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CANDIDATE NUMBER

2020 Trial HSC Examination

Form VI Mathematics Standard 2

Wednesday 12th August 2020

General Instructions

- Reading time — 10 minutes
- Working time — 2 hours 30 minutes
- Attempt all questions
- Write using black pen
- Calculators approved by NESA may be used
- A loose reference sheet is provided separate to this paper

Total Marks: 100

Section I (15 marks) Questions 1–15

- This section is multiple-choice. Each question is worth 1 mark
- Record your answers on the provided answer sheet

Section II (85 marks) Questions 16–43

- Relevant mathematical reasoning and calculations are required
- Answer the questions in this paper in the spaces provided

Collection

- Write your candidate number on this page and on the multiple choice sheet
- Place everything inside this question booklet

Checklist

- Reference sheet
- Multiple-choice answer sheet
- Candidature: 9 pupils

Writer: LL

Section I

15 marks

Attempt Questions 1-15

Allow about 25 minutes for this section

Use the multiple-choice answer sheet for Questions 1-15

1. Jimmy invested \$1600 at a simple interest rate of 5% per annum. Which calculation will determine how many months is required for his investment to grow to a total value of \$1820?

(A) $\frac{1820 - 1600}{1600} \times 5\% \times 12$

(B) $\frac{1820 - 1600}{1600} \div 5\% \times 12$

(C) $\frac{1820 - 1600}{1820} \div 5\% \times 12$

(D) $\frac{1820 - 1600}{1820} \times 5\% \times 12$

2. Which of the following is equivalent to 2 000 μm ?

(A) 0.02 m

(B) 20 cm

(C) 20000 mm

(D) 2 000 000 nm

3. The formula below is used to estimate the blood alcohol content (BAC) for males.

$$BAC_{Male} = \frac{10N - 7.5H}{6.8M}$$

where N is the number of standard drinks consumed

H is the number of hours drinking

M is the person's weight in kilograms

Sam weighs 72 kilograms. He starts drinking at 6:30pm and stops at 9:00pm. During this time, he consumes 3 standard drinks. What is his approximate BAC at 9:00pm?

(A) 0.005

(B) 0.007

(C) 0.023

(D) 0.026

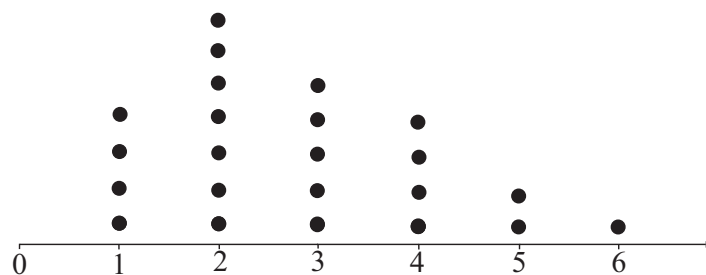
4. The number of pupils in each form group is shown in the table below.

Form I	Form II	Form III	Form IV	Form V	Form VI
179	183	172	176	184	181

A sample of 75 pupils were surveyed using the stratified sampling method. How many of those surveyed were from Form III?

- (A) 12
(B) 13
(C) 16
(D) 44
5. What amount must be invested now at 5% per annum, compounded monthly, so that in four years time it will have grown to \$50 000?
- (A) \$38 772
(B) \$39 176
(C) \$40 954
(D) \$41 135
6. The value of A varies directly with B . It is known that when $B = 15$, $A = 9$.
What is the value of A when $B = 65$?
- (A) 39
(B) 59
(C) 60
(D) 108
7. Which of the following correctly expresses y as the subject of the formula $2x - 5y + 3 = 0$?
- (A) $y = \frac{2}{5}x + \frac{3}{5}$
(B) $y = \frac{2}{5}x - \frac{3}{5}$
(C) $y = \frac{2}{5}x + 3$
(D) $y = \frac{2}{5}x - 3$

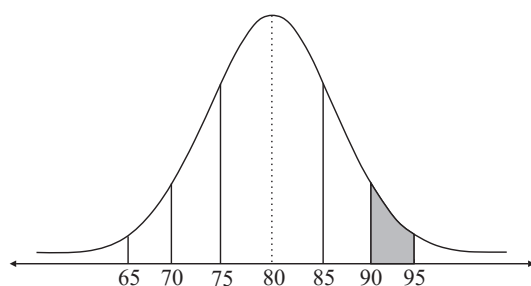
8. Which of the following best describes the dot plot below?



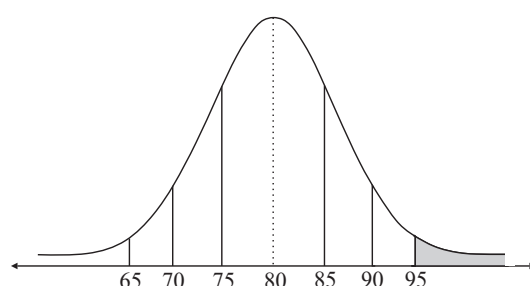
- (A) Bimodal
- (B) Symmetrical
- (C) Negatively skewed
- (D) Positively skewed

9. The scores on an examination are normally distributed with a mean of 80 and a standard deviation of 5. Timmy's examination score placed him in the top 2.5% of scores. Which of the following graphs best shades the region where Timmy's score lies?

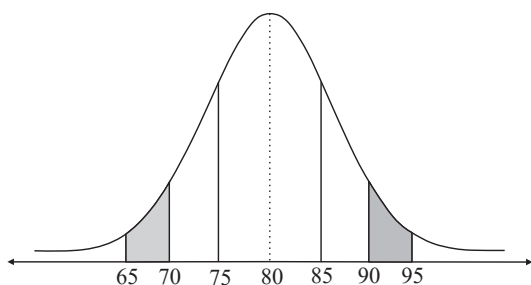
(A)



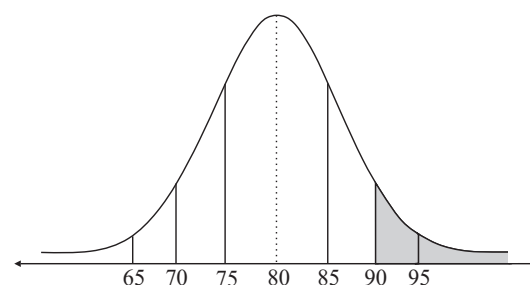
(C)



(B)



(D)



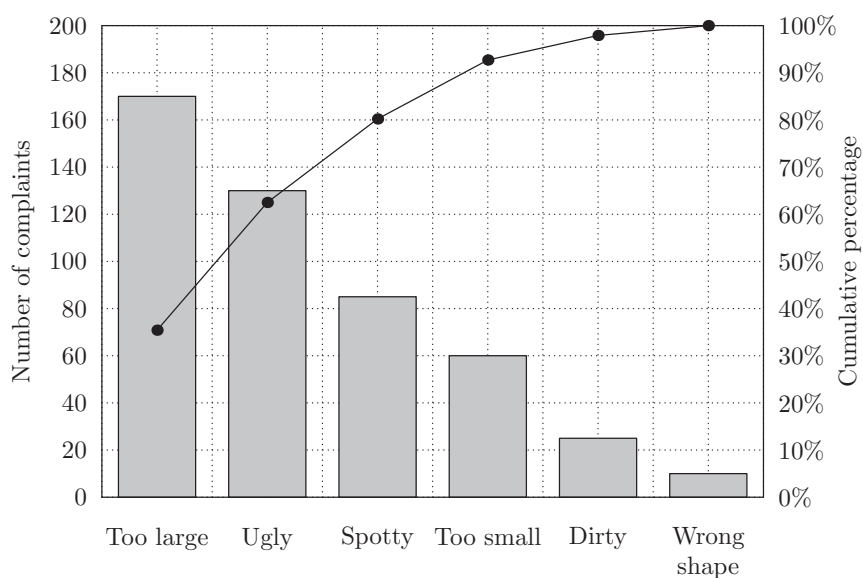
10. A group of people were asked whether they preferred cats or dogs and the results were recorded.

	Cats	Dogs	Total
Male	26	65	91
Female	52	57	109
Total	78	122	200

If a person were selected at random, what is the probability of choosing a male who prefers dogs?

- (A) $\frac{65}{91}$
- (B) $\frac{65}{200}$
- (C) $\frac{65}{122}$
- (D) $\frac{122}{200}$
11. James is driving along the highway at 80 km/h. He notices a kangaroo on the road and applies the brakes 1.8 seconds after noticing the kangaroo. His braking distance is 36 metres. What is his total stopping distance, to the nearest metre?
- (A) 40 m
- (B) 76 m
- (C) 92 m
- (D) 180 m
12. The weights of a particular bug species are normally distributed with mean 700 g and standard deviation 20 g. What percentage of bugs have mass exceeding 720 g?
- (A) 2.5%
- (B) 5%
- (C) 16%
- (D) 32%

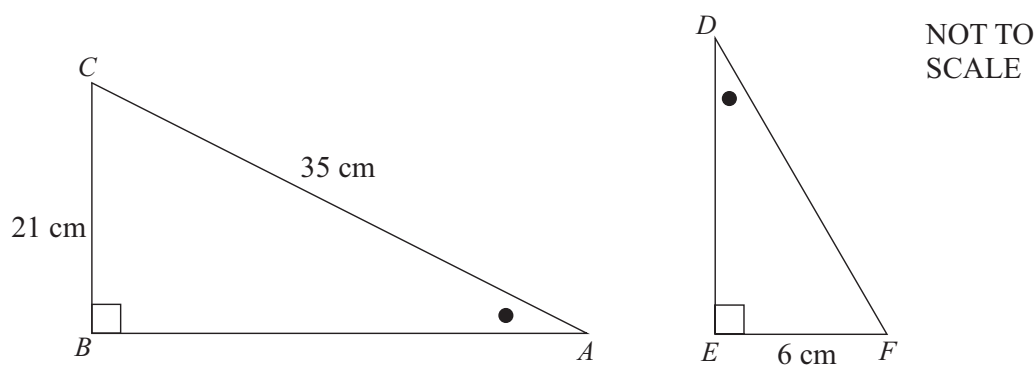
13. The number of complaints for the return of a particular item is shown in the Pareto chart below.



What percentage of the total number of complaints do the three most common complaints account for?

- (A) 60%
- (B) 70%
- (C) 80%
- (D) 90%

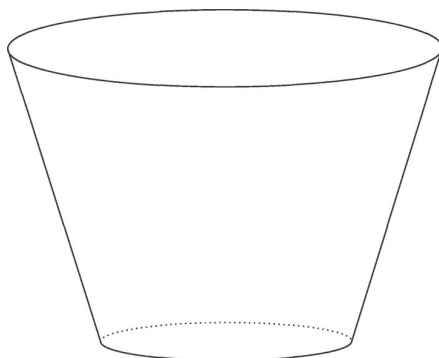
14. The triangles shown below are similar.



What is the length of DF?

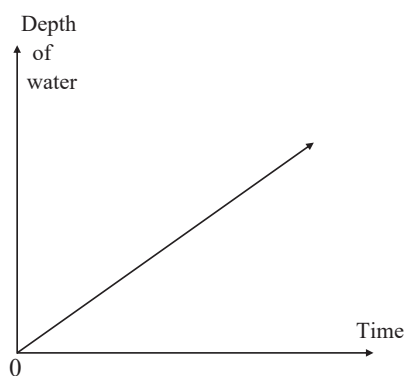
- (A) 3.6 cm
- (B) 8 cm
- (C) 10 cm
- (D) 122.5 cm

15. Water was poured into a container at a constant rate. The container is shown below.

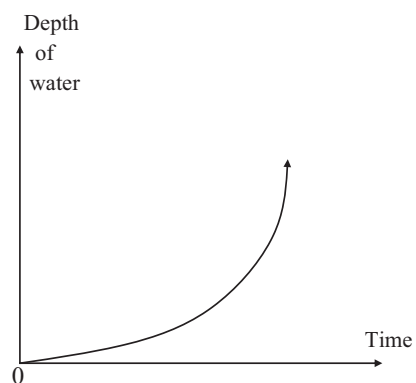


Which of the following graphs correctly shows the depth of water in the container as it was being filled?

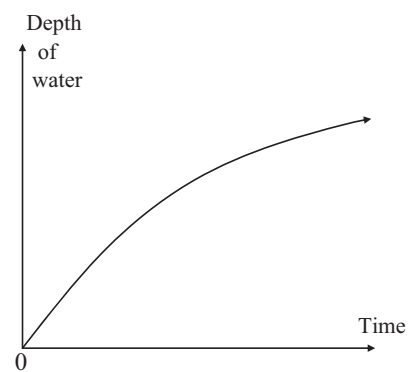
(A)



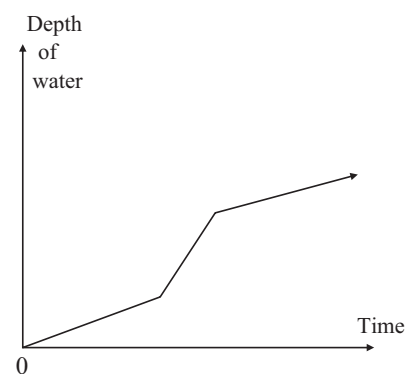
(C)



(B)



(D)



End of Section I

The paper continues in the next section

Section II

85 marks

Attempt Questions 16-43

Allow about 2 hours and 5 minutes for this section

QUESTION SIXTEEN (2 marks)

Marks

Henry is paid an hourly rate and receives penalty rates for weekends. His total pay for one particular week is shown in the pay slip below.

2

Employee	Henry		
Date	1/7/20-7/7/20		
Normal hours	15		
Time-and-a-half	6	Hourly rate:	Total pay:
Double time	4		\$561.92

His hourly rate is missing in the pay slip. Calculate his hourly rate.

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QUESTION SEVENTEEN (2 marks)

Marks

Alice uses 9 kilocalories of energy per minute while she is cycling. She consumes an energy drink that contains 895 kilojoules of energy. How many minutes will she need to cycle in order to use up all the energy from the energy drink, correct to the nearest minute? (1 kilocalorie = 4.184 kilojoules)

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QUESTION EIGHTEEN (2 marks)

Marks

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A researcher used the capture-recapture technique to estimate the number of fish in a lake. He captured, tagged and released 36 fish. Later he caught 25 at random and found that 4 had been tagged. What is the estimate for the total fish in the lake?

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QUESTION NINETEEN (2 marks)

Marks

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A patient requires 1800 mL of fluid to be delivered at a constant rate by means of an intravenous drip over 12 hours. Each millilitre of fluid is equivalent to 20 drops.

How many drops per minute need to be delivered?

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QUESTION TWENTY (2 marks)**Marks**

Charlie bought a new car for \$17 000. Each year, the value of the car is depreciated by the same amount. The table shows the value of the car, based on the straight-line method of depreciation, for the first three years.

2

End of year	Value
1	\$15 980
2	\$14 960
3	\$13 940

What is the value of the car at the end of the 7th year?

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QUESTION TWENTY-ONE (2 marks)**Marks**

Jim is calculating the fuel cost to commute to work each week by car. He has to commute to and from work 6 days a week and he incurs no tolls or parking fees. The distance from his home to work is 11.2 km one-way and his car has a fuel efficiency of 7.2 L/100 km. The average price of fuel is \$1.13/L. How much does it cost Jim to commute to and from work each week, correct to the nearest cent?

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QUESTION TWENTY-TWO (2 marks)**Marks**

The following table shows the future value of an annuity of \$1 for varying interest rates and time periods. The contributions are made at the end of each period.

2

Future value of an annuity of \$1

<i>Period</i>	<i>Interest rate per period</i>			
	1%	2%	3%	4%
1	1.000	1.000	1.000	1.000
2	2.010	2.020	2.030	2.040
3	3.030	3.060	3.091	3.122
4	4.060	4.122	4.184	4.246
5	5.101	5.204	5.309	5.416
6	6.152	6.308	6.468	6.633
7	7.214	7.434	7.662	7.898
8	8.286	8.583	8.892	9.214
9	9.369	9.755	10.159	10.583
10	10.462	10.950	11.464	12.006

Oliver is planning to purchase a car in 2 years time. He wants to save \$12 500 for this purchase. He is going to make regular quarterly payments into an account that earns 4% per annum, compounded quarterly.

What is the minimum investment Oliver needs to make each quarter in order to purchase a car, correct to the nearest \$10? Support your answer with calculations.

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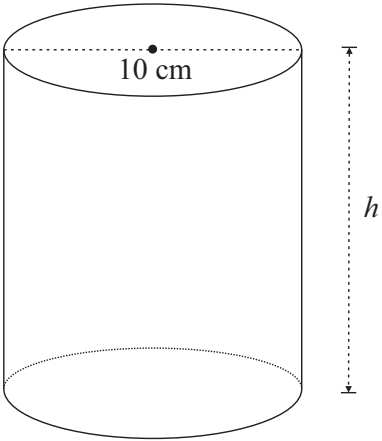
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QUESTION TWENTY-THREE (3 marks)

Marks

A block of wood is carved to form a cylinder. The cylinder has a diameter of 10 cm, a height of h cm and a total volume of 628 cm^3 . 3



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What is the surface area of the cylinder, correct to the nearest square centimetre?

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QUESTION TWENTY-FOUR (3 marks)**Marks**

A paddock grows daisies whose heights are normally distributed with a mean of 14 cm and standard deviation of 2 cm.

- (a) A daisy is considered “exquisite” if its height exceeds 20 cm. What percentage of daisies in the paddock are considered “exquisite”?

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- (b) Calculate the z -score for a daisy with a height of 11 cm.

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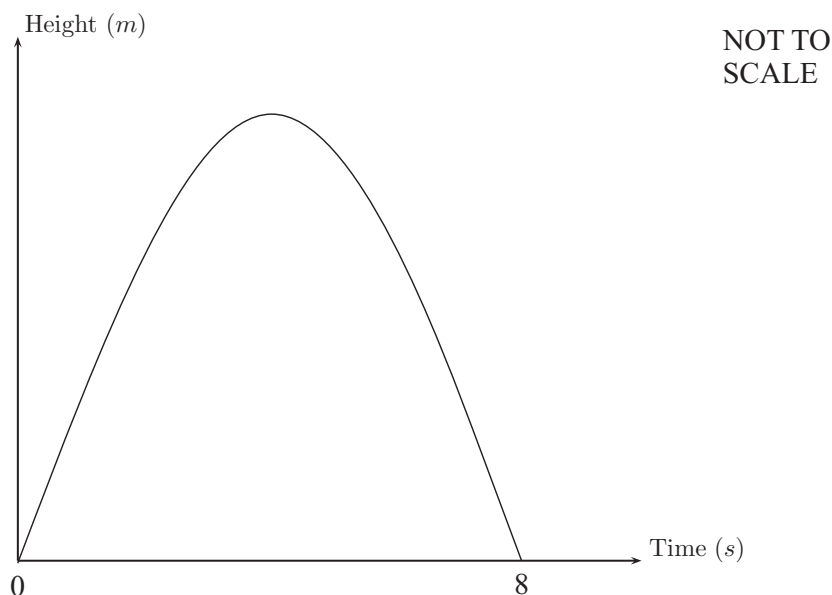
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QUESTION TWENTY-FIVE (3 marks)**Marks****3**

A tennis ball is hit from the ground into the air. It lands on the ground 8 seconds later. The flight path of the tennis ball is modelled by the equation $h = -t^2 + 8t$, where h is the height of the tennis ball in metres and t is the time in seconds.

The graph of $h = -t^2 + 8t$ is shown.



By first finding the maximum height, find the total vertical distance travelled by the tennis ball.

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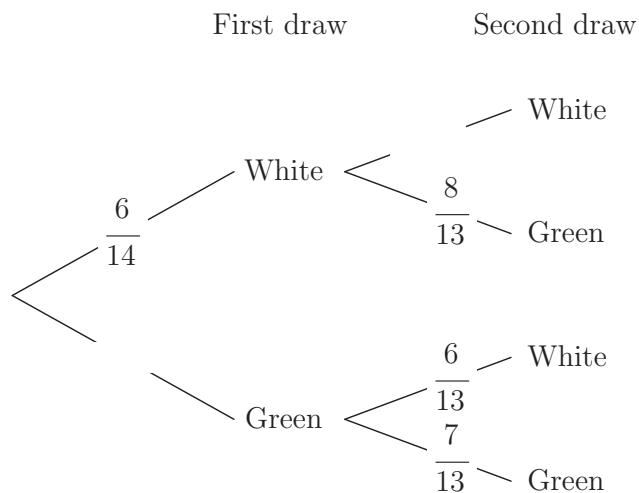
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QUESTION TWENTY-SIX (3 marks)**Marks**

A bag contains 8 green balls and 6 white balls. Two balls are selected at random. A partially completed tree diagram is shown below. 3



Complete the probability tree diagram and calculate the probability of selecting two balls of different colour.

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QUESTION TWENTY-SEVEN (5 marks)**Marks**

A class of 22 boys were given a class test. The marks are shown in the stem-and-leaf plot below.

Stem	Leaf
2	0 0 1 5 6
3	3 4 4 7 7 7 9
4	1 3 3 6 7 9 9
5	0 3 8

Key: 4 | 5 = 45 marks

- (a) Find the 5-number summary.

2

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- (b) Are there any outliers in the class test? Justify your answer with calculations.

2

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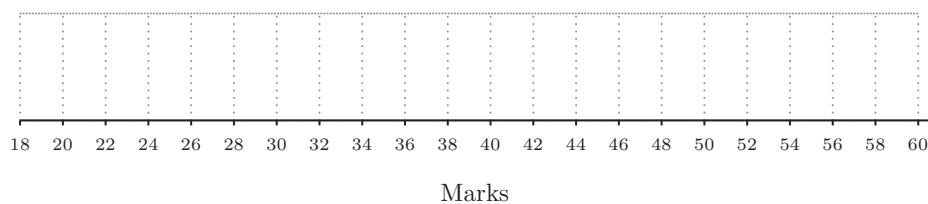
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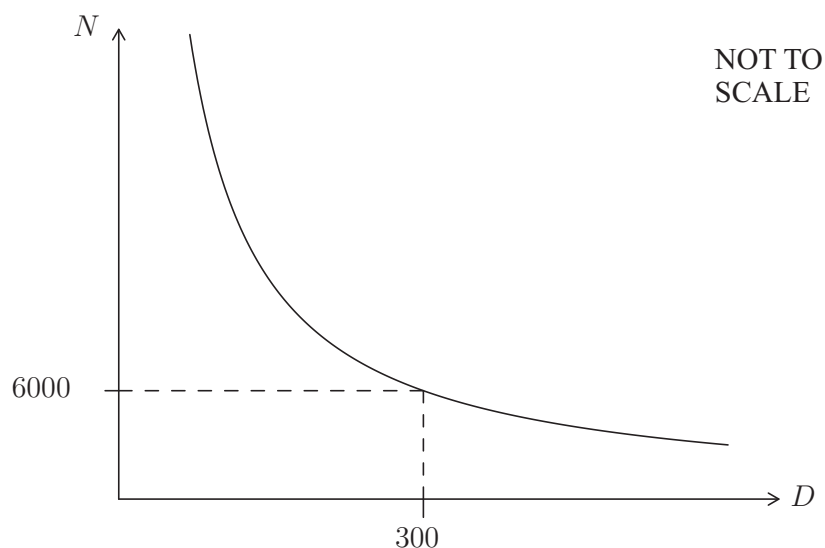
- (c) Construct a box plot to represent this data.

1



QUESTION TWENTY-EIGHT (3 marks)**Marks**

A concert is to be held. The number of people (N) expected to attend varies inversely with how far the concert is held from the city centre (D) measured in metres. If the distance from the city centre is 300 m then 6000 people are expected to attend, as shown below.



- (a) Find an equation for the graph in terms of N and D in the form $N = \frac{k}{D}$, where k is a constant.

1

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- (b) The concert needs an attendance of at least 2000 in order to make a profit. Find the maximum distance the concert can be from the city centre and still make a profit.

2

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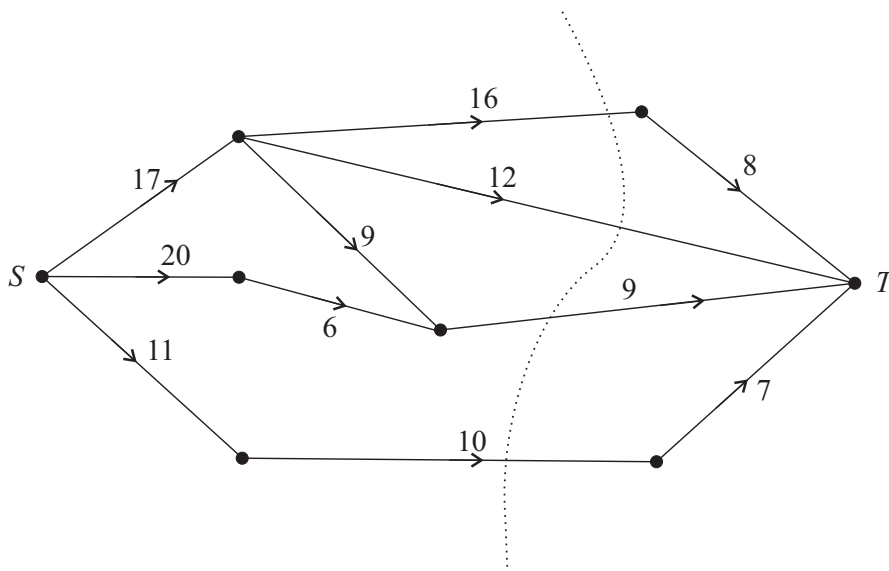
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QUESTION TWENTY-NINE (2 marks)**Marks**

A diagram below shows a directed network. The source is at S and the sink is at T .



- (a) What is the capacity of the cut shown?

1

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- (b) What is the maximum flow of this network?

1

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QUESTION THIRTY (2 marks)

Marks

2

Blake is charged interest at a rate of 20.56% per annum, compounding daily on any outstanding credit card balances. He has a \$1456 balance outstanding for 13 days. How much interest is he charged?

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QUESTION THIRTY-ONE (3 marks)

Marks

3

The table below shows the Australian tax rates for the 2019-2020 financial year.

Taxable income	Tax on this income
0 - \$18 200	Nil
\$18 201 - \$37 000	19c for each \$1 over \$18 200
\$37 001 - \$90 000	\$3 572 plus 32.5c for each \$1 over \$37 000
\$90 001 - \$180 000	\$20 797 plus 37c for each \$1 over \$90 000
\$180 001 and over	\$54 097 plus 45c for each \$1 over \$180 000

The Medicare levy is calculated as 2% of the taxable income. For the 2019-2020 financial year, Alex paid \$18 253.88 in tax. Calculate the Medicare levy on Alex's taxable income.

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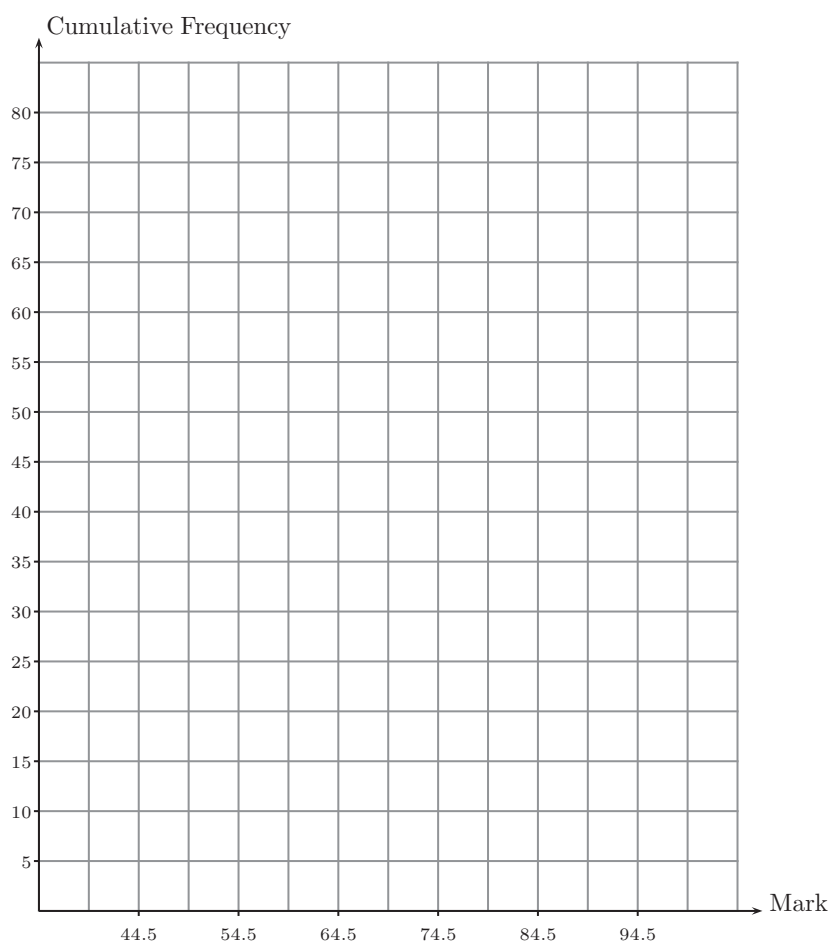
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QUESTION THIRTY-TWO (4 marks)**Marks**

The results of 80 students who sat a Mathematics Standard 2 examination are recorded in the frequency table below.

Mark Range	Class Centre	Frequency
40-49	44.5	2
50-59	54.5	6
60-69	64.5	9
70-79	74.5	14
80-89	84.5	32
90-99	94.5	17

- (a) By drawing a cumulative frequency histogram on the grid provided below, estimate the median mark. 3



Median mark:

- (b) Calculate an estimate for the mean mark, correct to one decimal place. 1

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QUESTION THIRTY-THREE (4 marks)**Marks**

A project requires activities A to G. The activity chart shows the immediate predecessors and duration of each activity.

Activity	Immediate Predecessor(s)	Duration in hours
A	-	2
B	A	5
C	B	6
D	B	10
E	C	5
F	D, E	2
G	F	7

- (a) By drawing a network diagram, determine the minimum time for the project to be completed.

3

Minimum time =

- (b) Determine the float time for the non-critical activity.

1

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QUESTION THIRTY-FOUR (3 marks)

Marks

Solve the equation $\frac{3(x+4)}{2} - 7x = -5$.

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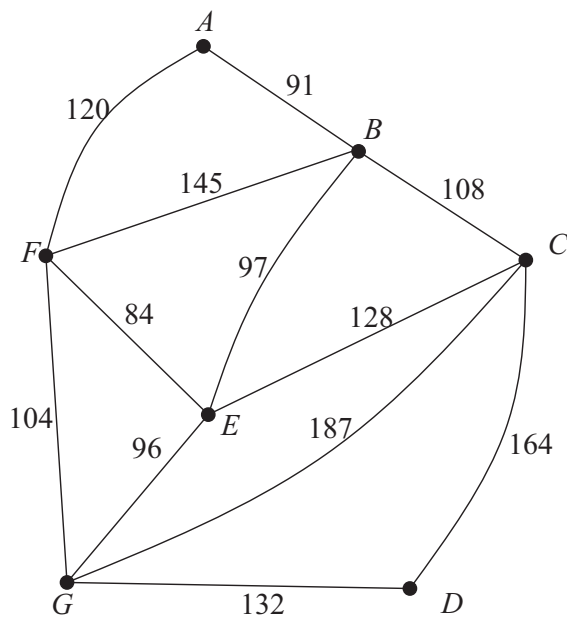
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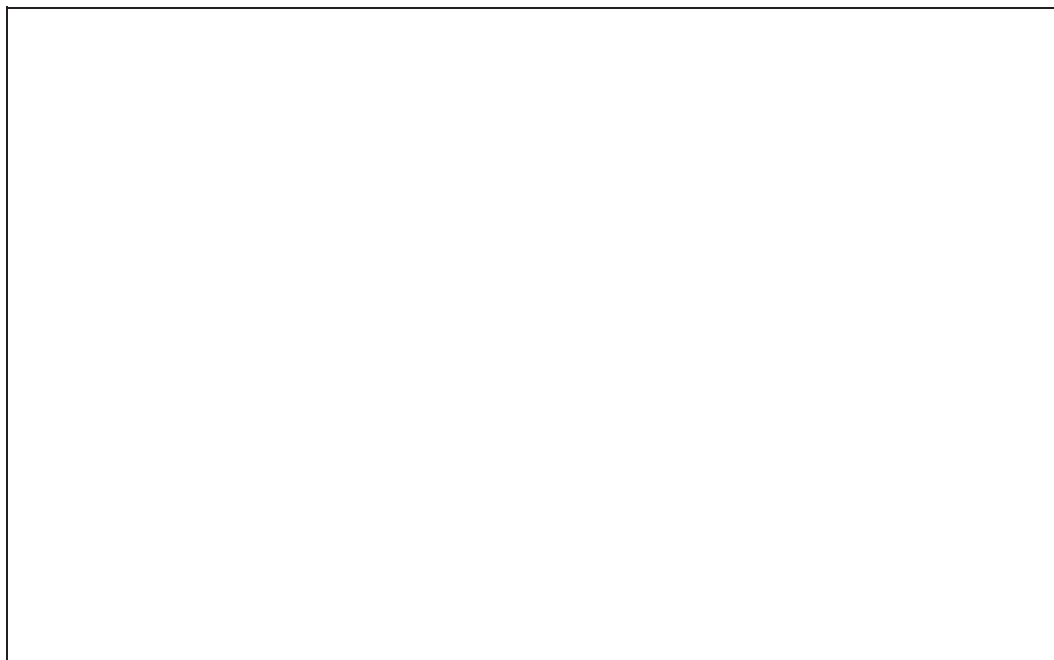
QUESTION THIRTY-FIVE (2 marks)**Marks**

The network diagram shows the electrical wires connecting 7 buildings on a school campus. The vertices A to G represent the buildings. The weights on the edges represent the length of wire in metres used to connect the buildings.



- (a) Draw the minimum spanning tree in the space below.

1



- (b) What is the minimum length of wire required to connect all the buildings with electricity?

1

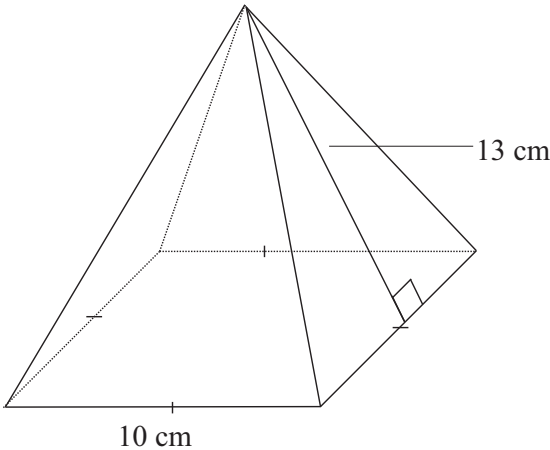
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QUESTION THIRTY-SIX (3 marks)

Marks

3

A paperweight is in the shape of a square-based pyramid. The square base has side length 10 cm and the pyramid has a slant height of 13 cm. Find the volume of the pyramid.



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QUESTION THIRTY-SEVEN (6 marks)**Marks**

A study was conducted to investigate the effect of drinking coffee on sleep in adults. In this study, the amount of sleep in hours and the amount of coffee drunk in millilitres on a given day were recorded in the table below.

Coffee (millilitres)	Time (hours)
40	8.5
60	7.5
90	7
50	8
80	7.75
150	6.25
120	6.75
100	7
85	8
60	7.5

- (a) Calculate the Pearson's correlation coefficient, correct to two decimal places and comment on the direction and strength of the linear correlation between the variables.

2

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- (b) Calculate the standard deviation for the variable time, correct to two decimal places.

1

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- (c) Calculate correct to two decimal places the predicted amount of sleep an adult will have if they consume 200 mL of coffee, by first finding the equation of the least-squares regression line in the form 2

$$\text{Hours slept} = B \times (\text{amount of coffee}) + A$$

where B is the gradient, and
 A is the y -intercept.

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- (d) Give ONE limitation of using the least-squares regression line to estimate the amount of sleep an adult will have. 1

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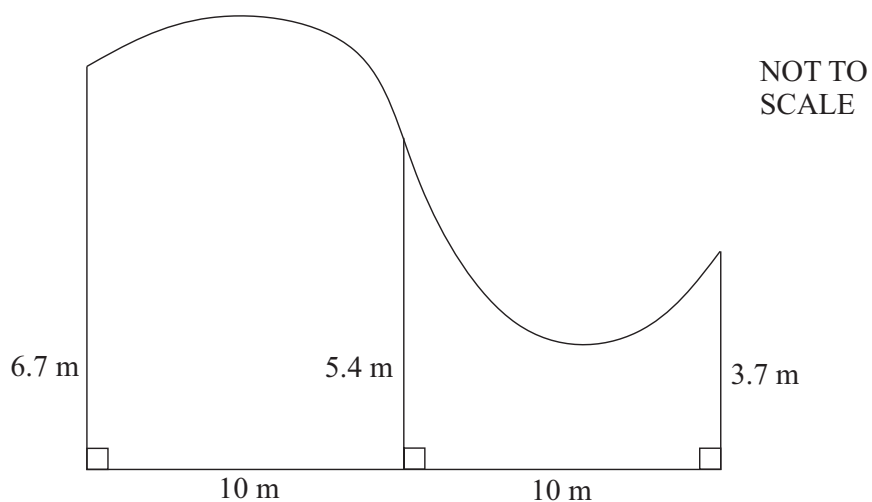
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QUESTION THIRTY-EIGHT (3 marks)

Marks

A swimming pool is constructed to have a uniform cross-section from an aerial view as shown below.

3



The pool has a uniform depth of 1.6 metres. By using TWO applications of the trapezoidal rule, estimate the capacity of the pool to the nearest litre.

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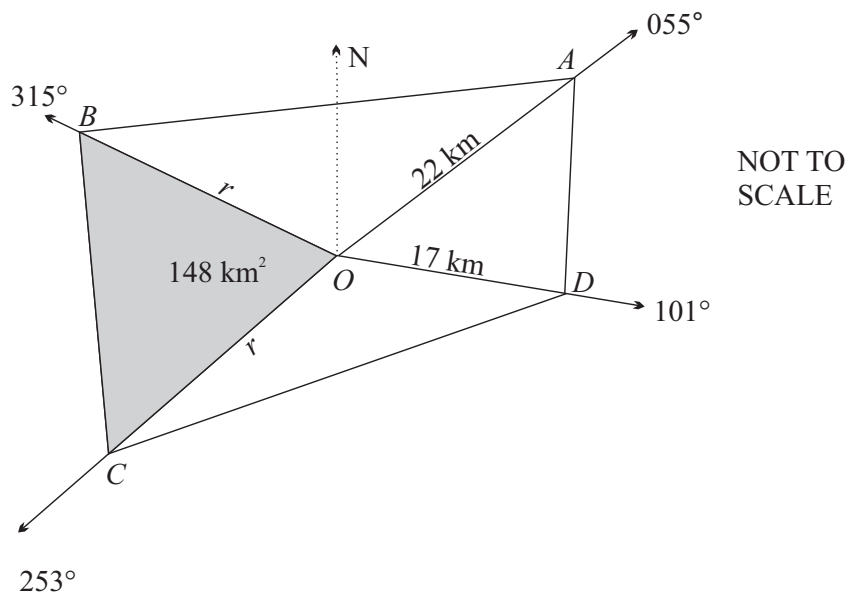
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QUESTION THIRTY-NINE (3 marks)

Marks

3

A radial survey is taken on a plot of land. Points B and C are equal distance in kilometres from O . Point B is on a bearing of 315° and point C is on a bearing of 253° . The area of $\triangle BOC$ is 148 km^2 .



What is the distance OB , correct to one decimal place?

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QUESTION FORTY (4 marks)

Marks

4

Emma is in Sydney (34°S, 150°E) and is flying to Singapore (1°N, 105°E). Her plane is scheduled to leave Sydney at 9:45pm on Friday (Sydney time). The total flight time is 8 hours and 30 minutes. What day and time will it be in Singapore when Emma arrives?

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QUESTION FORTY-ONE (3 marks)**Marks**

The table below shows the monthly repayments per \$1000 borrowed on a reducible-balance loan.

3

Monthly repayment per \$1000 borrowed

Period of loan	Interest rate per month			
	0.25%	0.75%	1.5%	3.0%
120 months	\$9.66	\$12.67	\$18.02	\$30.89
180 months	\$6.91	\$10.14	\$16.10	\$30.15
240 months	\$5.55	\$9.00	\$15.43	\$30.02

Elliot borrowed \$320 000 at an interest rate of 3% per annum, compounded monthly. His loan is to be repaid in equal monthly repayments. How much will Elliot save if he pays the loan off in 15 years rather than 20 years?

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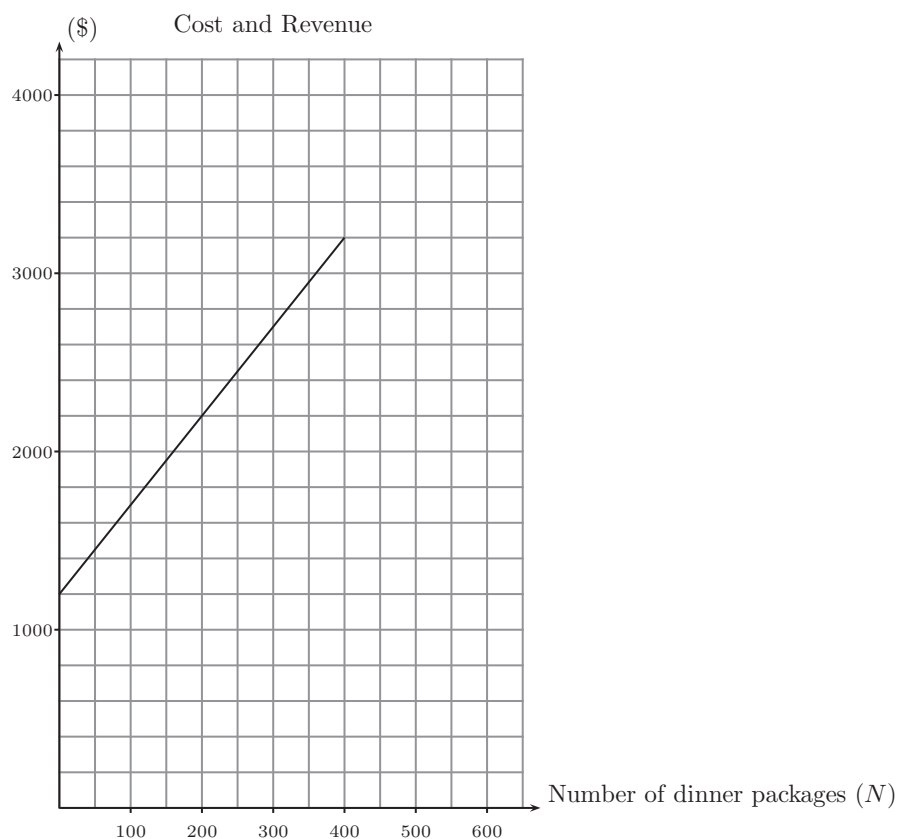
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QUESTION FORTY-TWO (4 marks)**Marks**

A meal delivery business makes and sells dinner packages. The cost $\$C$ to make N dinner packages is modelled by the equation

$$C = 1200 + 5N.$$

Technology was used to draw the straight-line graph to represent the cost of making each dinner package. The x -axis displays the number of packages and the y -axis displays the cost/revenue in dollars.



It is known that the company breaks even at 400 dinner packages. Using the graph, form an equation for revenue to determine how many dinner packages need to be sold to make a profit of \$1500.

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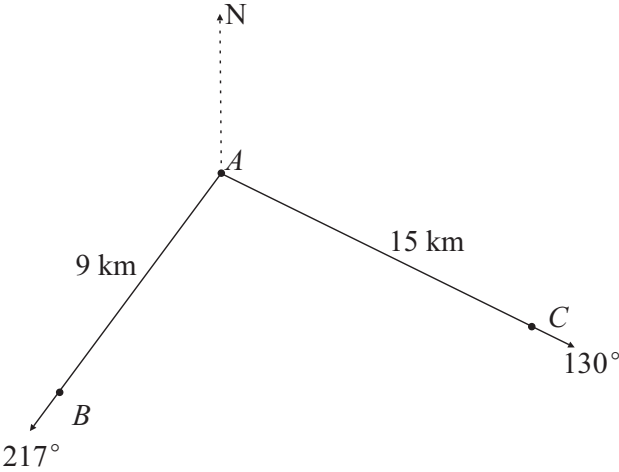
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QUESTION FORTY-THREE (5 marks)

Marks

5

The diagram shows the location of three hospitals. Hospital *B* is 9 kilometres from hospital *A* on a bearing of 217° . Hospital *C* is 15 kilometres from hospital *A* on a bearing of 130° .



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What is the bearing of hospital *C* from hospital *B*?

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————— **END OF PAPER** —————

Section 1

Multiple Choice Answer Key

Question	Answer
1	B
2	D
3	C
4	A
5	C
6	A
7	A
8	D
9	D
10	B
11	B
12	C
13	C
14	C
15	B

Section 2

Question 16

Criteria	Marks
• Provides correct answer	2
• Makes progress towards the correct solution	1

Sample Answer:

Number of hours paid = $15 + (1.5 \times 6) + (2 \times 4) = 32$ hours

Hourly Rate = $\$561.92 \div 32$
= \$17.56

Question 17

Criteria	Marks
• Provides correct answer	2
• Correct conversion from kilojoules to kilocalories	1

Sample Answer:

$895 \div 4.1 = 213.91$ kJ

$213.91 \div 9 \approx 23.77$

= 24 minutes (to the nearest minute)

Question 18

Criteria	Marks
Provides correct answer	2
Makes progress towards the correct answer	1

Sample Answer:

$$\begin{aligned}\frac{4}{25} &= \frac{36}{x} \\ x &= \frac{36}{4} \times 25 \\ x &= 225 \text{ fish}\end{aligned}$$

Question 19

Criteria	Marks
Provides a correct numerical expression for the number of drops per minute	2
Makes progress towards the correct solution	1

Sample Answer:

$$\begin{aligned}1800 \text{ mL} \div 12 \div 60 &= 2.5 \text{ mL per minute} \\ 2.5 \times 20 &= 50 \text{ drops per minute.}\end{aligned}$$

ALTERNATIVE SOLUTION

$$\begin{aligned}\text{Total drops needed} &= 1800 \times 20 \\ &= 36000 \text{ drops} \\ 36000 \div 12 \div 60 &= 50 \text{ drops per minute}\end{aligned}$$

Question 20

Criteria	Marks
• Correctly calculates salvage value	2
• Calculates correct annual depreciation amount	1

Sample Answer:

Annual depreciation:

$$\$17000 - \$15980 = \$1020$$

Straight line depreciation:

$$S = V_0 - Dn$$

$$S = 17000 - 1020 \times 7$$

$$S = \$9860$$

Question 21

Criteria	Marks
• Correctly calculates the weekly cost	2
• Makes progress towards the correct solution	1

Sample Answer:

Total distance travelled in a week: $D = 11.2 \times 6 \times 2$

$$D = 134.4 \text{ km}$$

$$\text{Total cost} = 134.4 \times \frac{7.2}{100} \times 1.13$$

$$\text{Cost} = \$10.93 \text{ (correct to the nearest cent)}$$

Question 22

Criteria	Marks
Correctly calculates the correct minimum amount required	2
Identifies the correct annuity factor	1

Sample Answer:

Annuity Factor: (8 periods, 1% per quarter) 8.286

Minimum investment :

$$\frac{12500}{8.286} \approx 1508.57$$
$$= \$1510 \text{ (to the nearest \$10)}$$

Question 23

Criteria	Marks
Correctly calculates the surface area of the cylinder	3
Applies the surface area formula of a cylinder correctly	2
Applies the volume of a cylinder to correctly calculate the height of the cylinder	1

Sample Answer:

$$\text{Volume} = \pi r^2 h$$

$$628 = \pi \times 5^2 \times h$$

$$h = \frac{628}{\pi \times 5^2}$$

$$h \approx 7.9959 \dots$$

Note: They can use the rounded $h = 8$ (nearest whole number) as it does not affect the final rounding.

$$\text{Surface Area} = 2\pi r^2 + 2\pi r h$$

$$SA = 2 \times \pi \times 5^2 + 2 \times \pi \times 5 \times \frac{628}{\pi \times 5^2}$$

$$SA \approx 408.27 \dots$$

$$SA = 408 \text{ cm}^2 \text{ (correct to the nearest whole number)}$$

Question 24 (a)

Criteria	Marks
Provides correct answer	1

Sample Answer:

$$z\text{-score} = \frac{20-14}{2}$$

$$z\text{-score} = 3$$

$$\frac{(100 - 99.7)}{2} = 0.15\%$$

Question 24 (b)

Criteria	Marks
Provides correct answer	2
Correctly applies the z-score formula	1

Sample Answer:

$$z\text{-score} = \frac{11-14}{2}$$

$$z\text{-score} = -1.5$$

Question 25

Criteria	Marks
• Provides correct answer	3
• Correctly calculates the max height using $h = -t^2 + 8t$	2
• Identifies that the max height occurs at $t = 4$	1

Sample Answer:

A parabola is symmetrical so the max height occurs at

$$t = \frac{8 - 0}{2} = 4$$

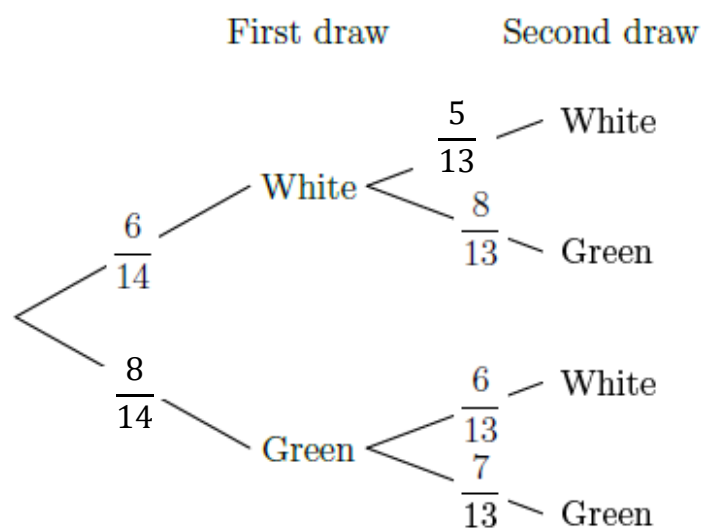
$$\begin{aligned}\text{At } t = 4, h &= -(4)^2 + 8 \times 4 \\ &= 16 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Total vertical distance travelled} &= 16 + 16 \\ &= 32 \text{ m}\end{aligned}$$

Question 26

Criteria	Marks
• Provides correct answer	3
• Considers only one case, either P(WG) or P(GW)	2
• Completes the tree diagram with the two missing values, or equivalent merit	1

Sample Answer:



Probability of selecting two balls of different colour:

$$P(WG) + P(GW) = \frac{6}{14} \times \frac{8}{13} + \frac{8}{14} \times \frac{6}{13}$$

$$= \frac{48}{91} \text{ or } 53\%$$

Question 27 (a)

Criteria	Marks
Provides the correct answer for all FIVE of the 5-number summary	2
Provides correct answer for any THREE of the 5-number summary	1

Sample Answer:

Min : 20

Q1 : 33

Med : 38

Q3 : 47

Max : 58

Question 27 (b)

Criteria	Marks
Provides correct solution with justification	2
Correctly calculates the interquartile range	1

Sample Answer:

$$\begin{aligned}\text{IQR} &= Q_3 - Q_1 \\ &= 47 - 33 \\ &= 14\end{aligned}$$

$$\text{Lower Outliers : } 33 + 1.5 \times 14 = 53.5$$

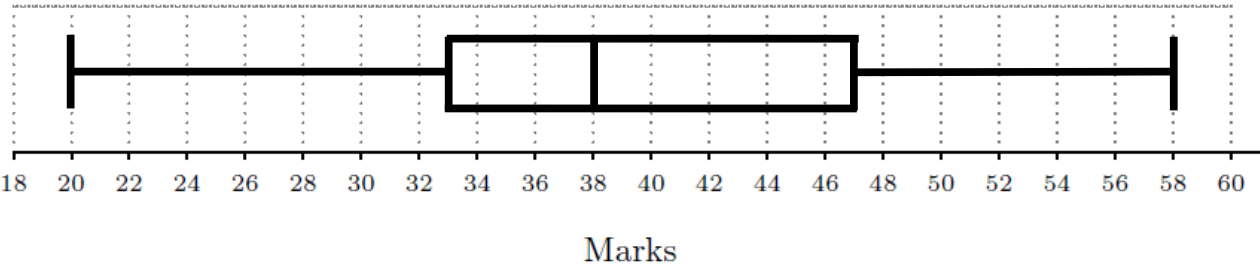
$$\text{Upper Outliers : } 47 + 1.5 \times 14 = 68$$

Since no scores are less than 53.5 nor above 68, then there are no outliers.

Question 27 (c)

Criteria	Marks
Provides correct answer	1

Sample Answer:



Question 28 (a)

Criteria	Marks
Provides correct solution	1

Sample Answer:

$$N = \frac{k}{D}$$
$$6000 = \frac{k}{300}$$
$$k = 6000 \times 300$$
$$k = 1\,800\,000$$

Question 28 (b)

Criteria	Marks
Provides correct answer	2
Makes some progress towards the answer	1

Sample Answer:

$$2000 = \frac{1\,800\,000}{D}$$
$$D = \frac{1\,800\,000}{2000}$$
$$D = 900 \text{ m}$$

Question 29(a)

Criteria	Marks
Provides correct answer	1

Sample Answer:

$$\begin{aligned}\text{Cut} &= 16 + 12 + 9 + 10 \\ &= 47\end{aligned}$$

Question 29(b)

Criteria	Marks
Provides correct answer	1

Sample Answer:

Max Flow : 30

Question 30

Criteria	Marks
Provides correct answer	2
Correctly applies compound interest formula	1

Sample Answer:

$$A = 1456 \times \left(1 + \frac{20.56\%}{365}\right)^{13}$$

$$A \approx \$1466.698 \dots$$

$$A = \$1466.70$$

Interest : $\$1466.70 - \$1456 = \$10.70$ (correct to the nearest cent)

Question 31

Criteria	Marks
• Provides correct answer	3
• Calculates the taxable income, or equivalent merit	2
• Chooses the correct tax bracket to use for calculation	1

Sample Answer:

Let the taxable income be $\$x$

$$18253.88 = 3572 + 0.325(x - 37000)$$

$$\frac{14681.88}{0.325} = x - 37000$$

$$x = 87175.02$$

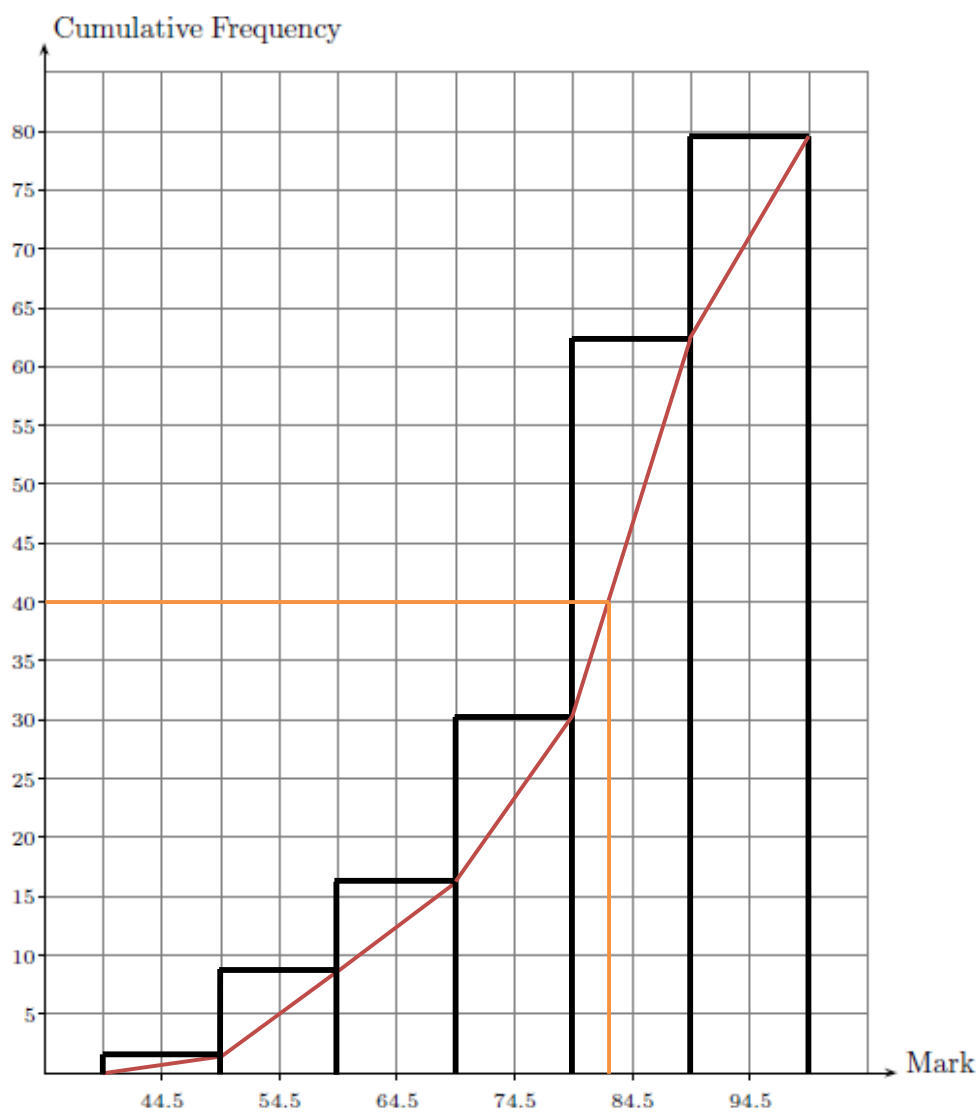
Medicare Levy

$$87175.02 \times 0.02 = \$1643.50 \text{ (correct to the nearest cent)}$$

Question 32(a)

Criteria	Marks
Provides correct solution within the range 82 ± 0.5	3
Correctly draws the cumulative frequency polygon	2
Correctly draws the cumulative frequency histogram	1

Sample Answer:



Median Mark : 82

Found by drawing the orange line

Question 32(b)

Criteria	Marks
Correctly calculates the mean mark	1

Sample Answer:

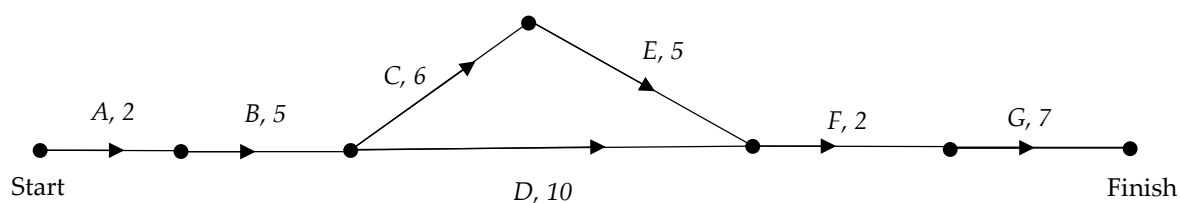
Mean Mark : 79.4 (correct to one decimal place)

Found by inputting the data using the class centres as x in 1-VAR mode with frequency turned on in the calculator.

Question 33(a)

Criteria	Marks
Provides correct minimum completion time with a correct network diagram	3
Fully completed and correct network diagram	2
Some attempt at a network diagram	1

Sample Answer:



Note : Some students may have used a dummy variable, not necessary, but valid.

Minimum completion time: 27

Question 33(b)

Criteria	Marks
Correctly calculates the float time for non-critical activity	1

Sample Answer:

Non critical activity D

Float time = 1 hour

Question 34

Criteria	Marks
Provides correct answer	3
Correctly collects like terms, or equivalent merit	2
Correctly expands the brackets, or creates a common fraction	1

Sample Answer:

$$3(x + 4) - 14x = -10$$

$$3x + 12 - 14x = -10$$

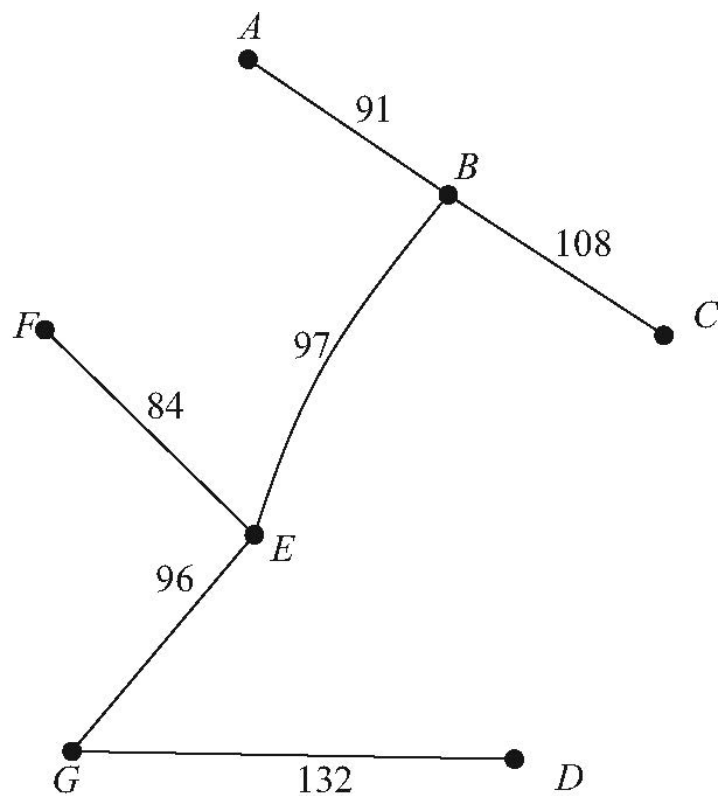
$$-11x = -22$$

$$x = 2$$

Question 35(a)

Criteria	Marks
Correctly draws the minimum spanning tree	1

Sample Answer:



Question 35(b)

Criteria	Marks
Correctly calculates the minimum length required	1

Sample Answer:

608 metres

Question 36

Criteria	Marks
• Correctly calculates the volume of the solid	3
• Correctly applies formula for the volume of a pyramid	2
• Applies Pythagoras to find the perpendicular height	1

Sample Answer:

Perpendicular height : $h = \sqrt{13^2 - 5^2}$

$$h = 12$$

$$V = \frac{1}{3}Ah$$

$$= \frac{1}{3} \times 10 \times 10 \times 12$$

$$= 400 \text{ cm}^3$$

Question 37(a)

Criteria	Marks
Correct comment on the strength and direction based on their correlation coefficient	2
Correctly calculates the Pearson's correlation coefficient	1

Sample Answer:

Found using STAT mode A+BX on the calculator, then Shift+1+Reg+r

$r = -0.89$ (correct to two decimal places)

There is a strong negative correlation

Question 37(b)

Criteria	Marks
Correctly calculates the standard deviation for time	1

$\sigma_y = 0.64$ (correct to two decimal places)

Found using STAT mode A+BX on the calculator, then Shift+1+Var+ σ_y

Question 37(c)

Criteria	Marks
Correctly calculates the number of hours slept	2
Correctly finds equation of the least-square regression line	1

From the calculator in A+BX mode, Shift+1+Reg+A/ Shift+1+Reg+B

Hours slept = $-0.0179 \times (\text{amount of coffee}) + 8.918$

Hours slept = $-0.0179 \times (200) + 8.918$

Hours slept = 5.34 hours (correct to two decimal places)

Question 37(d)

Criteria	Marks
Identifies ONE reasonable limitation and justifies their choice	1

For large amounts of coffee the results will become negative. For example, if someone consumes 550 mL of coffee it will result in -0.9 hours of sleep.

The biological nature of the adult hasn't been taken into consideration, some people just need less sleep and it's not affected by the amount of coffee they consume.

Note: A variety of reasons can be provided, check validity.

Question 38

Criteria	Marks
Correctly calculates the capacity of the pool	3
Correctly calculates the volume of the pool	2
Applies the Trapezoidal rule correctly	1

Sample Answer:

$$V \approx \frac{10}{2}(6.7 + 5.4) + \frac{10}{2}(5.4 + 3.7)$$

$$V \approx 166.4 \text{ m}^3$$

$$\begin{aligned}\text{Capacity} &= 166.4 \text{ kL} \\ &= 166400 \text{ L}\end{aligned}$$

Question 39

Criteria	Marks
Correctly calculates the value of r	3
Applies the area of a triangle using sine rule	2
Finds the size of $\angle BOC$	1

Sample Answer:

$$\begin{aligned}\angle BOC &= 315^\circ - 253^\circ \\ &= 62^\circ\end{aligned}$$

$$A = \frac{1}{2} \times a \times b \times \sin C$$

$$148 = \frac{1}{2} \times r^2 \times \sin 62^\circ$$

$$r^2 = \frac{148}{\frac{1}{2} \times \sin 62^\circ}$$

$$r = \sqrt{\frac{148}{\frac{1}{2} \times \sin 62^\circ}}$$

$$r \approx 18.30958 \dots$$

$$r = 18.3 \text{ km (correct to one decimal place)}$$

Question 40

Criteria	Marks
Provides correct time and date of scheduled landing	4
Makes significant progress to the solution	3
Identifies that there is a 3 hours difference	2
Correctly calculates the difference in latitude	1

Sample Answer:

Difference in latitude : $150 - 105 = 45^\circ$

Time difference : $\frac{45}{3} = 3$ hours

The plane departs Sydney at 6:45 pm (Singapore time) and takes 8.5 hours

So the plane lands in Singapore at 3:15 am on Saturday (Singapore time)

Question 41

Criteria	Marks
• Determines the correct saving	3
• Correctly calculates the total repayment for either loans	2
• Correctly calculates the monthly repayment for either loans	1

Sample Answer:

$\frac{3}{12}\% = 0.25\%$ per month and 15 years = 180 months and 20 years = 240 months

For the 15-year loan at 3% per annum, monthly repayments per \$1000 is \$6.91.

$$\begin{aligned}\text{Monthly repayment} &= \$6.91 \times 320 \\ &= \$2211.20\end{aligned}$$

$$\begin{aligned}\text{Total Repayment} &= 2211.2 \times 180 \\ &= \$398\,016\end{aligned}$$

For the 20-year loan at 3% per annum, monthly repayments per \$1000 is \$5.55.

$$\begin{aligned}\text{Monthly repayment} &= \$5.55 \times 320 \\ &= \$1776\end{aligned}$$

$$\begin{aligned}\text{Total Repayment} &= 1776 \times 240 \\ &= \$426\,240\end{aligned}$$

$$\begin{aligned}\text{Saving} &= 426240 - 398016 \\ &= \$28224\end{aligned}$$

Question 42

Criteria	Marks
• Provides correct solution	4
• Makes significant progress to the solution	3
• Recognises Profit = Revenue – Cost, to form an equation to solve	2
• Correctly finds a formula for revenue, R	1

Sample Answer:

Break-even point is at (400, 3200)

The gradient of the line for revenue is $\frac{3200}{400} = 8$

So the equation to model the revenue is $R = 8N$

Profit = Revenue – Cost

Profit = $8N - (1200 + 5N)$

$1500 = 3N - 1200$

$3N = 2700$

$N = 900$ packages

Question 43

Criteria	Marks
• Provides correct bearing of C from B (B to C)	5
• Correctly applies sine rule to find $\angle ABC$, or equivalent merit	4
• Correctly calculates the length of BC , or equivalent merit	3
• Correctly applies the cosine rule to find BC	2
• Correctly calculates $\angle BAC$	1

Sample Answer:

$$\begin{aligned}\angle BAC &= 217 - 130 \\ &= 87^\circ\end{aligned}$$

Using the cosine rule to find length of BC

$$BC^2 = 9^2 + 15^2 - 2 \times 9 \times 15 \times \cos 87^\circ$$

$$BC = \sqrt{9^2 + 15^2 - 2 \times 9 \times 15 \times \cos 87^\circ}$$

$$BC \approx 17.084 \dots$$

$$BC = 17.084 \text{ (correct to three decimal places)}$$

Let $\angle ABC = \theta$

$$\frac{\sin \theta}{15} = \frac{\sin 87}{17.084}$$

$$\sin \theta = \frac{15 \times \sin 87}{17.084}$$

$$\theta = \sin^{-1} \left(\frac{15 \times \sin 87}{17.084} \right)$$

$$\theta \approx 61.26^\circ$$

$$\therefore \text{bearing of } C \text{ from } B \text{ is } 61 + 37 = 98^\circ$$