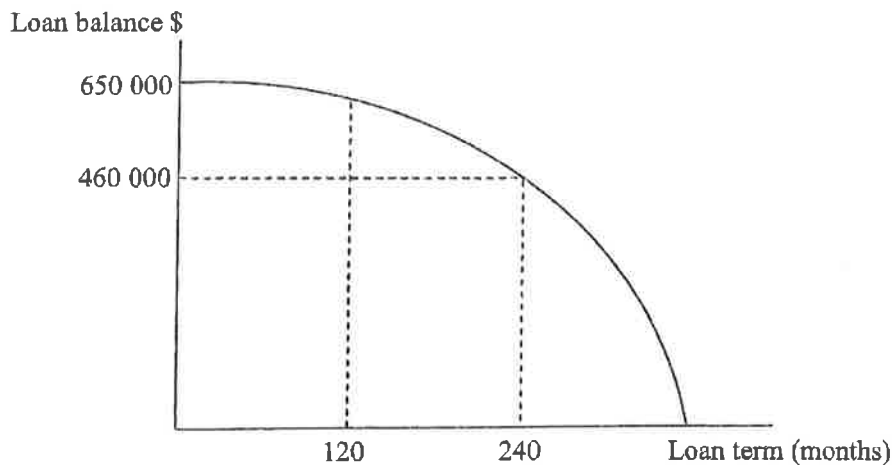(i) Using: $A = P + I - R$, show that Evan owes $649 506.25 after his first repayment.   2

$$I = 650000 \times \frac{0.0435}{12} \times 1$$

$$= \$2356.25 \checkmark$$

$$A = 650000 + 2356.25 - 2850$$

$$= \$649506.25 \checkmark$$

(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

$$n = 20y$$
$$240 \text{ months}$$
$$\checkmark \quad \text{Balance} = 460000$$
$$\text{Paid off} = 650000 - 460000$$
$$= \$190000$$

$$\text{Repay} = 2850 \times 240$$
$$= \$684000 \checkmark$$
$$\text{Int} = 684000 - 190000$$
$$\$494000 \checkmark$$

End of paper